

TITLE PAGE

PROJECT MANUAL for:

Mackenzie Chown A-Block Renovation
Also known as “Brock University - MCA”
Phase 2

SITE:

1812 Sir Isaac Brock Way
St. Catharines – Ontario

OWNER:

Brock University
1812 Sir Isaac Brock Way
St. Catharines, ON L2S 3A1

TITLE PAGE

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LIST OF CONSULTANTS

- 1.1 THE CONSULTANT – ARCHITECTURAL (A)
McCallum Sather Architects Inc.
Westinghouse HQ, 2nd Floor
286 Sanford Ave. N.
Hamilton, Ontario L8L 6A1
- 1.2 STRUCTURAL: (S)
MTE Consultants Inc.
123 St. George St.
London, Ontario N6A 3A1
- 1.3 MECHANICAL: (M)
McCallum Sather Architects Inc.
Westinghouse HQ, 2nd Floor
286 Sanford Ave. N.
Hamilton, Ontario L8L 6A1
- 1.4 ELECTRICAL: (E)
Seguin Engineering Inc.
12 Argyle St. N.
Caledonia, ON N3W 1B6
- 1.5 CIVIL: (C)
MTE Consultants Inc.
.1 1016 Sutton Dr., Unit A
Burlington, Ontario L7L 6B8
- 1.6 HARDWARE: (H)
Allegion Canada Inc.
1076 Lakeshore Rd. E.
Mississauga, Ontario L5E 1E4

End of Section

LIST OF CONSULTANTS

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TABLE OF CONTENTS

DR- indicates discipline responsible for preparation of listed documents:

A	Architect	AB	Abatement Consultant
C	Civil Consultant	Cx	Commissioning Consultant
E	Electrical Consultant	H	Hardware Consultant
M	Mechanical Consultant	S	Structural Consultant

The specification documents listed by the Architect are governed under the seal of the Architect. All other specification sections listed below are not included under, nor governed by, McCallum Sather Architects Inc's seal.

<u>List of Specification Sections</u>	<u>DR</u>	<u>Pgs</u>	<u>Date Issued</u>
Document 00			
00 00 01 Project Title Page	A	2	Nov. 1, 2022
00 01 05 List of Consultants.....	A	2	Dec. 8, 2021
00 01 10 Table of Contents	A	4	Nov. 2, 2022
00 31 01 Information Available to Bidders.....	BU	186	Jan. 28, 2022
Division 01 – General Requirements			
01 10 00 Summary of Work	A	2	Nov. 2, 2022
01 19 00 Specifications and Documents.....	A	4	Dec. 8, 2021
01 21 00 Allowances	A	2	Dec. 8, 2021
01 29 00 Payment Procedures	A	4	Dec. 8, 2021
01 32 00 Construction Progress Documentation	A	4	Dec. 8, 2021
01 33 00 Submittal Procedures	A	4	Dec. 8, 2021
01 35 23 Health and Safety	A	2	Dec. 8, 2021
01 35 26 Environment Protection.....	A	2	Dec. 8, 2021
01 35 41 Waste Management and Disposal.....	A	4	Dec. 8, 2021
01 41 00 Regulatory Requirements	A	2	Dec. 8, 2021
01 42 00 References.....	A	4	Dec. 8, 2021
01 45 00 Quality Control	A	4	Dec. 8, 2021
01 51 00 Temporary Utilities	A	2	Nov. 1, 2022
01 52 00 Construction Facilities.....	A	2	Nov. 1, 2022
01 53 00 Temporary Construction	A	2	Dec. 8, 2021
01 57 13 Temporary Erosion and Sediment Control	A	2	Dec. 8, 2021
01 58 00 Project Identification	A	2	Dec. 8, 2021
01 61 00 Product Requirements.....	A	4	Dec. 8, 2021
01 62 00 Product Exchange Procedures	A	2	Dec. 8, 2021
01 70 00 Examination and Preparation	A	2	Dec. 8, 2021
01 73 00 Execution	A	2	Dec. 8, 2021
01 73 30 Cutting and Patching.....	A	2	Dec. 8, 2021
01 74 00 Cleaning	A	2	Dec. 8, 2021
01 75 16 Start-Up Procedures.....	A	4	Dec. 8, 2021
01 75 19 Testing, Adjusting and Balancing.....	A	2	Dec. 8, 2021
01 78 10 Closeout Submittals	A	4	Nov. 1, 2022
01 78 40 Maintenance Requirements.....	A	4	Dec. 8, 2021
01 79 00 Demonstration and Training	A	4	Dec. 8, 2021
01 91 00 Commissioning (Cx)	A	10	Dec. 8, 2021
Division 02 – Existing Conditions			
02 40 00 Demolition.....	A	2	Dec. 8, 2021
Division 03 - Concrete			
03 20 00 Concrete Reinforcing.....	S	7	Jan. 17, 2022

TABLE OF CONTENTS

03 30 00	Cast-in-Place Concrete	S	18	Jan. 17, 2022
03 35 10	Concrete Floor Finishing.....	A	4	Dec. 8, 2021
Division 04 - Masonry				
04 04 05	Mortar	A	2	Dec. 8, 2021
04 20 00	Masonry.....	A	6	Dec. 8, 2021
Division 05 - Metals				
05 12 23	Structural Steel for Buildings	S	10	Jan. 17, 2022
05 31 00	Steel Decking	S	6	Jan. 17, 2022
05 42 50	Structural Metal Studs.....	A	4	Dec. 8, 2021
05 50 00	Metal Fabrications	A	8	Dec. 8, 2021
Division 06 - Wood, Plastics and Composites				
06 10 13	Rough Carpentry	A	2	Dec. 8, 2021
06 20 00	Finish Carpentry.....	A	4	Dec. 8, 2021
06 40 00	Architectural Woodwork.....	A	4	Nov. 1, 2022
Division 07 - Thermal and Moisture Protection				
07 16 00	Dampproofing.....	A	4	Nov. 1, 2022
07 20 00	Thermal Insulation	A	6	Dec. 8, 2021
07 19 00	Air and Vapour Barriers	A	4	Dec. 8, 2021
07 21 40	Spray Applied Foam Insulation	A	4	Feb. 23, 2022
07 26 16	Under Floor Vapour Barrier System	A	4	Dec. 8, 2021
07 42 20	Aluminum Composite Panels.....	A	4	Dec. 8, 2021
07 46 01	Metal Trim.....	A	4	Dec. 8, 2021
07 51 13	Cold-Applied - Built-Up Asphalt Roofing.....	A	12	Jan. 28, 2022
07 81 16	Cementitious Fireproofing.....	A	4	Dec. 8, 2021
07 84 00	Firestopping	A	12	Dec. 8, 2021
07 92 00	Joint Sealing	A	10	Dec. 8, 2021
07 95 00	Expansion Control.....	A	6	Dec. 8, 2021
Division 08 - Openings				
08 11 13	Metal Doors and Frames.....	A	12	Dec. 8, 2021
08 21 00	Wood Doors.....	A	8	Dec. 8, 2021
08 41 13.1	Aluminum Doors, Frames and Windows.....	A	6	Dec. 8, 2021
08 44 13	Glazed Aluminum Curtain Wall System.....	A	8	Jan. 28, 2022
08 71 00	Door Hardware	H	12	Nov. 1, 2022
08 71 01	Hardware Groups	H	8	02/16/2022
08 80 50	Glass and Glazing.....	A	10	Dec. 8, 2021
Division 09 - Finishes				
09 21 16	Gypsum Board Assemblies	A	18	Dec. 8, 2021
09 35 00	Tile	A	4	Jan. 28, 2022
09 51 13	Acoustic Ceiling Tile.....	A	6	Dec. 8, 2021
09 55 00	Acoustic Wood Ceiling	A	4	Dec. 8, 2021
09 66 50	Resilient Flooring.....	A	4	Dec. 8, 2021
09 68 00	Carpet Tile.....	A	4	Dec. 8, 2021
09 77 13	Acoustic Wall Panels	A	4	Dec. 8, 2021
09 91 10	Painting	A	8	Jan. 28, 2022
Division 12 – Furnishings				
12 52 00	Interior Window Shades.....	A	4	Dec. 8, 2021
12 69 00	Foot Grilles.....	A	2	Dec. 8, 2021

TABLE OF CONTENTS

Division 20, 21, 22, 23 and 25

20 05 05	Table of Contents – Mechanical	M	1	Jan. 2022
	Mechanical Specifications	M	209	Jan. 2022

Division 26, 27 and 28

See Electrical drawings

Division 31 – Earthwork

31 00 00	See Civil drawing C2.1	C		
31 23 00	Building Excavation & Backfill.....	S	9	Jan. 17, 2022

Division 32 - Exterior Improvements

32 16 15 Concrete Walks, Curbs and Gutters, See drawing C2.1 C

Division 33 - Utilities

33 00 00 See Civil drawing C2.1

List of Drawings

Refer to drawing A001 33 drawings

End of Section

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TABLE OF CONTENTS

INFORMATION AVAILABLE TO BIDDERS

PART 1 – GENERAL

1.1 Reports

- .1 The following material bound herein (or in a separate volume of the Contract Documents) is included for information or is available from the Owner/Consultant (for complete data, provide copies with each bid package).
 - .1 Hazardous Building Materials Assessment (Pre-construction) by Pinchin Ltd. Dated January 18, 2022; 185 pages.
- .2 The above material cannot, by its nature, reveal all conditions that may exist at the Place of the Work. Should conditions be found to vary substantially from the above, advise the Owner or Consultant accordingly and request direction.
- .3 Prior to proceeding with the Work, obtain the Designated Substance Survey (DSS) from Brock University. This report is to be used for reference prior to working in areas with designated substances.

End of Section

INFORMATION AVAILABLE TO BIDDERS

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Hazardous Building Materials Assessment (Pre-construction)

Level 200 Mackenzie Chown
Complex A Block and Goodman
School of Business
Brock University
1812 Sir Isaac Brock Way, St.
Catharines, Ontario

Prepared for:

Brock University
1812 Sir Isaac Brock Way
St. Catharines, Ontario, L2S 3A1

January 18, 2022

Pinchin File: 287774.014



Issued to: Brock University
Issued on: January 18, 2022
Pinchin File: 287774.014
Issuing Office: St. Catharines, ON

Author:

Kris Douglas, C. Tech.
Senior Project Technologist
289.241.8256
kdouglas@pinchin.com

Reviewer:

Chris Mego, C.E.T.
Project Manager
289.407.2594
cmego@pinchin.com



EXECUTIVE SUMMARY

Brock University (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at Brock University located at 1812 Sir Isaac Brock Way, St. Catharines, Ontario. Pinchin performed the assessment on November 29, 2021.

The objective of the assessment was to identify specified hazardous building materials in preparation for building renovation activities. The proposed work includes renovations in the Level 200 office spaces and an addition/connection to be constructed to the Goodman School of Business building.

The results of this assessment are intended for use with a properly developed scope of work or performance specifications and safe work procedures.

The assessed area was limited to the Level 200 of the Mackenzie Chow Complex A Block, the exterior of the Mackenzie Chown Complex A Block, and exterior of the Goodman School of Business and Vestibule 208, as shown on the drawings in Appendix I.

SUMMARY OF FINDINGS

The following is a summary of significant findings; refer to the body of the report for detailed findings:

Asbestos:

- Sprayed Fireproofing;
- Pipe insulation;
- Butyl sealant; and
- Paint on masonry block walls.

All asbestos-containing materials were observed to be in good condition, with the exception of asbestos-containing sprayed fireproofing debris that is present above solid drywall ceilings.

Lead:

- Lead in paints is present as follows:
 - Low levels of lead are present in brown paint.
 - Low levels of lead are present in aqua paint.
- Lead within batteries of emergency lights.

The following components are presumed lead containing:

- Electrical components, including wiring connectors, grounding conductors, and solder



- Solder on pipe connections

Silica: Crystalline silica is present in concrete, mortar, masonry, drywall, and plaster.

Mercury: Mercury vapour is present in lamp tubes.

Polychlorinated Biphenyls (PCBs): Based on the date of construction, PCBs may be present in light ballasts. Caulking present on window frames and expansion joints are not considered PCB solids.

Mould and Water Damage: Visible mould and water damage was not observed.



SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Remediate the following materials:
 - a. Follow Type 2 asbestos entry procedures above solid ceilings where debris is present.
2. Prepare a scope of work or specifications and safe work procedures for the hazardous materials removal required for the planned work.
3. Do not disturb suspected hazardous building materials discovered during the planned work, which have not been identified in this report and arrange for further evaluation and testing.
4. Remove and properly dispose of asbestos-containing materials prior to renovation activities.
5. Remove and properly dispose of PCB ballasts when fixtures are decommissioned. All PCB lamp ballasts must be removed from service and properly disposed of by December 31, 2025.
6. Recycle mercury-containing lamp tubes and thermostats when removed from service.
7. Follow appropriate safe work procedures when handling or disturbing asbestos, lead, and silica.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.



TABLE OF CONTENTS

1.0	INTRODUCTION AND SCOPE	1
1.1	Scope of Assessment	1
2.0	METHODOLOGY	2
3.0	BACKGROUND INFORMATION	2
3.1	Building Description	2
3.2	Existing Reports	3
4.0	FINDINGS	3
4.1	Asbestos	4
4.2	Lead	12
4.3	Silica	13
4.4	Mercury	13
4.5	Polychlorinated Biphenyls	13
4.6	Mould and Water Damage	14
5.0	RECOMMENDATIONS	15
5.1	General	15
5.2	Remedial Work	15
5.3	Building Renovation Work	15
6.0	TERMS AND LIMITATIONS	16
7.0	REFERENCES	17

APPENDICES

APPENDIX I	Drawings
APPENDIX II-A	Asbestos Analytical Certificates
APPENDIX II-B	Lead Analytical Certificates
APPENDIX II-C	PCB Analytical Certificates
APPENDIX III	Methodology
APPENDIX IV	Location Summary Report
APPENDIX V	Hazardous Materials Summary Report / Sample Log
APPENDIX VI	HMIS All Data Report



1.0 INTRODUCTION AND SCOPE

Brock University (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at Brock University located at 1812 Sir Isaac Brock Way, St. Catharines, Ontario.

Pinchin performed the assessment on November 29, 2021. The surveyor was accompanied by the Project Coordinator for Capital Planning and Project Management, Facilities Management during the assessment. The assessed area was vacant at the time of the assessment.

The objective of the assessment was to identify specified hazardous building materials in preparation for building renovation activities.

The renovation work will be completed to reconfigure the current office space layout and provide a connection from the Mackenzie Chown Complex A Block to the Goodman School of Business.

The results of this assessment are intended for use with a properly developed scope of work or performance specification.

1.1 Scope of Assessment

The **assessed area** is limited to the portion(s) of the building to renovated as per the construction drawings for the project and as described by the Client and identified in the drawings in Appendix I.

The assessment was performed to establish the type of specified hazardous building materials, locations and approximate quantities incorporated in the structure(s) and its finishes.

For the purpose of the assessment and this report, hazardous building materials are defined as follows:

- Asbestos
- Lead
- Silica
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Mould

The following Designated Substances are not typically found in building materials in a composition/state that is hazardous and were not included in this assessment:

- Arsenic
- Acrylonitrile
- Benzene



- Coke oven emissions
- Ethylene oxide
- Isocyanates
- Vinyl chloride monomer

2.0 METHODOLOGY

Pinchin conducted a room-by-room assessment (rooms, corridors, service areas, exterior, etc.) to identify the hazardous building materials as defined in the scope.

The assessment included limited demolition of wall and ceiling finishes (drywall or plaster) to view concealed conditions at representative areas as permitted by the current building use. Limited destructive testing of flooring was conducted where possible (under ceramic tiles, carpets or multiple layers of flooring). Demolition of exterior building finishes, masonry walls (chases, shafts etc.), and structural surrounds was not conducted.

Limited demolition of masonry block walls (core holes) was conducted to investigate for loose fill vermiculite insulation. Sampling of roofing materials was not conducted.

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

3.0 BACKGROUND INFORMATION

3.1 Building Description

Mackenzie Chown Complex A Block	
Description Item	Details
Use	University
Number of Floors	The building is 3 storeys plus 1 level below grade.
Total Area	The assessed area is approximately 13,000 square feet.
Year of Construction	The building was constructed in 1972.
Structure	Structural steel and concrete
Exterior Cladding	Pre-cast concrete, poured concrete and masonry
HVAC	Forced-air and electric radiator heating
Roof	Built-up roofing
Flooring	Vinyl floor tile and concrete
Interior Walls	Drywall, concrete block, plaster and poured concrete
Ceilings	Drywall, acoustic ceiling tiles and egg crate tiles



Goodman School of Business	
Use	University
Number of Floors	The building is 4 storeys plus 1 level below grade.
Total Area	The assessed area is approximately 200 square feet.
Year of Construction	The building was constructed in 1990.
Structure	Structural steel and concrete
Exterior Cladding	Masonry and metal cladding
HVAC	Forced-air
Roof	Built-up roofing
Flooring	Vinyl floor tile
Interior Walls	Drywall
Ceilings	Drywall

3.2 Existing Reports

Pinchin previously prepared the following reports, which have been reviewed as part of this assessment:

- *“Brock University MC A Block ACM Inventory Report”*, dated 2014, prepared by Pinchin Ltd., Pinchin File No. 83844.001
- *“Brock University TA Taro Hall ACM Inventory Report”*, dated 2014, prepared by Pinchin Ltd., Pinchin File No. 83844.001
- *“Hazardous Building Materials assessment Taro Hall (Building 20)”*, dated 2016, prepared by Pinchin Ltd., Pinchin File No. 104796.012
- *“Asbestos Reassessment Letter Mackenzie Chown Complex Block A”*, dated 2021, Prepared by Pinchin Ltd., Pinchin File No. 287774.012

4.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the hazardous materials identified and their locations. For details on approximate quantities, condition, friability, accessibility and locations of hazardous materials; refer to the Hazardous Material Summary / Sample Log and All Data Report in Appendices V and VI.

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

4.1 Asbestos

4.1.1 Spray-Applied Insulation

Spray-applied fireproofing, containing chrysotile asbestos, is present on structural steel including beams, and corrugated steel deck, in the assessed area and is presumed to be present in the soffit of the building on the exterior of the building (samples S0020A-G).

Overspray from asbestos-containing spray-applied fireproofing is present on concrete block walls, pipes, ducts, conduit, cabling, hangers, junction boxes, etc.

Debris from asbestos-containing sprayed spray-applied fireproofing is present on horizontal surfaces above ceiling systems including on ceilings, pipes, ducts, etc.

Dust or spray-applied fireproofing within ducts, fan units etc. was not sampled. As per O.Reg. 278/05 (Section 12 (4) 3), air handling equipment and ducts in a building with asbestos-containing spray-applied fireproofing are considered to be asbestos-contaminated in absence of sampling. In areas where asbestos-containing spray-applied fireproofing is present, assume air handling equipment and ducts to have asbestos-containing spray-applied fireproofing or associated dust.

Non-asbestos spray-applied fireproofing and overspray is present on the structure throughout the assessed area Goodman School of Business (installed in 1990).



Asbestos-containing sprayed fireproofing present in metal deck and structural steel



Asbestos-containing sprayed fireproofing present in metal deck and structural steel



Asbestos-containing sprayed fireproofing present in metal deck and structural steel



Asbestos-containing sprayed fireproofing present in metal deck and structural steel

4.1.2 *Texture Finishes (Decorative)*

Non-asbestos texture finish is present on the exterior drywall soffits around A Block (Location 109, samples 0017A-C).



Non asbestos textured finish on exterior drywall soffits

4.1.3 *Pipe Insulation*

Parging cement, containing chrysotile asbestos, is present on pipe fittings (elbows), jacketed with canvas, on domestic water systems (samples S0025A-C).

Pipes insulated with asbestos-containing insulations may be present in inaccessible spaces such as above solid ceilings, in chases, in column enclosures and within shafts.



Asbestos-containing parging cement present on pipe elbows

4.1.4 *Duct Insulation and Mastic*

Ducts are uninsulated.

Brown duct mastic present on seams / joints on ducts throughout the assessed area does not contain asbestos (samples S0009A-C).

Overspray from asbestos-containing spray-applied fireproofing is present on ducts.

Dust or spray-applied fireproofing within ducts, fan units etc. was not sampled. As per O.Reg. 278/05 (Section 12 (4) 3), air handling equipment and ducts in a building with asbestos-containing spray-applied

fireproofing are considered to be asbestos-contaminated in absence of sampling. In areas where asbestos-containing spray-applied fireproofing is present, assume air handling equipment and ducts to have asbestos-containing spray-applied fireproofing or associated dust.



Duct work with asbestos-containing sprayed fireproofing overspray

4.1.5 *Mechanical Equipment Insulation*

Mechanical equipment is either uninsulated or insulated with non-asbestos fibreglass.

Dust or spray-applied fireproofing within ducts, fan units etc. could not be sampled. As per O.Reg. 278/05 (Section 12 (4) 3), air handling equipment and ducts in a building with asbestos-containing spray-applied fireproofing are considered to be asbestos-contaminated in absence of sampling. In areas where asbestos-containing spray-applied fireproofing is present, assume air handling equipment and ducts to have asbestos-containing spray-applied fireproofing or associated dust.

4.1.6 *Vermiculite*

Destructive testing was conducted of a representative selection of masonry block walls, including creating penetrations at various locations. The locations of destructive testing have been indicated on the drawings in Appendix I.

Loose fill vermiculite was not observed within the cavities.

4.1.7 *Acoustic Ceiling Tiles*

All ceiling tiles in the assessed area of Mackenzie Chown Complex A Block are presumed to be non-asbestos based on the composition of the tiles (e.g. plastic and metal).

Ceiling tiles in the assessed area of the Goodman School of Business are presumed to be non-asbestos based on the age of the materials determined from the age of the building construction. The tiles were manufactured after asbestos stopped being used in acoustic ceiling tiles.

4.1.8 Plaster and Stucco

Plaster present on columns throughout the assessed area of the Mackenzie Chown Complex A Block does not contain asbestos (samples S0028A-C).

Plaster present on soffit on the exterior doorways of the Goodman School of Business does not contain asbestos based on the date of installation (1990).



Non-asbestos plaster on columns throughout the assessed area



Non asbestos plaster on exterior soffits

4.1.9 Drywall Joint Compound

Drywall joint compound present on wall and ceiling finishes throughout the assessed area does not contain asbestos (samples S0019A-G, S0027A-C, S0029A-E and S0030A-G).

Asbestos in drywall joint compound was banned in Canada in 1980. Drywall joint compound in the Goodman School of Business was installed on or after 1990 and is presumed to contain no asbestos.

4.1.10 Vinyl Floor Tiles, and Baseboard

Vinyl floor products are present as follows:

Description, Photo #	Sample Locations	Sample Number	Asbestos Type (tile)	Asbestos Type (mastic)
Mackenzie Chown Complex A Block				
12" x 12", beige with brown streaks, Photo #1	Corridor (Location 13)	S0006A-C	None Detected	None Detected
12" x 12", beige flecks, Photo #2	Printer Room (Location 16)	S0007A-C	None Detected	None Detected
12" x 12", blue flecks, Photo #3	Office (Location 42)	S0010A-C	None Detected	None Detected
12" x 12", orange flecks, Photo #4	Office (Location 49)	S0011A-C	None Detected	None Detected

Description, Photo #	Sample Locations	Sample Number	Asbestos Type (tile)	Asbestos Type (mastic)
Brown baseboard mastic, Photo #5	Office (Location 24) Office (Location 28) Staff Meeting Room and Lounge (Location 35)	S0021A-C	N/A	None Detected
12" x 12" grey with grey fleck, Photo #6	Communication Room (Location 29)	S0024A-C	None Detected	None Detected
12" x 12" white with grey streak, Photo #7	Photocopy Room (Location 34)	S0026A-C	None Detected	None Detected
Goodman School of Business				
12" x 12" beige with black streaks, Photo #8	Office Area (Location 7)	S0001A-C	None Detected	None Detected



Photo #1

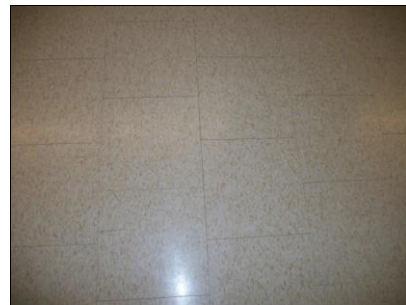


Photo #2



Photo #3



Photo #4



Photo #5



Photo #6



Photo #7

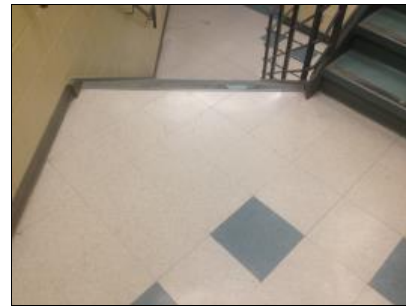


Photo #8

4.1.11 Firestopping

Firestopping (cementous) present at pipe and conduit penetrations in throughout the assessed area does not contain asbestos (samples S0008A-C).

Non-asbestos fibreglass/foam is present between concrete and drywall walls at the steel structure above. Asbestos-containing sprayed fireproofing debris is present to be attached to fibreglass and foam.



Non-asbestos firestopping present at pipe and conduit penetrations



Non-asbestos firestopping present at pipe and conduit penetrations

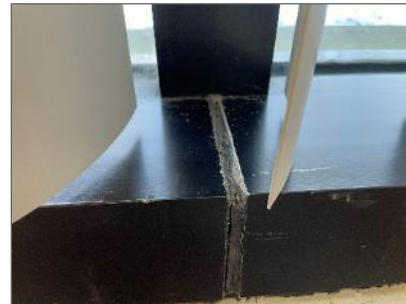
4.1.12 Sealants, Caulking, and Putty

The following table presents a summary of caulking, sealants and putties present:

Material, Colour	Application	Sample Locations	Sample Number	Asbestos Type
Mackenzie Chown Complex A Block				
Caulking, black	Windows Frames	Office (Location 24) Office (Location 25) Office (Location 28)	S0022A-C	None Detected
Caulking, black	Windows Frame Expansion Joint	Office (Location 24) Office (Location 25) Office (Location 28)	S0023A-C	None Detected
Butyl sealant	Exterior Windows	Exterior (Location 109)	S0031A-C	None Detected
Goodman School of Business				
Caulking, grey	Exterior Door Frames	Exterior (Location 23)	S0006A-C	None Detected
Butyl sealant	Exterior and Interior Door, Windowpanes	Exterior (Location 23)	S0007A-C	Chrysotile



Non-asbestos window frame caulking



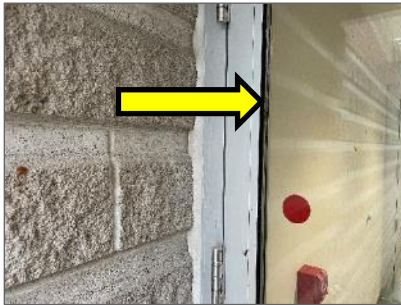
Non-asbestos expansion joint caulking on window frames



Non-asbestos butyl sealant on exterior window frames



Non-asbestos grey caulking on exterior door frame



Asbestos-containing butyl sealant on exterior door windowpanes

4.1.13 Other Building Materials

Paint/compound, containing chrysotile asbestos, is present on concrete block walls present throughout the assessed area (samples S0032A-G and S0033A-C).

Non-asbestos brown mastic adhering fibreglass insulation to drywall is present above soffits on the exterior of the building (samples 0034A-C, Location 109).



Asbestos-containing cream paint on masonry block



Asbestos-containing aqua paint on masonry block



Non-asbestos brown mastic associated with fibreglass insulation present above drywall soffit

4.1.14 Excluded 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 by sampling and analysis:

- Roofing felts and tar, mastics
- Electrical components
- Vibration dampers on HVAC equipment
- Sealants on pipe threads

4.2 Lead

4.2.1 Paints and Surface Coatings

Refer to the lab report(s) in Appendix II-B and the Hazardous Materials Summary Report in Appendix V for details on paints sampled and their locations.

The following table summarizes the analytical results of paints sampled.

Sample Number	Colour, Substrate Description	Sample Location	Lead (%)
L0001	Brown paint on drywall	Office (Location 22)	0.042
L0002	White paint on drywall	Office (Location 23)	<0.0066
L0003	Aqua paint on masonry block wall	Photocopy Room (Location 34)	0.069
L0004	Peach paint on drywall	Office (Location 42)	<0.0072
L0005	Blue green paint on drywall	Corridor (Location 13)	<0.0053

Results less than or equal to 0.1% (1,000 mg/kg), but equal to or greater than 0.009% (90 mg/kg), are considered low-level lead paints or surface coatings in accordance with the EACC guideline.

Paints containing less than 0.009% (90 mg/kg) lead is assumed to be insignificant.



Brown paint on drywall containing low levels of lead



Aqua paint on masonry wall containing low levels of lead



4.2.2 *Lead Products and Applications*

Lead-containing batteries are present in emergency lighting.

4.2.3 *Excluded Lead Materials*

Lead is known to be present in a number of materials which were not assessed or sampled. The following materials, where found, should be presumed to contain lead.

- Electrical components, including wiring connectors, grounding conductors, and solder
- Solder on pipe connections

4.3 **Silica**

Crystalline silica is known to be a component of the following materials:

- Poured or pre-cast concrete
- Masonry and mortar
- Plaster
- Drywall

4.4 **Mercury**

4.4.1 *Lamps*

Mercury vapour is present in fluorescent lamp tubes.

4.4.2 *Mercury-Containing Devices*

Thermostats inspected did not contain liquid mercury ampules.

Mercury-containing devices were not found during the assessment.

4.5 **Polychlorinated Biphenyls**

4.5.1 *Caulking and Sealants*

Refer to the Hazardous Materials Summary Report in Appendix V for details on caulking sampled and their locations.

The following table presents a summary of caulking sampled:

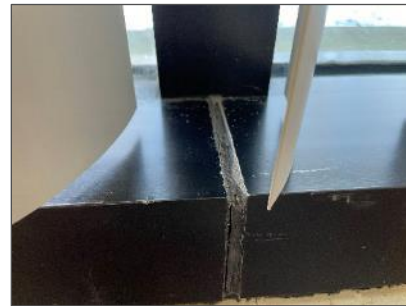
Material, Colour	Sample Location (Location #)	Sample Number	PCB concentration mg/kg
Caulking, black	Windows Frames (Location 24)	P0001	<0.2

Material, Colour	Sample Location (Location #)	Sample Number	PCB concentration mg/kg
Caulking, black	Window Frame Expansion Joint (Location 24)	P0002	3
Butyl sealant, black	Exterior Windowpanes (Location 109)	P0003	<0.2

Caulking in the table above is considered a non-PCB solid based on the threshold (50 mg/kg).



Non-PCB caulking on window frames



Non-PCB expansion joint caulking on window frames



Non-PCB black butyl sealant on exterior windowpanes

4.5.2 Lighting Ballasts

The building has not been comprehensively re-lamped with energy efficient light fixtures (evidence of T-12 fixtures, and as such, a percentage of light ballasts may be manufactured prior to 1980 and may contain PCBs.

4.5.3 Transformers

Transformers were not found during the assessment.

4.6 Mould and Water Damage

Visible mould growth and water damage was not found during the assessment.



5.0 RECOMMENDATIONS

5.1 General

1. Prepare scope of work or performance specifications for hazardous material removal required for the planned work. The specifications should include, safe work practices, personal protective equipment, respiratory protection, and disposal of waste materials.
2. If suspected hazardous building materials are discovered during the planned work, which are not identified in this report, do not disturb and arrange for further testing and evaluation.
3. Provide this report and the detailed plans and specifications to the contractor prior to bidding or commencing work.
4. Retain a qualified consultant to specify, observe and document the successful removal of hazardous materials.
5. Update the asbestos inventory upon completion of the abatement and removal of asbestos-containing materials and any other relevant findings.

5.2 Remedial Work

The following remedial work is recommended regardless of the planned construction work due to the condition and location of the material.

Material, Quantity & Condition	Location	Recommended Procedure
Sprayed fireproofing, debris, above solid ceilings throughout the Project Area.	Corridor (Location 13)	Type 2 entry procedures.

5.3 Building Renovation Work

The following recommendations are made regarding renovation involving the hazardous materials identified.

5.3.1 Asbestos

Remove asbestos-containing materials (ACM) prior to renovation, alteration, or maintenance if ACM may be disturbed by the work.

If the identified ACM will not be removed prior to commencement of the work, any potential disturbance of ACM must follow asbestos precautions appropriate for the type of work being performed.

Asbestos-containing materials must be disposed of at a landfill approved to accept asbestos waste.



5.3.2 *Lead*

For paints identified as having low levels of lead (i.e., less than the EACC guideline of 0.1% (1,000 mg/kg) for lead-containing paints but equal to or above 0.009% (90 mg/kg)) special precautions are not recommended unless aggressive disturbance (grinding, blasting, torching) is planned. Exposure from construction disturbance of paints containing lead less than 0.009% (90 mg/kg) is assumed to be insignificant.

Items painted with paints containing elevated levels of lead may be a hazardous waste. Test lead-painted materials for leachable lead and other metals prior to disposal.

Lead-containing items should be recycled when taken out of service.

5.3.3 *Silica*

Construction disturbance of silica-containing products may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions that comply with per applicable regulations and guidelines.

5.3.4 *Mercury*

Do not break lamps. Recycle and reclaim mercury from fluorescent lamps when taken out of service. Mercury is classified as a hazardous waste and must be disposed of in accordance with applicable regulations.

5.3.5 *PCBs*

As light fixtures are removed from service, examine light ballasts for PCB content. If ballasts are not clearly labelled as "non-PCB" or are suspected to contain PCBs; package and ship ballasts for destruction at a federally permitted facility. As per the PCB Regulation (SOR/2008-273), all PCB light ballasts must be removed from service and properly disposed of by December 31, 2025.

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.

7.0 REFERENCES

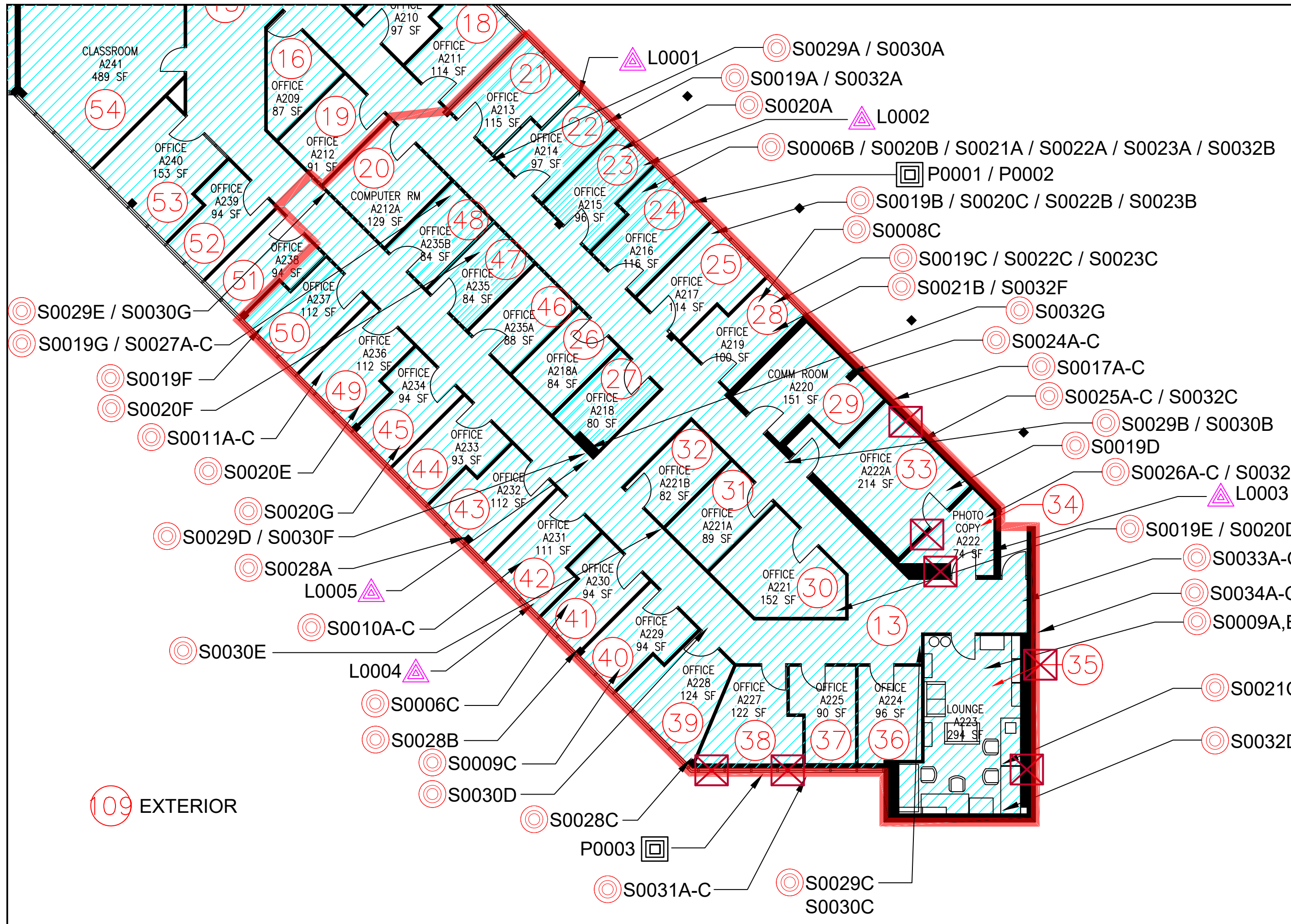
The following legislation and documents were referenced in completing the assessment and this report:


1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Lead on Construction Projects, Ministry of Labour Guidance Document.
4. The Environmental Abatement Council of Canada (EACC) Lead Guideline for Construction, Renovation, Maintenance or Repair.
5. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.
6. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 362 as amended.
7. Silica on Construction Projects, Ministry of Labour Guidance Document.
8. Alert – Mould in Workplace Buildings, Ontario Ministry of Labour.
1. PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act.
2. Surface Coating Materials Regulations, SOR/2016-193, Canada Consumer Product Safety Act.
3. Consolidated Transportation of Dangerous Goods Regulations, including Amendment SOR/2019-101, Transportation of Dangerous Goods Act.
4. Mould Guidelines for the Canadian Construction Industry, Standard Construction Document CCA 82 – 2004 (Revised 2018), Canadian Construction Association.
5. Ozone-depleting Substances and Halocarbon Alternatives Regulations, SOR/2016-137.

\\pinchin.com\ham\Job\287000s\0287774.000 Brock,2021Projects,HAZ,IEQ\0287774.014 Brock,MCC,ABlock,HAZ,DSS\Deliverables\287774.014 HBMA Report MCC A Block 1812 Sir Isaac Brock Way St Cath ON Brock Jan 18 2022.docx

Template: Master Report for Hazardous Materials Assessment (Pre-Construction), HAZ, July 29, 2021

APPENDIX I
Drawings





N


LEGEND

- ⊗ PINCHIN LOCATION NUMBER
- SURVEY BOUNDARY/ASSESSED AREA
- ⊙ ASBESTOS BULK SAMPLE
- ▲ LEAD BULK SAMPLE
- PCB BULK SAMPLE
- A-C SPRAYED FIRE PROOFING
- X INTRUSIVE INSPECTION

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE HAZARDOUS 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: HAZARDOUS BUILDING MATERIALS ASSESSMENT	
CLIENT NAME: BROCK UNIVERSITY	
PROJECT LOCATION: 1812 SIR ISAAC BROCK WAY ST. CATHARINES ONTARIO	
FIGURE NAME: MACKENZIE CHOWN COMPLEX BLOCK A LEVEL 200	
PROJECT NUMBER: 287774.014	SCALE: NOT TO SCALE
DRAWN BY: KD	REVIEWED BY: CM
DATE: JANUARY 2022	FIGURE NUMBER: 1 OF 2



- LEGEND**
- PINCHIN LOCATION NUMBER
 - SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE HAZARDOUS 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.



PROJECT NAME:
HAZARDOUS BUILDING MATERIALS ASSESSMENT

CLIENT NAME:
BROCK UNIVERSITY

PROJECT LOCATION:
**1812 SIR ISAAC BROCK WAY
ST. CATHARINES
ONTARIO**

FIGURE NAME:
**GOODMAN SCHOOL OF BUSINESS
LEVEL 200**

PROJECT NUMBER:
287774.014

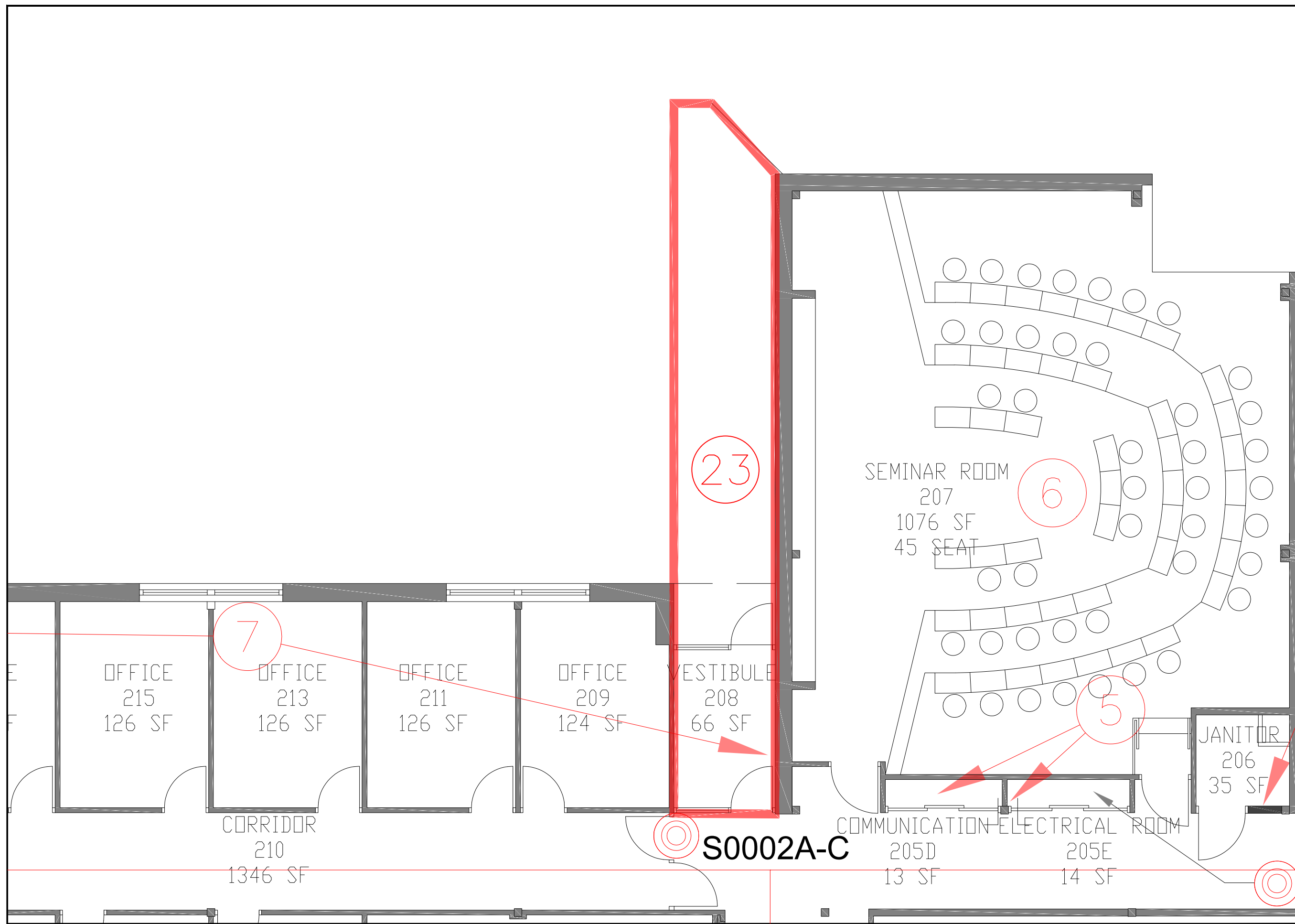
SCALE:
NOT TO SCALE

DRAWN BY:
KD

REVIEWED BY:
CM

DATE:
JANUARY 2022

FIGURE NUMBER:
2 OF 2



APPENDIX II-A
Asbestos Analytical Certificates



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, MCA: MacKenzie Chown Block A,
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego

Lab Reference No.: b263195

Analyst(s): N. Gerrow

Date Received: November 30, 2021 **# Samples submitted:** 53

Date Analyzed: December 6, 2021 **# Phases analyzed:** 55

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.

The Pinchin Ltd. Dartmouth asbestos laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 201032-0) 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.

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.*



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Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego

Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0019A Wall, Drywall And Joint Compound, Loc:22, Office	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019B Wall, Drywall And Joint Compound, Joint Compound, Loc:25, Office	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019C Wall, Drywall And Joint Compound, Loc:28, Office	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019D Wall, Drywall And Joint Compound, Joint Compound, Loc:33, Undergraduate and	Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019E Wall, Drywall And Joint Compound, Loc:30, Office	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019F Wall, Drywall And Joint Compound, Loc:50, Office	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0019G Wall, Drywall And Joint Compound, Loc:48, Test and Exam Room	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%



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Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0020A Structure, Fireproofing (cementitious), Spray Fireproofing, Loc:23, Office	Homogeneous, grey, fibrous material.	Chrysotile 5-10%	Vermiculite 10-25% Other Non-Fibrous > 75%
S0020B Structure, Fireproofing (cementitious), Sprayed Fireproofing, Loc:24, Office			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0020C Structure, Fireproofing (cementitious), Sprayed Fireproofing, Loc:25, Office			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0020D Structure, Fireproofing (cementitious), Loc:30, Office			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0020E Structure, Fireproofing (cementitious), Loc:49, Office			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0020F Structure, Fireproofing (cementitious), Loc:47, Storage			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		



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Lab Reference No.: b263195

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BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0020G Structure, Fireproofing (cementitious), Loc:45, Office			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0021A Floor, Mastic, Baseboard Mastic - Brown, Loc:24, Office	Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
Comments:	Another phase is present but there was insufficient material submitted to analyze.		
S0021B Floor, Mastic, Baseboard Mastic - Brown, Loc:28, Office	3 Phases:		
	a) Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, beige, caulking material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0021C Floor, Mastic, Baseboard Mastic, Loc:35, Faculty & Staff Meeting Room & Lounge	Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
S0022A Wall, Caulking, Window Caulking - Black, Loc:24, Office	Homogeneous, black, rubbery, caulking material.	None Detected	Non-Fibrous Material > 75%



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Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego

Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0022B Wall, Caulking, Loc:25, Office	Homogeneous, black, rubbery, caulking material.	None Detected	Non-Fibrous Material > 75%
S0022C Wall, Caulking, Window Caulking Black, Loc:28, Office	Homogeneous, black, rubbery, caulking material.	None Detected	Non-Fibrous Material > 75%
S0023A Wall, Caulking, Caulking In Compression Joint On Window Frame, Loc:24, Office	Homogeneous, black, caulking material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
S0023B Wall, Caulking, Loc:25, Office	Homogeneous, black, rubbery, caulking material.	None Detected	Non-Fibrous Material > 75%
S0023C Wall, Caulking, Expansion Joint Caulking, Loc:28, Office	Homogeneous, black, caulking material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
S0024A Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, soft, sticky material on the back of vinyl floor tile.	None Detected	Tar and other non- fibrous material > 75%



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Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0024B Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, soft, sticky material on the back of vinyl floor tile.	None Detected	Tar and other non-fibrous material > 75%
S0024C Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, soft, sticky material on the back of vinyl floor tile.	None Detected	Tar and other non-fibrous material > 75%
S0025A Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge	Homogeneous, grey, soft, parging cement.	Chrysotile > 75%	Non-Fibrous Material 10-25%
Comments:	Fabric reinforcement is present on the surface of the sample.		
S0025B Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		



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Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0025C Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0026A Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile. b) Homogeneous, yellow, soft, sticky material on the back of vinyl floor tile.	None Detected None Detected	Non-Fibrous Material > 75% Non-Fibrous Material > 75%
S0026B Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile. b) Homogeneous, yellow, soft, sticky material on the back of vinyl floor tile.	None Detected None Detected	Non-Fibrous Material > 75% Non-Fibrous Material > 75%
S0026C Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room	2 Phases: a) Homogeneous, light grey, consolidated, vinyl floor tile. b) Homogeneous, yellow, soft, sticky material on the back of vinyl floor tile.	None Detected None Detected	Non-Fibrous Material > 75% Non-Fibrous Material > 75%



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Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0027A Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room	Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0027B Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room	Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0027C Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room	Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0028A Wall, Plaster, Plaster On Column, Loc:43, Office	Homogeneous, grey, granular, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%
S0028B Wall, Plaster, Plaster On Column, Loc:41, Office	Homogeneous, grey, granular, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%
S0028C Wall, Plaster, Plaster On Column, Loc:39, Office	Homogeneous, grey, granular, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

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Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0029A Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor	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%
S0029B Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13,	Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0029C Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13,	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0029D Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13,	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0029E Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor	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%
S0030A Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, MCA: MacKenzie Chown Block A,
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego

Lab Reference No.: b263195

Date Analyzed: December 6, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0030B Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0030C Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0030D Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0030E Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0030F Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0030G Wall, Drywall And Joint Compound, Loc:13, Corridor	Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
S0031A Wall, Caulking, Black Sealant, Loc:109, Exterior	Homogeneous, black, soft, sticky, caulking material.	None Detected	Non-Fibrous Material > 75%



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Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego


Lab Reference No.: b263195

Date Analyzed: December 6, 2021


BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0031B Wall, Caulking, Black Sealant, Loc:109, Exterior	Homogeneous, black, soft, sticky, caulking material.	None Detected	Non-Fibrous Material > 75%
S0031C Wall, Caulking, Black Sealant, Loc:109, Exterior	Homogeneous, black, soft, sticky, caulking material.	None Detected	Non-Fibrous Material > 75%

Reviewed by:


Digitally signed
by Jason Stapleton
Date: 2021-12-06
16:55:12

Reporting Analyst:


Digitally signed by
Nicole Gerrow
Date: 2021-12-06
16:54:57

Pinchin Ltd. - Asbestos Laboratory

Internal Asbestos Bulk Sample Chain of Custody

Client Name:	Brock University			Project Address:	1812 Sir Isaac Brock Way, St. Catharines, ON		
Portfolio/Building No:	MCA: MacKenzie Chown Block A			Pinchin File:	287774.014		
Submitted by:	Kris Douglas			Email:	Kdouglas@pinchin.com		
CC Results to:	Chris Mego			CC Email:	cmego@pinchin.com		
Date Submitted:	November	29	2021	Required by:	12	6	2021
# of Samples:	53			Priority:	Regular		
Year of Building Construction (Mandatory, Years ONLY):	1972						
Do NOT Stop on Positive (Sample Numbers):	19, 28, 29, 30						
Pinchin Group Company (Mandatory Field):	Pinchin						
HMIS2 Building Reference #:	98880/202110297740718						
To be Completed by Lab Personnel Only:							
Lab Reference #:	b263195			Time:	24 hour clock		
Received by:	Reid Janssen			Date:	November	30	2021
Name(s) of Analyst(s):	N Gerrow			Dec 6 th 2021			
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)				
S	0019	A	Wall, Drywall And Joint Compound, Loc:22, Office ND				
S	0019	B	Wall, Drywall And Joint Compound, Joint Compound, Loc:25, Office ND				
S	0019	C	Wall, Drywall And Joint Compound, Loc:28, Office ND				
S	0019	D	Wall, Drywall And Joint Compound, Joint Compound, Loc:33, Undergraduate and Graduate Lounge ND				
S	0019	E	Wall, Drywall And Joint Compound, Loc:30, Office ND				
S	0019	F	Wall, Drywall And Joint Compound, Loc:50, Office ND				
S	0019	G	Wall, Drywall And Joint Compound, Loc:48, Test and Exam Room ND				
S	0020	A	Structure, Fireproofing (cementitious), Spray Fireproofing, Loc:23, Office CH 5-10				
S	0020	B	Structure, Fireproofing (cementitious), Sprayed Fireproofing, Loc:24, Office (na)				
S	0020	C	Structure, Fireproofing (cementitious), Sprayed Fireproofing, Loc:25, Office (na)				

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0020	D	Structure, Fireproofing (cementitious), Loc:30, Office (na)
S	0020	E	Structure, Fireproofing (cementitious), Loc:49, Office (na)
S	0020	F	Structure, Fireproofing (cementitious), Loc:47, Storage (na)
S	0020	G	Structure, Fireproofing (cementitious), Loc:45, Office (na)
S	0021	A	Floor, Mastic, Baseboard Mastic - Brown, Loc:24, Office ND
S	0021	B	Floor, Mastic, Baseboard Mastic - Brown, Loc:28, Office a)ND b)ND c)ND
S	0021	C	Floor, Mastic, Baseboard Mastic, Loc:35, Faculty & Staff Meeting Room & Lounge ND
S	0022	A	Wall, Caulking, Window Caulking - Black, Loc:24, Office ND
S	0022	B	Wall, Caulking, Loc:25, Office ND
S	0022	C	Wall, Caulking, Window Caulking Black, Loc:28, Office ND
S	0023	A	Wall, Caulking, Caulking In Compression Joint On Window Frame, Loc:24, Office ND
S	0023	B	Wall, Caulking, Loc:25, Office ND
S	0023	C	Wall, Caulking, Expansion Joint Caulking, Loc:28, Office ND
S	0024	A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room a)ND b)ND
S	0024	B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room a)ND b)ND
S	0024	C	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Grey Fleck, Loc:29, Communication Room a)ND b)ND
S	0025	A	Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge CH >>S
S	0025	B	Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge (na)

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0025	C	Piping, Cement Product, Parging Cement, Loc:33, Undergraduate and Graduate Lounge (na)
S	0026	A	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room a)ND b)ND
S	0026	B	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room a)ND b)ND
S	0026	C	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Grey Streak, Loc:34, Photocopy Room a)ND b)ND
S	0027	A	Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room ND
S	0027	B	Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room ND
S	0027	C	Ceiling, Drywall And Joint Compound, Drywall Compound, Loc:48, Test and Exam Room ND
S	0028	A	Wall, Plaster, Plaster On Column, Loc:43, Office ND
S	0028	B	Wall, Plaster, Plaster On Column, Loc:41, Office ND
S	0028	C	Wall, Plaster, Plaster On Column, Loc:39, Office ND
S	0029	A	Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor a)ND b)ND
S	0029	B	Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor ND
S	0029	C	Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor ND
S	0029	D	Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor ND
S	0029	E	Ceiling, Drywall And Joint Compound, Joint Compound, Loc:13, Corridor a)ND b)ND
S	0030	A	Wall, Drywall And Joint Compound, Loc:13, Corridor ND
S	0030	B	Wall, Drywall And Joint Compound, Loc:13, Corridor ND
S	0030	C	Wall, Drywall And Joint Compound, Loc:13, Corridor ND

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0030	D	Wall,Drywall And Joint Compound,Loc:13,Corridor ND
S	0030	E	Wall,Drywall And Joint Compound,Loc:13,Corridor ND
S	0030	F	Wall,Drywall And Joint Compound,Loc:13,Corridor ND
S	0030	G	Wall,Drywall And Joint Compound,Loc:13,Corridor ND
S	0031	A	Wall,Caulking,Black Sealant,Loc:109,Exterior ND
S	0031	B	Wall,Caulking,Black Sealant,Loc:109,Exterior ND
S	0031	C	Wall,Caulking,Black Sealant,Loc:109,Exterior ND



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, MCA: MacKenzie Chown Block A,
1812 Sir Isaac Brock Way, St. Catharines, ON
Project No.: 0287774.014
Prepared For: K. Douglas / C. Mego
Lab Reference No.: b264064
Analyst(s): J. Raisch-Berkoff
Date Received: December 17, 2021 **# Samples submitted:** 10
Date Analyzed: December 23, 2021 **# Phases analyzed:** 21

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 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.

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.

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: Brock University, MCA: MacKenzie Chown Block A,
 1812 Sir Isaac Brock Way, St. Catharines, ON
Project No.: 0287774.014
Prepared For: K. Douglas / C. Mego

Lab Reference No.: b264064
Date Analyzed: December 23, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0032A Wall, Paint, Cream Paint On Masonry Block, Loc:22, Office	2 Phases: a) Homogeneous, white, coating material (inner layer).	Chrysotile	< 0.5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, coating material (outer layer)	None Detected	Non-Fibrous Material > 75%
S0032B Wall, Paint, Cream Paint On Masonry Block, Loc:24, Office	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	< 0.5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, coating material (outer layer)	None Detected	Non-Fibrous Material > 75%
S0032C Wall, Paint, Cream Paint On Masonry Block, Loc:33, Undergraduate and Graduate Lounge	2 Phases: a) Homogeneous, white, coating material (inner layer).	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, coating material (outer layer).	None Detected	Non-Fibrous Material > 75%
S0032D Wall, Paint, Cream Paint On Masonry Block, Loc:35, Faculty & Staff Meeting Room & Lounge	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	< 0.5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, coating material (outer layer).	None Detected	Non-Fibrous Material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, MCA: MacKenzie Chown Block A,
 1812 Sir Isaac Brock Way, St. Catharines, ON
Project No.: 0287774.014
Prepared For: K. Douglas / C. Mego

Lab Reference No.: b264064
Date Analyzed: December 23, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0032E Wall, Paint, Cream Paint On Masonry Block, Loc:34, Photocopy Room	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Non-homogeneous, off-white and light blue, layered, coating material (outer layers).	None Detected	Non-Fibrous Material > 75%
Comments:	Phase a) is small in size. For more reliable results, a larger sample is required.		
S0032F Wall, Paint, Cream Paint On Masonry Block, Loc:28, Office	a) Homogeneous, white, coating material (inner layer)	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, coating material (outer layer).	None Detected	Non-Fibrous Material > 75%
S0032G Wall, Paint, Cream Paint On Masonry Block, Loc:27, Office	a) Homogeneous, white, coating material (inner layer)	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, off-white, coating material (outer layer).	None Detected	Non-Fibrous Material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, MCA: MacKenzie Chown Block A,
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 0287774.014

Prepared For: K. Douglas / C. Mego

Lab Reference No.: b264064

Date Analyzed: December 23, 2021

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0033A Wall, Paint, Aqua Paint On Masonry Block, Loc:13, Corridor	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	< 0.5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white and light blue, layered, coating material (outer layers).	None Detected	Non-Fibrous Material > 75%
Comments:	Phase a) is small in size. For more reliable results, a larger sample is required.		
S0033B Wall, Paint, Aqua Paint On Masonry Block, Loc:13, Corridor	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white and light blue, layered, coating material (outer layers).	None Detected	Non-Fibrous Material > 75%
S0033C Wall, Paint, Aqua Paint On Masonry Block, Loc:13, Corridor	2 Phases: a) Homogeneous, white, coating material (inner layer)	Chrysotile	0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, off-white and light blue, layered, coating material (outer layers).	None Detected	Non-Fibrous Material > 75%

Reviewed by:

Digitally signed
by Lian Noonan
Date: 2021.12.23
15:55:06-05'00'

Reporting Analyst:

Digitally signed
by Lian Noonan
Date: 2021.12.23
15:54:51-05'00'

Analyzed by: JRB Dec 23/21
 Reviewed by: [Signature]
 Report Sent by: CW.

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

Client Name:	Brock University	Project Address:	1812 Sir Isaac Brock Way, St. Catharines, ON
Portfolio/Building No:	MCA: MacKenzie Chown Block A	Pinchin File:	287774.014
Submitted by:	Kris Douglas	Email:	kdouglas@pinchin.com
CC Results to:	Chris Mego	CC Email:	cmego@pinchin.com
Date Submitted:	December 16 2021	Required by:	December 23 2021
# of Samples:	10	Priority:	Regular
Year of Building Construction (Mandatory, Years ONLY):	1972		
Do NOT Stop on Positive (Sample Numbers):	0032, 0033		
Pinchin Group Company (Mandatory Field):	Pinchin		
HMIS2 Building Reference #:	98880/202110297740718		

To be Completed by Lab Personnel Only:			
Lab Reference #:	b264064 (LN)	Time:	24 hour clock
Received by:	DEC 17 2021	Date:	Month Day Year
Name(s) of Analyst(s):			

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0032	A	Wall, Paint, Cream Paint On Masonry Block, Loc: 22, Office a) CH < 0.5? b) ND
S	0032	B	Wall, Paint, Cream Paint On Masonry Block, Loc: 24, Office a) CH < 0.5? b) ND
S	0032	C	Wall, Paint, Cream Paint On Masonry Block, Loc: 33, Undergraduate and Graduate Lounge a) CH 0.5-5? b) ND
S	0032	D	Wall, Paint, Cream Paint On Masonry Block, Loc: 35, Faculty & Staff Meeting Room & Lounge a) CH < 0.5? b) ND
S	0032	E	Wall, Paint, Cream Paint On Masonry Block, Loc: 34, Photocopy Room a) CH 0.5-5? b) ND
S	0032	F	Wall, Paint, Cream Paint On Masonry Block, Loc: 28, Office a) CH 0.5-5? b) ND
S	0032	G	Wall, Paint, Cream Paint On Masonry Block, Loc: 27, Office a) CH 0.5-5? b) ND d) ND
S	0033	A	Wall, Paint, Aqua Paint On Masonry Block, Loc: 13, Corridor a) CH < 0.5? b) ND

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0033	B	Wall, Paint, Aqua Paint On Masonry Block, Loc: 13, Corridor a) at 0.5-5%. b) ND
S	0033	C	Wall, Paint, Aqua Paint On Masonry Block, Loc: 13, Corridor a) at 0.5-5%. b) ND



Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

Project No.:	0287774.014	Date Received:	January 12, 2022
Prepared For:	K. Douglas / C. Mego	Date Analyzed:	January 12, 2022
Lab Reference No.:	b264697	# Samples submitted:	3
Analyst(s):	T. Lam	# Phases analyzed:	3

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 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.

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.

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 No.: 0287774.014
Prepared For: K. Douglas / C. Mego

Lab Reference No.: b264697
Date Analyzed: January 12, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0034A Brown mastic on drywall, above Soffit, Loc 109, Exterior	Homogeneous, brown, mastic material.	None Detected	Non-Fibrous Material > 75%
Comments:	Man-made vitreous fibres are present on the surface of this sample.		
S0034B Brown mastic on drywall, above Soffit, Loc 109, Exterior	Homogeneous, brown, mastic material.	None Detected	Non-Fibrous Material > 75%
Comments:	Man-made vitreous fibres are present on the surface of this sample.		
S0034C Brown mastic on drywall, above Soffit, Loc 109, Exterior	Homogeneous, brown, mastic material.	None Detected	Non-Fibrous Material > 75%
Comments:	Man-made vitreous fibres are present on the surface of this sample.		

Reviewed by:

Digitally signed by
Elizabeth DeCurtis
Date: 2022.01.12
13:22:56-05'00'

Reporting Analyst:

Digitally signed by
Elizabeth DeCurtis
Date: 2022.01.12
13:23:11-05'00'



Pinchin Environmental Asbestos Laboratory Certificate of Analysis

Project Name:	Brock University - MacKenzie Chown Building, A Block Level 3	Date Received:	March 2, 2006
Project No.:	33744	Date Analyzed:	March 10, 2006
Lab Reference No.:	b35621	# Samples submitted:	15
Analyst(s):	N. Barinque	# Phases analyzed:	13

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 volume 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. Refer to the chart below for the provincial regulatory thresholds. Multiple phases within a sample are analyzed separately.

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

Pinchin Environmental Ltd. is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Code 101270-0) for selected test methods for the identification of asbestos in bulk samples and meets all requirements of ISO/IEC 17025:1999 and relevant requirements of ISO 9002:1994.

Provincial Jurisdiction	Regulatory Threshold	Methods of Analysis	
Ontario	0.5%	EPA 600/R-93/116	OHSD MOL
Quebec	0.1%	EPA 600/R-93/116	IRSST 244-2
Manitoba	0.1%	EPA 600/R-93/116	NIOSH 9002
British Columbia	1.0%	EPA 600/R-93/116	OHSD MOL
Alberta, Saskatchewan	Unstated, likely 1.0%	EPA 600/R-93/116	OHSD MOL
Atlantic Provinces (NL, NS, PEI, NB)	1.0%	EPA 600/R-93/116	OHSD MOL

Methods of Analysis:

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

OHSD MOL – Code for the Determination of Asbestos from Bulk Insulation Samples dated 23rd of August, 1985 issued by the Occupational Health and Safety Division of the Ontario Ministry of Labour

IRSST 244-2 - Characterization of fibres in settled dust or in bulk materials. Institut de recherche en santé et en sécurité du travail du Québec, Issued 1999

NIOSH 9002 Method – Bulk Asbestos Method, Issue 2 dated the 15th, August 1994

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Pinchin Environmental Asbestos Laboratory Certificate of Analysis

Project Name: Brock University - MacKenzie Chown Building, A Block Level 3
 Project No.: 33744
 Prepared For: Rob Wagner

Lab Reference No.: b35621
 Date Analyzed: March 10, 2006

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
001 Cementitious fireproofing, Room A339J	Homogeneous, beige, soft, cementitious material.	Chrysotile 5-10%	Vermiculite 5-10% Other Non-Fibrous > 75%
002 Drywall compound-Room A339J ceiling	Homogeneous, beige, soft, cementitious material.	Chrysotile 0.5-5%	Non-Fibrous Material > 75%
003 Drywall compound-corridor wall	Homogeneous, off-white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
004 Drywall compound-east lobby bulkhead	Homogeneous, off-white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
005a Plaster column-east lobby	Homogeneous, grey, hard, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%
005b Plaster column-Room A336	Homogeneous, grey, hard, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%
005c Plaster column-Room A303	Homogeneous, grey, hard, cementitious material.	None Detected	Perlite 10-25% Other Non-Fibrous > 75%
006 Drywall compound-A332 wall	Homogeneous, off-white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
007 Drywall compound-corridor wall	Homogeneous, off-white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
008 Drywall compound-corridor wall	Homogeneous, off-white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%

REVIEWED BY: _____

ANALYST: _____



**Pinchin Environmental Asbestos Laboratory
Certificate of Analysis**

Project Name: Brock University - MacKenzie Chown Building, A Block Level 3
 Project No.: 33744
 Prepared For: Rob Wagner
 Lab Reference No.: b35621
 Date Analyzed: March 10, 2006

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
009 Drywall compound- corridor ceiling (west end)	Homogeneous, off- white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
010a 12" vinyl floor tile-white with black line pattern	Homogeneous, white, consolidated material.	Chrysotile 0.5-5%	Non-Fibrous Material > 75%
Comments:	Vinyl floor tiles may contain very fine asbestos fibres which are not visible using the PLM method, therefore the estimated percentage of asbestos in this sample should be treated as a minimum value only.		
010b 12" vinyl floor tile-white with black line pattern			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
010c 12" vinyl floor tile-white with black line pattern			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
011 Parging cement-elbow, Room A220	Homogeneous, grey, soft, cementitious material.	Chrysotile 50-75%	Non-Fibrous Material 25-50%

REVIEWED BY: _____

ANALYST: _____



ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0819

DATE ANALYZED: 01/30/13

DATE REPORTED: 01/30/13

TOTAL SAMPLES ANALYZED: 8

SAMPLES >1% ASBESTOS:

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0819

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026-018-W01		A1406067	White	Joint Compound	None Detected
00026-018-W02		A1406068	White	Joint Compound	None Detected
00026-018-W03		A1406069	White	Joint Compound	None Detected
00026-018-W04		A1406070	White	Joint Compound	None Detected
00026-018-W05		A1406071	White,Beige	Joint Compound	None Detected
00026-018-W06		A1406072	Grey,Tan	Drywall	None Detected
00026-018-W07		A1406073	Grey,White	Drywall/Joint Compound	None Detected
00026-018-W08		A1406074	Grey,White	Drywall/Joint Compound	None Detected



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-0819
Date Received: 01-24-13
Date Analyzed: 01-30-13
Date Reported: 01-30-13

Project: ITS PROJECT 523 M/C "A" Block

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026-018- W01 A1406067	Joint Compound	Homogeneous White Non-fibrous Bound	10% 10% 80%	Mica Silicates Binder	None Detected
Lab Notes: No drywall present.					
00026-018- W02 A1406068	Joint Compound	Heterogeneous White Fibrous Tightly Bound	2%	Cellulose 80% 18%	Paint Binder None Detected
Lab Notes: No drywall present.					
00026-018- W03 A1406069	Joint Compound	Heterogeneous White Fibrous Bound	10%	Cellulose 10% 70%	Mica Paint Binder None Detected
Lab Notes: No drywall present.					
00026-018- W04 A1406070	Joint Compound	Homogeneous White Non-fibrous Bound	10% 10% 80%	Mica Silicates Binder	None Detected
Lab Notes: No drywall present.					
00026-018- W05 A1406071	Joint Compound	Heterogeneous White, Beige Non-fibrous Bound	10% 10% 80%	Mica Paint Binder	None Detected
Lab Notes: No drywall present.					
00026-018- W06 A1406072	Drywall	Heterogeneous Grey, Tan Fibrous Loosely Bound	25%	Cellulose 10% 65%	Silicates Gypsum None Detected



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-0819
Date Received: 01-24-13
Date Analyzed: 01-30-13
Date Reported: 01-30-13

Project: ITS PROJECT 523 M/C "A" Block

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
00026-018- W07 A1406073	Drywall/Joint Compound	Heterogeneous Grey,White Fibrous Bound	25%	Cellulose	10%	Calc Carb Gypsum Paint	None Detected
00026-018- W08 A1406074	Drywall/Joint Compound	Heterogeneous Grey,White Fibrous Bound	25%	Cellulose	10%	Calc Carb Gypsum Paint	None Detected



LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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ANALYST: Thomas Messina
Thomas Messina

APPROVED BY: Tianbao Bai
Tianbao Bai, Ph.D.
Laboratory Director



A13-0819
 A1406007-A1406074
 (8) 1/24/13

Laboratory: CEI					Chain of Custody Record																														
Date: January <u>22</u> , 2013					COC <u>1</u> of <u>1</u>																														
Job Reference: ITS PROJECT 523 M/C "A" Block					<table border="1"> <tr> <td colspan="6">Laboratory Analysis</td> <td rowspan="4">Results By:</td> </tr> <tr> <td colspan="6">Asbestos / Paint Coatings</td> </tr> <tr> <td>PLM - Bulk</td> <td>Pb - Bulk</td> <td>Hg - Bulk</td> <td>As - Bulk</td> <td>Cr - Bulk</td> <td>PCB's - Bulk</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>						Laboratory Analysis						Results By:	Asbestos / Paint Coatings						PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk	PCB's - Bulk						
Laboratory Analysis											Results By:																								
Asbestos / Paint Coatings																																			
PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk								PCB's - Bulk																							
Job Number: 00026.018																																			
Contact Name: Lisa Tappay																																			
Contact Email: ltappay@oesn.net																																			
Sample Code	Sample Number	Material Description	Sample Location		PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk	PCB's - Bulk																									
			#	Name																															
* HW-01	00026-018-W01	White - Drywall Joint Compound	A	205C-1 Hall	X																														
* HW-01	00026-018-W02	White - Drywall Joint Compound	A	205C-1 Hall	X																														
* HW-01	00026-018-W03	White - Drywall Joint Compound	A	205C-1 Hall	X																														
* HW-01	00026-018-W04	White - Drywall Joint Compound	A	205C-1 Hall	X																														
* HW-01	00026-018-W05	White - Drywall Joint Compound	A	205C-1 Hall	X																														
* HW-02	00026-018-W06	White - Drywall Board	A	205C-2 Hall	X																														
* HW-02	00026-018-W07	White - Drywall Board	A	205C-2 Hall	X																														
* HW-02	00026-018-W08	White - Drywall Board	A	205C-2 Hall	X																														
Comments: s#s: w01-w05 collected from corner bead					<input checked="" type="checkbox"/> Positive stop on analyses identified above with '*'			Total # samples shipped: 8																											
Relinquished By: <u>J. Drummond</u>			COC Number: <u>002</u>		Received by: <u>[Signature]</u>		Date/Time: <u>1/24/13 9:30</u>		Laboratory:																										
Date: <u>Jan 23 2013</u>																																			

*
*
*

WALL





ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0817

DATE ANALYZED: 01/30/13

DATE REPORTED: 01/30/13

TOTAL SAMPLES ANALYZED: 5

SAMPLES >1% ASBESTOS:

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0817

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026.018-C01		A1406042	White	Joint Compound	None Detected
00026.018-C02		A1406043	White	Joint Compound	None Detected
00026.018-C03		A1406044	White	Joint Compound	None Detected
00026.018-C04		A1406045	White	Joint Compound	None Detected
00026.018-C05		A1406046	White	Joint Compound	None Detected



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-0817
Date Received: 01-24-13
Date Analyzed: 01-30-13
Date Reported: 01-30-13

Project: ITS PROJECT 523 M/C "A" Block

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026.018-C01 A1406042	Joint Compound	Homogeneous White Non-fibrous Bound	80% 20%	Calc Carb Binder	None Detected
00026.018-C02 A1406043	Joint Compound	Homogeneous White Non-fibrous Bound	80% 20%	Calc Carb Binder	None Detected
00026.018-C03 A1406044	Joint Compound	Homogeneous White Non-fibrous Bound	80% 20%	Calc Carb Binder	None Detected
00026.018-C04 A1406045	Joint Compound	Homogeneous White Non-fibrous Bound	80% 20%	Calc Carb Binder	None Detected
00026.018-C05 A1406046	Joint Compound	Homogeneous White Non-fibrous Bound	80% 20%	Calc Carb Binder	None Detected




LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

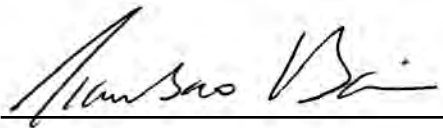
METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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ANALYST: 
Lynn Burkholder

APPROVED BY: 
Tianbao Bai, Ph.D.
Laboratory Director



A13-0817
 A1406042-A1406046
 (5) 1/24/13

Laboratory: CEI						Chain of Custody Record COC / of /					
Date: January 22, 2013											
Job Reference: ITS PROJECT 523 M/C "A" Block						Laboratory Analysis Asbestos / Paint Coatings					
Job Number: 00026.018											
Contact Name: Lisa Tappay						Results By:					
Contact Email: ltappay@oesn.net											
Sample Code	Sample Number	Material Description	Sample Location		PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk	PCB's - Bulk	
			#	Name							
HC-01	00026.018-C01	White - Drywall Joint Compound	A	205C-1 Hall	X						
HC-01	00026.018-C02	White - Drywall Joint Compound	A	205C-1 Hall	X						
HC-01	00026.018-C03	White - Drywall Joint Compound	A	205C-1 Hall	X						
HC-01	00026.018-C04	White - Drywall Joint Compound	A	205C-1 Hall	X						
HC-01	00026.018-C05	White - Drywall Joint Compound	A	205C-1 Hall	X						
Comments:											
Relinquished By: J. Drummord						<input checked="" type="checkbox"/> Positive stop on analyses identified above with '*'			Total # samples shipped: 5		
Date: Jan. 23 2013						COC Number: 003			Received by: [Signature] 1/24/13		
						Date/Time:			Laboratory:		

CEILING





ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0816

DATE ANALYZED: 01/30/13

DATE REPORTED: 01/30/13

TOTAL SAMPLES ANALYZED: 4

SAMPLES >1% ASBESTOS: 4

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: ITS PROJECT 523 M/C "A" Block

CEI LAB CODE: A13-0816

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026.018-T01		A1406030	Grey	Fireproofing	Chrysotile 5%
00026.018-T02		A1406031		Sample Not Analyzed per COC	
00026.018-T03		A1406032		Sample Not Analyzed per COC	
00026.018-T04		A1406033	Grey	Thermal Cement	Chrysotile 65%
00026.018-T05		A1406034		Sample Not Analyzed per COC	
00026.018-T06		A1406035		Sample Not Analyzed per COC	
00026.018-T07		A1406036	Grey	Thermal Cement	Chrysotile 65%
00026.018-T08		A1406037		Sample Not Analyzed per COC	
00026.018-T09		A1406038		Sample Not Analyzed per COC	
00026.018-T10		A1406039	Grey	Thermal Cement	Chrysotile 65%
00026.018-T11		A1406040		Sample Not Analyzed per COC	
00026.018-T12		A1406041		Sample Not Analyzed per COC	



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-0816
Date Received: 01-24-13
Date Analyzed: 01-30-13
Date Reported: 01-30-13

Project: ITS PROJECT 523 M/C "A" Block

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026.018-T01 A1406030	Fireproofing	Homogeneous Grey Fibrous Loosely Bound	75% 20%	Binder Mica	5% Chrysotile
00026.018-T02 A1406031	Sample Not Analyzed per COC				
00026.018-T03 A1406032	Sample Not Analyzed per COC				
00026.018-T04 A1406033	Thermal Cement	Homogeneous Grey Fibrous Loosely Bound	35%	Binder	65% Chrysotile
00026.018-T05 A1406034	Sample Not Analyzed per COC				
00026.018-T06 A1406035	Sample Not Analyzed per COC				
00026.018-T07 A1406036	Thermal Cement	Homogeneous Grey Fibrous Loosely Bound	35%	Binder	65% Chrysotile
00026.018-T08 A1406037	Sample Not Analyzed per COC				
00026.018-T09 A1406038	Sample Not Analyzed per COC				



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
RR #2
1783 Highway 20C
Allanburg, ON L0S 1A0

CEI Lab Code: A13-0816
Date Received: 01-24-13
Date Analyzed: 01-30-13
Date Reported: 01-30-13

Project: ITS PROJECT 523 M/C "A" Block

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026.018- T10 A1406039	Thermal Cement	Homogeneous Grey Fibrous Loosely Bound	35%	Binder	65% Chrysotile
00026.018- T11 A1406040	Sample Not Analyzed per COC				
00026.018- T12 A1406041	Sample Not Analyzed per COC				




LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

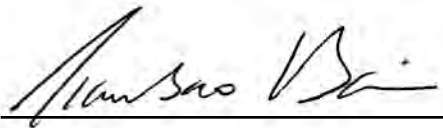
METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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ANALYST: 
Lynn Burkholder

APPROVED BY: 
Tianbao Bai, Ph.D.
Laboratory Director



A13-0816
 A1406030 - A1406041
 (12) 1/24/13

Laboratory CEI				Chain of Custody Record																														
Date: January 22 , 2013				COC 1 of 1																														
Job Reference: ITS PROJECT 523 M/C "A" Block				<table border="1"> <tr> <td colspan="6">Laboratory Analysis</td> <td rowspan="4">Results By:</td> </tr> <tr> <td colspan="6">Asbestos / Paint Coatings</td> </tr> <tr> <td>PLM - Bulk</td> <td>Pb - Bulk</td> <td>Hg - Bulk</td> <td>As - Bulk</td> <td>Cr - Bulk</td> <td>PCB's - Bulk</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						Laboratory Analysis						Results By:	Asbestos / Paint Coatings						PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk	PCB's - Bulk						
Laboratory Analysis										Results By:																								
Asbestos / Paint Coatings																																		
PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk								Cr - Bulk	PCB's - Bulk																						
Job Number: 00026.018																																		
Contact Name: Lisa Tappay																																		
Contact Email: ltappay@oesn.net																																		
Sample Code	Sample Number	Material Description	Sample Location		PLM - Bulk	Pb - Bulk	Hg - Bulk	As - Bulk	Cr - Bulk	PCB's - Bulk																								
			#	Name																														
* HT-01	00026.018-T01	Grey - Fireproofing - I beam	A220	Comm Rm.	X																													
* HT-01	00026.018-T02	Grey - Fireproofing - I beam	A220	Comm Rm.	X																													
* HT-01	00026.018-T03	Grey - Fireproofing - I beam	A220	Comm Rm.	X																													
* HT-02	00026.018-T04	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-02	00026.018-T05	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-02	00026.018-T06	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-03	00026.018-T07	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-03	00026.018-T08	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-03	00026.018-T09	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-04	00026.018-T10	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-04	00026.018-T11	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
* HT-04	00026.018-T12	Grey - Thermal Cement - Elbow	A220	Comm Rm.	X																													
Comments: T04 - T06 Sanitary system T07 - T09 Storm Drain system T10 - T12 Cold water system				<input checked="" type="checkbox"/> Positive stop on analyses identified above with '*'				Total # samples shipped: 12																										
Relinquished By: J. Drummond			COC Number: 001			Received by: [Signature]																												
Date: Jan 22, 2013						Date/Time: 1/24/13 9:50																												
						Laboratory:																												



THERMAL

Ontario Environmental and Safety Network Ltd.

1783 Highway 20, RR#2
 Allanburg, Ontario
 1-888-271-2111



ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: 00026.028

CEI LAB CODE: A13-7673

DATE ANALYZED: 07/08/13

DATE REPORTED: 07/08/13

TOTAL SAMPLES ANALYZED: 5

SAMPLES >1% ASBESTOS: 5

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: 00026.028

CEI LAB CODE: A13-7673

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026.026-T01		A1504725	Brown,Grey	Fireproofing	Chrysotile 5%
00026.026-T02		A1504726	Brown,Grey	Fireproofing	Chrysotile 5%
00026.026-T03		A1504727	Brown,Grey	Fireproofing	Chrysotile 5%
00026.026-T04		A1504728	Brown,Grey	Fireproofing	Chrysotile 5%
00026.026-T05		A1504729	Brown,Grey	Fireproofing	Chrysotile 5%



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-7673
Date Received: 07-05-13
Date Analyzed: 07-08-13
Date Reported: 07-08-13

Project: 00026.028

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026.026- T01 A1504725	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.026- T02 A1504726	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.026- T03 A1504727	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.026- T04 A1504728	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.026- T05 A1504729	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			



LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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ANALYST: *Thomas Messina*
Thomas Messina

APPROVED BY: *Tianbao Bai*
Tianbao Bai, Ph.D.
Laboratory Director



⑤ A13-7673
A1504725-A1504729

Chain of Custody Record

COC 1 of 1

Laboratory: CEI								
Sample Date: July 31st 2013		Job Number: 00026.028						
Quotation#:				Analysis				
Job Reference: Block U: Mackenzie Churn A, C.F Blocks Spray-on Bulle Sampling				PLM Bulk	PLM Point Count	PLM Gravimetric	TEM Bulk	Results By:
Contact Name: Lisa Tappay								
Contact Email: ltappay@oesn.net								
HM #	Sample #	Sample ID	Location	PLM Bulk	PLM Point Count	PLM Gravimetric	TEM Bulk	<input type="checkbox"/> 4 hour <input type="checkbox"/> 24 hour <input checked="" type="checkbox"/> 2 B Days <input type="checkbox"/> 3 B Days <input type="checkbox"/> 5 B Days <input type="checkbox"/> Other:
HT-08	00026.028-T01	Spray-on FP - deck.	A 332	X				
HT-08	00026.028-T02	Spray-on FP - deck.	A 315	X				
HT-08	00026.028-T03	Spray-on FP - beam	A 310	X				
HT-08	00026.028-T04	Spray-on FP - beam <small>ext. wall beam across from elevator</small>	A Block 304	X				
HT-08	00026.028-T05	Spray-on FP - beam <small>interior of workroom washroom @ A336</small>	<small>(corner) counter junction</small>	X				
Comments: FP = file posting			Method of Delivery:	<input type="checkbox"/> Positive stop on analyses identified above with '*'		Total # samples shipped:		5
Relinquished By (Print & Sign): T. McPherson		Received by Driver/Depot: 000276		Received at Lab: 		Verified By:		
Date/Time: July 31st 2013		Date/Time:		Date/Time: 7/31/13 10.00		Date/Time:		



Ontario Environmental & Safety Network Ltd.



ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: 00026.028

CEI LAB CODE: A13-7672

DATE ANALYZED: 07/08/13

DATE REPORTED: 07/08/13

TOTAL SAMPLES ANALYZED: 2

SAMPLES >1% ASBESTOS:

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: 00026.028

CEI LAB CODE: A13-7672

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026.028-T06		A1504723	Brown,Grey	Fireproofing	None Detected
00026.028-T07		A1504724	Brown,Grey	Fireproofing	None Detected



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-7672
Date Received: 07-05-13
Date Analyzed: 07-08-13
Date Reported: 07-08-13

Project: 00026.028

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS			ASBESTOS %
			Fibrous	Non-Fibrous		
00026.028- T06 A1504723	Fireproofing	Heterogeneous	5%	Cellulose	40%	None Detected
		Brown,Grey			50%	
		Fibrous			5%	
		Loosely Bound			Paint	
00026.028- T07 A1504724	Fireproofing	Heterogeneous	5%	Cellulose	40%	None Detected
		Brown,Grey			50%	
		Fibrous			5%	
		Loosely Bound			Paint	



LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

This report may not be reproduced, except in full, without written approval by CEI LABS. CEI LABS makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U. S. Government.

ANALYST: Thomas Messina
Thomas Messina

APPROVED BY: Tianbao Bai
Tianbao Bai, Ph.D.
Laboratory Director



② A13-767Z
 #1504723- A1504724
Chain of Custody Record

Laboratory: CEI								COC of	
Sample Date: July 3rd 2013		Job Number: 00026-028							
Quotation#:				Analysis					
Job Reference: Block U: Madamie Cham A, C, G Blocks Spray-on Bulk Sampling									
Contact Name:									
Contact Email:									
HM #	Sample #	Sample ID	Location	PLM Bulk	PLM Point Count	PLM Gravimetric	TEM Bulk	Results By:	
HTB9	00026-028-T06	Spray-on FP-beam	C407	X					
HTD9	00026-028-T07	Spray-on FP-deck	C405	X				<input type="checkbox"/> 4 hour <input type="checkbox"/> 24 hour <input checked="" type="checkbox"/> 2 B Days <input type="checkbox"/> 3 B Days <input type="checkbox"/> 5 B Days <input type="checkbox"/> Other:	
Comments: FP = fire proofing				Method of Delivery:		<input type="checkbox"/> Positive stop on analyses identified above with '*'		Total # samples shipped: 2	
Relinquished By (Print & Sign): T. McPherson		Received by Driver/Depot: 000277		Received at Lab: A		Verified By:			
Date/Time: July 3rd 2013		Date/Time:		Date/Time: 7/5/13 10:00		Date/Time:			



Ontario Environmental & Safety Network Ltd.

1783 Highway 20, RR#2, Allanburg, Ontario Canada L0S 1A0 Tel: 1-888-271-2111 Fax: 905-988-1910 www.oesn.net



ASBESTOS LABORATORY REPORT

Prepared for

Ontario Environmental & Safety Network, LTD.

PROJECT: 000256.028

CEI LAB CODE: A13-7674

DATE ANALYZED: 07/08/13

DATE REPORTED: 07/08/13

TOTAL SAMPLES ANALYZED: 3

SAMPLES >1% ASBESTOS: 3

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: 000256.028

CEI LAB CODE: A13-7674

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
00026.028-T08		A1504730	Brown,Grey	Fireproofing	Chrysotile 5%
00026.028-T09		A1504731	Brown,Grey	Fireproofing	Chrysotile 5%
00026.028-T10		A1504732	Grey	Fireproofing	Chrysotile 5%



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Ontario Environmental & Safety Network, LTD.
 RR #2
 1783 Highway 20C
 Allanburg, ON L0S 1A0

CEI Lab Code: A13-7674
Date Received: 07-05-13
Date Analyzed: 07-08-13
Date Reported: 07-08-13

Project: 000256.028

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	
00026.028- T08 A1504730	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.028- T09 A1504731	Fireproofing	Heterogeneous	30%	Vermiculite	5% Chrysotile
		Brown,Grey	60%	Binder	
		Fibrous	5%	Paint	
		Loosely Bound			
00026.028- T10 A1504732	Fireproofing	Homogeneous	30%	Vermiculite	5% Chrysotile
		Grey	65%	Binder	
		Fibrous			
		Loosely Bound			



LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
 Non-Trem = Non-Asbestiform Tremolite
 Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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ANALYST: Thomas Messina
 Thomas Messina

APPROVED BY: Tianbao Bai
 Tianbao Bai, Ph.D.
 Laboratory Director



3 A13-763474
A1504730-A1504732

Chain of Custody Record

COC 1 of 1

Laboratory: CEI

Sample Date: July 3rd 2013 Job Number: 00026.028

Quotation#: _____

Analysis

Job Reference: Block 0: Mackenzie Chan A, C, G Blocks Spray-on Bulk Sampling

Contact Name: _____

Contact Email: _____

HM #	Sample #	Sample ID	Location	PLM Bulk	PLM Point Count	PLM Gravimetric	TEM Bulk	Results By:
HT-10	00026.028-T08	Spray-on FP - deck 300 level corridor between mens and wash room stairwell.		X				<input type="checkbox"/> 4 hour <input type="checkbox"/> 24 hour <input checked="" type="checkbox"/> 2 B Days <input type="checkbox"/> 3 B Days <input type="checkbox"/> 5 B Days <input type="checkbox"/> Other:
HT-10	00026.028-T09	Spray-on FP - beam	G 301	X				
HT-10	00026.028-T10	Spray-on FP - beam corridor 300 level 1st part of G3091 @ 312 @ height in ceiling		X				

Comments: FP = fire proofing

Method of Delivery: _____

Positive stop on analyses identified above with '+'

Total # samples shipped: 3

Relinquished By (Print & Sign): T. McPherson

Received by Driver/Depot: 000277

Received at Lab: A

Verified By: _____

Date/Time: July 3rd 2013

Date/Time: _____

Date/Time: 7/5/13 10:00

Date/Time: _____



Ontario Environmental & Safety Network Ltd.

Analyzed by: TTL
 Reviewed by: [Signature]
 Report Sent by: [Signature] Report Sent by: _____

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

Client Name:		Project Address:	
Portfolio/Building No:		Pinchin File:	287774.014
Submitted by:	Kris Douglas	Email:	Kdouglas@pinchin.com
CC Results to:	Chris Mego	CC Email:	cmego@pinchin.com
Date Submitted:	January 11 2022	Required by:	January 12 2022
# of Samples:	3	Priority:	Rush
Year of Building Construction (Mandatory, Years ONLY):		1972	
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):		Pinchin	
HMIS2 Building Reference #:		98880/202110297740718	
To be Completed by Lab Personnel Only:			
Lab Reference #:	62646970		Time: 24 hour clock
Received by:	JAN 12 2022	Date:	Month Day Year
Name(s) of Analyst(s):		TTL Jan 12 2022	
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0034	A	Brown mastic on drywall, above Soffit, Loc 109, Exterior NP
S	0034	B	Brown mastic on drywall, above Soffit, Loc 109, Exterior NP
S	0034	C	Brown mastic on drywall, above Soffit, Loc 109, Exterior NP



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, Taro Hall
 1812 Sir Isaac Brock Way, St. Catharines, ON
Project No.: 104796.012
Prepared For: C. Mego / M. Maiorana **Date Received:** June 22, 2016
Lab Reference No.: b131131 **Date Analyzed:** June 27, 2016
Analyst(s): A. Lebar Vertolli / N. Barinque / J. Dacquel
Samples submitted: 27
Phases analyzed: 25

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: Brock University, Taro Hall
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 104796.012

Prepared For: C. Mego / M. Maiorana

Lab Reference No.: b131131

Date Analyzed: June 27, 2016

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0003A Tan caulking around window, west side, Exterior (Location 23)	Homogeneous, off-white, caulking material.	None Detected	Non-Fibrous Material > 75%
0003B Tan caulking around window, west side, Exterior (Location 23)	Homogeneous, off-white, caulking material.	None Detected	Non-Fibrous Material > 75%
0003C Tan caulking around window, south side, Exterior (Location 23)	Homogeneous, off-white, caulking material.	None Detected	Non-Fibrous Material > 75%
0004A Butyl tape inside window, west side, Exterior (Location 23)	Homogeneous, black, caulking material.	None Detected	Non-Fibrous Material > 75%
0004B Butyl tape inside window, west side, Exterior (Location 23)	Homogeneous, black, caulking material.	None Detected	Non-Fibrous Material > 75%
0004C Butyl tape inside window, south side, Exterior (Location 23)	Homogeneous, black, caulking material.	None Detected	Non-Fibrous Material > 75%
0005A Expansion joint caulking, west side, Exterior (Location 23)	Homogeneous, beige, caulking material.	None Detected	Non-Fibrous Material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: Brock University, Taro Hall
 1812 Sir Isaac Brock Way, St. Catharines, ON
Project No.: 104796.012
Prepared For: C. Mego / M. Maiorana

Lab Reference No.: b131131
Date Analyzed: June 27, 2016

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0005B Expansion joint caulking, west side, Exterior (Location 23)	Homogeneous, beige, caulking material.	None Detected	Non-Fibrous Material > 75%
0005C Expansion joint caulking, east stairwell, Exterior (Location 23)	Homogeneous, beige, caulking material.	None Detected	Non-Fibrous Material > 75%
0006A Grey door caulking, north stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0006B Grey door caulking, north stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0006C Grey door caulking, north stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0007A Butyl tape on doors, south side, Exterior (Location 23)	Homogeneous, black, caulking material.	Chrysotile 0.5-5%	Non-Fibrous Material > 75%
0007B Butyl tape on doors, south side, Exterior (Location 23)			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		



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

Project Name: Brock University, Taro Hall
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 104796.012

Prepared For: C. Mego / M. Maiorana

Lab Reference No.: b131131

Date Analyzed: June 27, 2016

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0007C Butyl tape on doors, south side, Exterior (Location 23)			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
0008A Grey door caulking, east stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0008B Grey door caulking, east stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0008C Grey door caulking, east stairwell, Exterior (Location 23)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0009A Grey caulking at flashing on roof (Location 22)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0009B Grey caulking at flashing on roof (Location 22)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
0009C Grey caulking at flashing on roof (Location 22)	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%



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

Project Name: Brock University, Taro Hall
1812 Sir Isaac Brock Way, St. Catharines, ON

Project No.: 104796.012

Prepared For: C. Mego / M. Maiorana

Lab Reference No.: b131131

Date Analyzed: June 27, 2016

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0010A Brown duct mastic, Level 400, Corridor 409 (Location 15)	Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
0010B Brown duct mastic, Level 400, Corridor 409 (Location 15)	Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
0010C Brown duct mastic, Level 400, Corridor 409 (Location 15)	Homogeneous, brown, adhesive material.	None Detected	Non-Fibrous Material > 75%
0011A Butyl tape, interior, Level 200, Lounge 249 (Location 7)	Homogeneous, black, caulking material.	Chrysotile < 0.5%	Non-Fibrous Material > 75%
0011B Butyl tape, interior, Level 200, Lounge 249 (Location 7)	Homogeneous, black, caulking material.	Chrysotile < 0.5%	Non-Fibrous Material > 75%
0011C Butyl tape, interior, Level 200, Lounge 249 (Location 7)	Homogeneous, black, caulking material.	Chrysotile < 0.5%	Non-Fibrous Material > 75%

Reviewed by:

Reporting Analyst:



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0001a	Parging cement on pipe fitting, cold water line, Loc 1, Mech Room A200	10% Chrysotile		90% Other	Gray Non Fibrous Homogeneous
1405861PLM_1					Crushed
0001b	Parging cement on pipe elbow, drain pipe, Loc 3, Corridor	Not Analyzed			
1405861PLM_2					
0001c	Parging cement on pipe elbow, chilled water system, Loc 1, Mech Room A200	Not Analyzed			
1405861PLM_3					
0002a	Debris on top of AHU, Loc 1, Mech Room A200	10% Chrysotile		90% Other	Gray Non Fibrous Homogeneous
1405861PLM_4					Crushed
0002b	Debris on top of AHU, Loc 1, Mech Room A200	Not Analyzed			
1405861PLM_5					
0002c	Debris on top of AHU, Loc 1, Mech Room A200	Not Analyzed			
1405861PLM_6					
0003a	Rough plaster on column enclosure, Loc 1, Mech Room A200	None Detected		95% Other 5% Perlite	Gray Non Fibrous Heterogeneous
1405861PLM_7					Crushed
0003b	Rough plaster on column enclosure, Loc 1, Mech Room A200	None Detected		95% Other 5% Perlite	Gray Non Fibrous Heterogeneous
1405861PLM_8					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended 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 1.0%.

Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0004a	Parging cement at wall penetration, drain pipe, Loc 3, Corridor	10% Chrysotile		90% Other	Gray Non Fibrous Homogeneous
1405861PLM_9					Crushed
0004b	Parging cement at wall penetration, drain pipe, Loc 3, Corridor	Not Analyzed			
1405861PLM_10					
0004c	Parging cement at wall penetration, Loc 1, Mech Room A200	Not Analyzed			
1405861PLM_11					
0005a - A	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_12	tile				Dissolved
0005a - B	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_54	mastic				Dissolved
0005b - A	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_13	tile				Dissolved
0005b - B	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_55	mastic				Dissolved
0005c - A	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_14	tile				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 1.0%.

Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0005c - B	12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_56	mastic				Dissolved
0006a - A	12" x 12" vinyl floor tile, beige with brown streaks, Loc 14, Office A207	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_15	tile				Dissolved
0006a - B	12" x 12" vinyl floor tile, beige with brown streaks, Loc 14, Office A207	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_57	mastic				Dissolved
0006b - A	12" x 12" vinyl floor tile, beige with brown streaks, Loc 24, Office A216	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_16	tile				Dissolved
0006b - B	12" x 12" vinyl floor tile, beige with brown streaks, Loc 24, Office A216	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_58	mastic				Dissolved
0006c - A	12" x 12" vinyl floor tile, beige with brown streaks, Loc 41, Office A230	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_17	tile				Dissolved
0006c - B	12" x 12" vinyl floor tile, beige with brown streaks, Loc 41, Office A230	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_59	mastic				Dissolved
0007a - A	12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_18	tile				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 recommended 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 SAL. 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 1.0%.

Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0007a - B	12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_60	mastic				Dissolved
0007b - A	12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_19	tile				Dissolved
0007b - B	12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_61	mastic				Dissolved
0007c - A	12" x 12" vinyl floor tile, beige flecks, Loc 19, Office A212	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_20	tile				Dissolved
0007c - B	12" x 12" vinyl floor tile, beige flecks, Loc 19, Office A212	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_62	mastic				Dissolved
0008a	Parging at wall pipe penetration, Loc 18, Office A211	None Detected		95% Other 5% Perlite	Gray Non Fibrous Heterogeneous
1405861PLM_21					Crushed
0008b	Parging at wall pipe penetration, Loc 18, Office A211	None Detected		95% Other 5% Perlite	Gray Non Fibrous Heterogeneous
1405861PLM_22					Crushed
0008c	Parging at wall pipe penetration, Loc 28, Office A219	None Detected		95% Other 5% Quartz	Gray Non Fibrous Heterogeneous
1405861PLM_23					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended 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 1.0%.

Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0009a	Brown mastic on ducts, Loc 35, Faculty Lounge A223	None Detected	5% Wollastonite	95% Other	Brown Non Fibrous Homogeneous
1405861PLM_24					Dissolved
0009b	Brown mastic on ducts, Loc 35, Faculty Lounge A223	None Detected	5% Wollastonite	95% Other	Brown Non Fibrous Homogeneous
1405861PLM_25					Dissolved
0009c	Brown mastic on ducts, Loc 40, Office A229	None Detected	5% Wollastonite	95% Other	Brown Non Fibrous Homogeneous
1405861PLM_26					Dissolved
0010a - A	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Blue Non Fibrous Homogeneous
1405861PLM_27	tile				Dissolved
0010a - B	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_63	mastic				Dissolved
0010b - A	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Blue Non Fibrous Homogeneous
1405861PLM_28	tile				Dissolved
0010b - B	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_64	mastic				Dissolved
0010c - A	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Blue Non Fibrous Homogeneous
1405861PLM_29	tile				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 recommended 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 1.0%.

Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0010c - B	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_65	mastic				Dissolved
0011a - A	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Orange Non Fibrous Homogeneous
1405861PLM_30	tile				Dissolved
0011a - B	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_66	mastic				Dissolved
0011b - A	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Orange Non Fibrous Homogeneous
1405861PLM_31	tile				Dissolved
0011b - B	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_67	mastic				Dissolved
0011c - A	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Orange Non Fibrous Homogeneous
1405861PLM_32	tile				Dissolved
0011c - B	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_68	mastic				Dissolved
0012a	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1405861PLM_33					Teased

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Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0012b	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1405861PLM_34					Teased
0012c	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1405861PLM_35					Teased
0013a - A	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_36	tile				Dissolved
0013a - B	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_69	mastic				Dissolved
0013b - A	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_37	tile				Dissolved
0013b - B	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_70	mastic				Dissolved
0013c - A	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Gray Non Fibrous Homogeneous
1405861PLM_38	tile				Dissolved
0013c - B	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_71	mastic				Dissolved

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Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0014a - A	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected	40% Cellulose 10% Fiber Glass 10% Synthetic Fibers	40% Other	Gray Non Fibrous Heterogeneous
1405861PLM_39	backing				Teased
0014a - B	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_72	mastic				Dissolved
0014b - A	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected	40% Cellulose 10% Fiber Glass 10% Synthetic Fibers	40% Other	Gray Non Fibrous Heterogeneous
1405861PLM_40	backing				Teased
0014b - B	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_73	mastic				Dissolved
0014c - A	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected	40% Cellulose 10% Fiber Glass 10% Synthetic Fibers	40% Other	Gray Non Fibrous Heterogeneous
1405861PLM_41	backing				Teased
0014c - B	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_74	mastic				Dissolved
0015a - A	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_42	tile				Dissolved
0015a - B	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_75	mastic				Dissolved

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Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Project: 83844.001 Brock A Block MCC

Date Reported: 4/22/2014

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0015b - A	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_43	tile				Dissolved
0015b - B	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_76	mastic				Dissolved
0015c - A	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Beige Non Fibrous Homogeneous
1405861PLM_44	tile				Dissolved
0015c - B	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340	None Detected		100% Other	Black Non Fibrous Homogeneous
1405861PLM_77	mastic				Dissolved
0016a	Baseboard mastic ONLY, Loc 106, Meeting Room A323	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_45					Dissolved
0016b	Baseboard mastic ONLY, Loc 106, Meeting Room A323	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_46					Dissolved
0016c	Baseboard mastic ONLY, Loc 106, Meeting Room A323	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1405861PLM_47					Dissolved
0017a	Texture finish on drywall soffit, Loc 109, Exterior	None Detected		100% Other	White Non Fibrous Homogeneous
1405861PLM_48					Crushed

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Bart Huber (77)

Analyst

Approved Signatory



Bulk Asbestos Analysis

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



Customer: Pinchin Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1405861

Analysis ID: 1405861_PLM

Date Received: 4/2/2014

Date Reported: 4/22/2014

Project: 83844.001 Brock A Block MCC

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0017b	Texture finish on drywall soffit, Loc 109, Exterior	None Detected		100% Other	White Non Fibrous Homogeneous
1405861PLM_49					Crushed
0017c	Texture finish on drywall soffit, Loc 109, Exterior	None Detected		100% Other	White Non Fibrous Homogeneous
1405861PLM_50					Crushed
0018a	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201	10% Chrysotile		85% Other 5% Vermiculite	Gray Non Fibrous Homogeneous
1405861PLM_51					Crushed
0018b	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201	Not Analyzed			
1405861PLM_52					
0018c	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201	Not Analyzed			
1405861PLM_53					

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Bart Huber (77)

Analyst

Approved Signatory

1405861

1405889

Version 1-15-2012

Client:	Pinchin Environmental Ltd.	*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. <i>Only Enter your data on the first sheet "Sheet1"</i> <i>Note: Data 1 and Data 2 are optional</i> <i>fields that do not show up on the official</i> <i>report, however they will be included</i> <i>in the electronic data returned to you</i> <i>to facilitate your reintegration of the report data.</i>
Contact:	Leslie Cantar	
Address:	11-875 Main St W, Hamilton, ON	
Phone:	905-577-6206	
Fax:	905-577-6207	
Email:	lcantar@pinchin.com	
Project:	83844.001 Brock A Block MCC	
Client Notes:	PLM EPA 600/R-93/116, Stop Positi	
P.O. #.	83844.001 A Block MCC	
Date Submitted:	4/1/2014 0:00	
Analysis:	PLM EPA 600/R-93/116	
TurnAroundTime:	6 day+	

Scientific Analytical Institute



4604 Dundas Drive
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 on pipe fitting, cold water line, Loc 1, Mech Room A200	
0001b		Parging cement on pipe elbow, drain pipe, Loc 3, Corridor	
0001c		Parging cement on pipe elbow, chilled water system, Loc 1, Mech Room A200	
0002a		Debris on top of AHU, Loc 1, Mech Room A200	
0002b		Debris on top of AHU, Loc 1, Mech Room A200	
0002c		Debris on top of AHU, Loc 1, Mech Room A200	
0003a		Rough plaster on column enclosure, Loc 1, Mech Room A200	
0003b		Rough plaster on column enclosure, Loc 1, Mech Room A200	
0004a		Parging cement at wall penetration, drain pipe, Loc 3, Corridor	
0004b		Parging cement at wall penetration, drain pipe, Loc 3, Corridor	
0004c		Parging cement at wall penetration, Loc 1, Mech Room A200	
0005a		12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	
0005b		12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	
0005c		12" x 12" vinyl floor tile, grey with grey flecks, Loc 12, Elevator A205B	
0006a		12" x 12" vinyl floor tile, beige with brown streaks, Loc 14, Office A207	
0006b		12" x 12" vinyl floor tile, beige with brown streaks, Loc 24, Office A216	
0006c		12" x 12" vinyl floor tile, beige with brown streaks, Loc 41, Office A230	
0007a		12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209	

Accepted

Rejected

Bauer
4-2
10:30

0007b	12" x 12" vinyl floor tile, beige flecks, Loc 16, Printer Room A209
0007c	12" x 12" vinyl floor tile, beige flecks, Loc 19, Office A212
0008a	Parging at wall pipe penetration, Loc 18, Office A211
0008b	Parging at wall pipe penetration, Loc 18, Office A211
0008c	Parging at wall pipe penetration, Loc 28, Office A219
0009a	Brown mastic on ducts, Loc 35, Faculty Lounge A223
0009b	Brown mastic on ducts, Loc 35, Faculty Lounge A223
0009c	Brown mastic on ducts, Loc 40, Office A229
0010a	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231
0010b	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231
0010c	12" x 12" vinyl floor tile, blue fleck, Loc 42, Office A231
0011a	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236
0011b	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236
0011c	12" x 12" vinyl floor tile, orange fleck, Loc 49, Office A236
0012a	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200
0012b	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200
0012c	24" x 48" lay-in ceiling tile, pinhole and fleck pattern, Loc 5, Computer Lab A200
0013a	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A
0013b	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A
0013c	12" x 12" vinyl floor tile, grey with white and black streaks, Loc 64, Vestibule A300A
0014a	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A
0014b	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A
0014c	Vinyl sheet flooring, grey stone pattern, Loc 99, Washroom A334A
0015a	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340
0015b	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340
0015c	12" x 12" vinyl floor tile, beige fleck, Loc 101, Corridor A340
0016a	Baseboard mastic ONLY, Loc 106, Meeting Room A323
0016b	Baseboard mastic ONLY, Loc 106, Meeting Room A323
0016c	Baseboard mastic ONLY, Loc 106, Meeting Room A323
0017a	Texture finish on drywall soffit, Loc 109, Exterior
0017b	Texture finish on drywall soffit, Loc 109, Exterior
0017c	Texture finish on drywall soffit, Loc 109, Exterior
0018a	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201
0018b	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201
0018c	Trowelled on cementitious fireproofing, Loc 2, Elec Room A201

>>



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 Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1414516

Analysis ID: 1414516_PLM

Date Received: 7/30/2014

Date Reported: 8/5/2014

Project: 83844.001 Brock Taro Hall 500
Glenridge Ave, St. Catharines

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0001a - A	12" x 12" vinyl floor tile, beige with black streaks, Loc 5, Electrical Room	None Detected		100% Other	Beige Non Fibrous Homogeneous
1414516PLM_1	tile				Dissolved
0001a - B	12" x 12" vinyl floor tile, beige with black streaks, Loc 5, Electrical Room	None Detected		100% Other	Black Non Fibrous Homogeneous
1414516PLM_7	mastic				Dissolved
0001b - A	12" x 12" vinyl floor tile, beige flecks, Loc 2, Stairwell A, Room 310	None Detected		100% Other	Beige Non Fibrous Homogeneous
1414516PLM_2	tile				Dissolved
0001b - B	12" x 12" vinyl floor tile, beige flecks, Loc 2, Stairwell A, Room 310	None Detected		100% Other	Black Non Fibrous Homogeneous
1414516PLM_8	mastic				Dissolved
0001c - A	12" x 12" vinyl floor tile, beige, Loc 17, Electrical Closet 408	None Detected		100% Other	Beige Non Fibrous Homogeneous
1414516PLM_3	tile-ashed				Ashed
0001c - B	12" x 12" vinyl floor tile, beige, Loc 17, Electrical Closet 408	None Detected		100% Other	Black Non Fibrous Homogeneous
1414516PLM_9	mastic				Dissolved
0002a	24" x 48" lay-in ceiling tile, pinhole and fleck, Loc 9, Corridor, Level 100	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1414516PLM_4					Teased
0002b	24" x 48" lay-in ceiling tile, pinhole and fleck, Loc 9, Corridor, Level 100	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1414516PLM_5					Teased

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Bart Huber (9)

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 Environmental Ltd
11-875 Main St West
Hamilton Ontario L8S 4R9

Attn: Leslie Cantar

Lab Order ID: 1414516

Analysis ID: 1414516_PLM

Date Received: 7/30/2014

Date Reported: 8/5/2014

Project: 83844.001 Brock Taro Hall 500
Glenridge Ave, St. Catharines

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0002c	24" x 48" lay-in ceiling tile, pinhole and fleck, Loc 9, Corridor, Level 100	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1414516PLM_6					Teased

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Bart Huber (9)

Analyst

Approved Signatory

APPENDIX II-B
Lead Analytical Certificates



Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3050B/6010C/7000B



Customer: Pinchin Ltd
386 St Paul Street Suite 202
St. Catharines, ON L2R 3N2

Attn: Kris Douglas
Chris Mego

Lab Order ID: 71980678
Analysis ID: 71980678_PBP
Date Received: 12/2/2021
Date Reported: 12/9/2021

Project: 287774.014 Hazardous Building Materials Assessment

Sample ID	Description	Mass	Concentration	Concentration
Lab Sample ID	Lab Notes	(g)	(ppm)	(% by weight)
L0001	Wall, Drywall And Joint Compound, Brown Paint, Loc:22, Office	0.0710	420	0.042%
71980678PBP_1				
L0002	Wall, Drywall And Joint Compound, White Paint, Loc:23, Office	0.0602	< 66	< 0.0066%
71980678PBP_2				
L0003	Wall, Masonry, Aqua Paint, Loc:34, Photocopy Room	0.0751	690	0.069%
71980678PBP_3				
L0004	Wall, Drywall And Joint Compound, Peach Paint, Loc:42, Office	0.0555	< 72	< 0.0072%
71980678PBP_4				
L0005	Wall, Drywall And Joint Compound, Blue Green Paint, Loc:13, Corridor	0.0759	< 53	< 0.0053%
71980678PBP_5				

Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA ELPAT program. ELPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Analytical uncertainty available upon request. The quality control samples run with the samples in this report have passed all EPA required specifications unless otherwise noted. RL: (Report Limit for an undiluted 50ml sample is 4µg Total Pb). Unless indicated, areas and volumes were provided by the customer.

Xaviera Watkins (5)


Analyst

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

Laboratory Director

71980678

Version 1-15-2012

Client:	Pinchin Ltd.	<p>Instructions:</p> <p>Use Column "B" for your contact info</p> <p>To See an Example Click the bottom Example Tab</p> <p>5</p> <p>Begin Samples with a "<<" above the first sample and end with a ">>" below the last sample. Only Enter your data on the first sheet "Sheet 1"</p> <p>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</p>	<p>Scientific Analytical Institute</p>  <p>4604 Dundas Dr. Greensboro, NC 27407 Phone: 336.292.3888 Fax: 336.292.3313 Email: lab@sailab.com</p>
Contact:	Kris Douglas Chris Mego		
Address:	386 St Paul St Suite 202, St. Catharines, ON L2R 3J5		
Phone:	289.241.8256		
Fax:	289.407.2594		
Email:	kdouglas@pinchin.com cmego@pinchin.com		
Project:	287774.014 Hazardous		
Client Notes:			
P.O. #:	287774.014		
Date Submitted:	11-29-2021		
Analysis:	% of Lead by Weight <i>41</i>		
TurnAroundTime:	Regular		

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<			
L0001		Wall, Drywall And Joint Compound, Brown Paint, Loc:22, Office	
L0002		Wall, Drywall And Joint Compound, White Paint, Loc:23, Office	
L0003		Wall, Masonry, Aqua Paint, Loc:34, Photocopy Room	
L0004		Wall, Drywall And Joint Compound, Peach Paint, Loc:42, Office	
L0005		Wall, Drywall And Joint Compound, Blue Green Paint, Loc:13, Corridor	
>>			

Accepted

Rejected

Rachel
Non
12/2
10:30

APPENDIX II-C
PCB Analytical Certificates

Certificate of Analysis

Kris Douglas, Chris Mego

Pinchin Ltd. (St. Catharines)
386 St. Paul Street, Suite 202, St. Catharines, ON L2R 3N2

Date of Issue: Dec 08, 2021

Report Description: 3 solid samples were submitted for the following chemical analysis

Project Name: Hazardous Building Materials Assessment	Date Sampled: Nov 29, 2021
Project No.: 287774.014	Date Tested: Dec 07, 2021
Site Location: 1812 Sir Isaac Brock Way, St. Catharines, ON	Sampled by: Kris D

Report Number: 21-1984

No.	Analyte	Result	Units	MDL	Comments	Technique / Test Method
<u>1</u>	<u>Sample ID:</u> P0001 Window Caulking, Loc 24:, PCBs in Solid	<0.2	mg/Kg	0.2		LAB-M06 (EPA 3550C/8082A modified)
<u>2</u>	<u>Sample ID:</u> P0002 Window Caulking (Expansion Joints), Loc24:, PCBs in Solid	3	mg/Kg	0.2		LAB-M06 (EPA 3550C/8082A modified)
<u>3</u>	<u>Sample ID:</u> P0003 Black Butyl Sealant, Loc 109:, PCBs in Solid	<0.2	mg/Kg	0.2		LAB-M06 (EPA 3550C/8082A modified)

Results relate only to the samples tested above, as received.

Approved By:

Son C.H. Le, (Chem.)
Lab Manager
Phone: (519) 740-1333 Ext.: 1030
Fax: (519) 740-2320
Email: SonLe@aevitas.ca

The Analytical Chemistry Laboratory of Aevitas Inc. (Ayr) is accredited for specific tests in accordance with the recognized International Standard ISO/IEC 17025:2017, by the Canadian Association for Laboratory Accreditation (CALA) Inc. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017). The laboratory quality management system of Aevitas Inc. (Ayr) also operates in accordance with the principles of ISO 9001.

All Analytical data is subject to uncertainty which, may vary with sample matrices, sample preparation techniques and instrumental parameters. As a general guideline, uncertainty may be expressed as approximately +/- 50% of the reported value at or near the Method Detection Limit (MDL) and +/-10% or less, of the reported result that is greater than 10 times the MDL. Method Detection Limits are defined as approximately 3 times the standard deviation value (at 99% confidence level), which is obtained from replicate analysis of a low-level standard as per the Ontario MOE - MISA Protocol for the Sampling and Analysis of Industrial / Municipal Wastewater (2016). MDL determination is based on undiluted samples with relatively low matrix interferences. Where dilutions are required, the reported MDL value will be scaled proportionally.

All testing procedures follow strict guidelines and quality assurance / quality control (QA/QC) protocols. QA/QC data is available for review at any time upon client's request.

APPENDIX III
Methodology



1.0 GENERAL

An inspection was conducted to identify the type of Hazardous Building Materials incorporated in the structure and its finishes.

Information regarding the location and condition of hazardous building materials encountered and visually estimated quantities were recorded. The locations of any samples collected were recorded on small-scale plans. As-built drawings and previous reports were referenced where provided.

Sample collection was conducted in accordance with our Standard Operating Procedures.

1.1 Asbestos

The inspection for asbestos included friable and non-friable asbestos-containing materials (ACM). A friable material is a material that when dry can be crumbled, pulverized or powdered by hand pressure.

A separate set of samples was collected of each type of homogenous material suspected to contain asbestos. A homogenous material is defined by the US EPA as material that is uniform in texture and appearance, was installed at one time, and is unlikely to consist of more than one type or formulation of material. The homogeneous materials were determined by visual examination and available information on the phases of construction and prior renovations.

Samples were collected at a rate that is in compliance with the requirements of local regulations and guidelines. The sampling strategy was also based on known ban dates and phase out dates of the use of asbestos; sampling of certain building materials is not conducted after specific construction dates. In addition, to be conservative, several years past these dates are added to account for some uncertainty in the exact start / finish date of construction and associated usage of ACM. In some cases, manufactured products such as asbestos cement pipe were visually identified without sample confirmation.

The asbestos analysis was completed using a stop-positive approach. Only one result meeting the regulated criteria was required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos. The laboratory stopped analyzing samples from a homogeneous material once a result equal to or greater than the regulated criteria is detected in any of the samples of that material. All samples of a homogeneous material were analyzed if no asbestos is detected. In some cases, all samples were analyzed in the sample set regardless of result.

The analysis was performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

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 were evaluated in order to make recommendations regarding any remedial work. The priority for remedial action was 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.

1.2 Lead

Samples of distinctive paint finishes, and surface coatings present in more than a limited application, where removal of the paint is possible was collected. The samples were collected by scraping the painted finish to include base and covering applications.

Analysis for lead in paints or surface coatings was performed in accordance with EPA Method No. 3050B/Method No. 7420; flame atomic absorption.

Analytical results were compared to the following criteria.

Jurisdiction*	Units (%)	Units (ppm) / (mg/kg)
Ontario	0.1	1000

Other lead building products (e.g. batteries, lead sheeting, flashing) were identified by visual observation only.

1.3 Silica

Building materials known to contain crystalline silica (e.g. concrete, cement, tile, brick, masonry, mortar) were identified by visual inspection only. Pinchin did not perform sampling of these materials for laboratory analysis of crystalline silica content.

1.4 Mercury

Building materials, products or equipment (e.g. thermostats, barometers, pressure gauges, lamp tubes), suspected to contain mercury was identified by visually inspection only. Dismantling of equipment suspected of containing mercury was not performed. Sampling of these materials for laboratory analysis of mercury content was not performed.

1.5 Polychlorinated Biphenyls

The potential for light ballast and oil filled transformers to contain PCBs was based on the age of the building, a review of maintenance records and examination of labels or nameplates on equipment, where present and accessible. The information was compared to known ban dates of PCBs and Environment Canada publications.

Caulking, sealants, or paints were sampled and submitted for PCB analysis following EPA 3550C/8082A. Sample results are compared to the criteria of 50 mg/kg for solids as stated in the PCB Regulation, SOR/2008-273.

1.6 Visible Mould

The presence of mould or water damage was determined by visual inspection of exposed building surfaces. If any mould growth or water damage was concealed within building cavities it was not addressed in this assessment.

Template: Methodology for Hazardous Building Materials Assessment, HAZ, November 23, 2021

APPENDIX IV
Location Summary Report

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Survey Date:

Last Re-Assessment:

Location No.	Name or Description	Area ft ²	Floor No.	Bldg. Phase	Notes
13	Corridor, room no. A205C	1943	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
22	Office, room no. A214	97	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
23	Office, room no. A215	96	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
24	Office, room no. A216	116	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
25	Office, room no. A217	114	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
26	Office, room no. A218A	84	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
27	Office, room no. 218	80	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
28	Office, room no. A219	100	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
29	Communication Room, room no. A220	151	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
30	Office, room no. A221	152	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
31	Office, room no. A221A	89	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
32	Research Assistant Office, room no. A221B	82	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
33	Undergraduate and Graduate Lounge	214	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
34	Photocopy Room, room no. A222	74	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present Fitting inaccessible due to counter below.
35	Faculty & Staff Meeting Room & Lounge, room no. A223	294	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
36	Undergraduate Study Lounge, room no. A224	96	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
37	Graduate Study Room, room no. A225	90	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
38	Office, room no. A227	122	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
39	Office, room no. A228	124	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
40	Office, room no. A229	94	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
41	Office, room no. A230	94	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
42	Office, room no. A231	111	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
43	Office, room no. A232	112	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
44	Office, room no. A233	93	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
45	Office, room no. A234	94	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
46	Research Assistant Office, room no. A235A	112	200	A	Overspray from A-C fireproofing is on electrical, hangers & piping where present
47	Storage, room no. A235	84	200	A	Overspray from A-C fireproofing is on electrical, hangers & piping where present
48	Test and Exam Room, room no. A235B	84	200	A	Overspray from A-C fireproofing is on electrical, hangers & piping where present
49	Office, room no. A236	88	200	A	Overspray from A-C fireproofing is on electrical hangers, & piping, where present
50	Office, room no. A237	112	200	A	Overspray from A-C fireproofing is on electrical, hangers & piping where present
109	Exterior	0	N/A	A	Soffit is insulated with fiberglass. A-C sprayed fireproofing is suspected to be present above.

Client: Brock University
Building Name: GSB: Goodman School of Business
Survey Date: 2014-07-24

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Last Re-Assessment: 2016-06-23

Location No.	Name or Description	Area ft ²	Floor No.	Bldg. Phase	Notes
7	Office Area, room no. 204, 208-2	5238	200	A	O2 - Butyl tape inside windows
23	Exterior	0	NA	A	Plaster non-asbestos based on date of construction (1990).O1 - Tan window caulkingO2 - Butyl tape inside windowsO3 - Expansion joint caulkingO4 - Grey door caulking (Stairwell A)O5 - Butyl tape in windows of exterior doorsO6 - Grey door caulking (Stairwell B)

APPENDIX V

Hazardous Materials Summary Report / Sample Log

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Survey Date:

HAZMAT	Sample No	System/Material/Sample Description	Locations	Bldg. Phase	LF	SF	EA	%	Type	Positive	Friability
Asbestos	V0003	Wall Plaster Rough Plaster On Column Enclosure, Loc. 1, Mech Room	50	A	0	0	0	100	None Detected	No	
Asbestos	S0005	Floor Vinyl Floor Tile And Mastic 12x12 Vinyl Floor Tile, Grey With Grey Flecks, Loc. 12	41,42,44	A	0	298	0	0	None Detected	No	
Asbestos	S0006	Floor Vinyl Floor Tile And Mastic 12x12 Vinyl Floor Tile, Beige With Brown Streaks, Loc. 14, Office A207	13,26,27,31,32,33,35,36,37,38,39,40,43,45,46,47,48,50	A	0	3867	0	0	None Detected	No	
Asbestos	S0007	Floor Vinyl Floor Tile And Mastic 12x12 Vinyl Floor Tile, Beige Flecks, Loc. 16, Printer Room A209	22,23,24,25,28,30	A	0	675	0	0	None Detected	No	
Asbestos	S0008	Other Parging Cement Parging At Wall Pipe Penetration, Loc. 18, Office A211	37,38,39,40,41,42,43,44,45,49,50	A	0	22	0	0	None Detected	No	
Asbestos	S0009	Duct Mastic Brown Mastic On Ducts, Loc. 35, Faculty Lounge A223	35	A	40	0	0	0	None Detected	No	
Asbestos	S0011	Floor Vinyl Floor Tile And Mastic 12x12 Vinyl Floor Tile, Orange Fleck, Loc. 49, Office A236	49	A	0	88	0	0	None Detected	No	
Asbestos	S0017	Ceiling Texture Coat Texture Finish On Drywall Soffit, Loc. 109, Exterior	109	A	0	800	0	0	None Detected	No	
Asbestos	S0019 ABCDEFG	Wall Drywall And Joint Compound 12" X 12" Vinyl Floor Tile, Beige With Grey And Brown Flecks, Loc 6, Stairwell A202	22,23,24,25,26,27,28,30,31,32,33,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50	A	0	5500	0	188	None Detected	No	
Asbestos	S0020 ABCDEFG	Structure Fireproofing (cementitious) Spray Fireproofing	13,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,109	A	0	4932	0	100	Chrysotile	Yes	F
Asbestos	S0021 ABC	Floor Mastic Baseboard Mastic - Brown	24,28,35	A	200	0	0	0	None Detected	No	
Asbestos	S0022 ABC	Wall Caulking Window Caulking - Black	24,25,28	A	5	15	0	0	None Detected	No	
Asbestos	S0023 ABC	Wall Caulking Caulking In Compression Joint On Window Frame	24,25,28	A	2	1	0	0	None Detected	No	
Asbestos	S0024	Floor Vinyl Floor Tile And Mastic 12x12 Grey With Grey Fleck	29	A	0	151	0	0	None Detected	No	
Asbestos	S0025	Piping Cement Product Parging Cement	29,33,34	A	0	0	26	0	Chrysotile	Yes	NF
Asbestos	S0026	Floor Vinyl Floor Tile And Mastic 12x12 White With Grey Streak	34	A	0	74	0	0	None Detected	No	
Asbestos	S0027	Ceiling Drywall And Joint Compound Drywall Compound	48	A	0	84	0	0	None Detected	No	
Asbestos	S0028 ABC	Wall Plaster Plaster On Column	13,38,39,40,41,43	A	0	90	0	100	None Detected	No	
Asbestos	S0029 ABCDE	Ceiling Drywall And Joint Compound Joint Compound	13	A	0	1250	0	0	None Detected	No	
Asbestos	S0030	Wall Drywall And Joint Compound	13	A	0	42000	0	0	None	No	

HAZMAT	Sample No	System/Material/Sample Description	Locations	Bldg. Phase	LF	SF	EA	%	Type	Positive	Friability
	ABCDEFGH								Detected		
Asbestos	S0031	Wall Caulking Black Sealant	109	A	200	0	0	0	None Detected	No	
Asbestos	S0032 ABCDEFGH	Wall Paint Cream Paint On Masonry Block	22,24,27,28,33,34,35	A	0	1630	0	0	Chrysotile	Yes	NF
Asbestos	S0033 ABC	Wall Paint Aqua Paint On Masonry Block	13	A	0	450	0	0	Chrysotile	Yes	NF
Asbestos	S0034	Ceiling Mastic Brown Mastic On Soffit	109	A	200	0	0	0	None Detected	No	
Asbestos	V0000	Ceiling Ceiling Tiles (lay-in)	22,23,24,25,27,28,33,36,37,38,39,40,41,42,43 44,45,46,49,50	A	0	2159	0	0	Non Asbestos	No	
Asbestos	V0000	Floor Rubber	13	A	0	43	0	0	Non Asbestos	No	
Asbestos	V0000	Structure Fireproofing (cementitious) New Fire Proofing - Need To Confirm	29	A	0	151	0	0	Non Asbestos	No	
Asbestos	V0000	Wall Drywall (no Compound)	47	A	0	0	0	100	Non Asbestos	No	
Paint	L0001	Wall Drywall And Joint Compound Brown Paint	22,23,24,25,26,27,28,30,31,32,33,35,36 37,38,39,40,41,42,43,44,45,46,47,48,49 50	A	0	5400	0	0	Lead (Low)	Yes	-
Paint	L0002	Wall Drywall And Joint Compound White Paint	22,23,24,25,26,27,28,29,30,31,32,33,35 36,37,38,39,40,41,43,44,45,46,47,48,49 50	A	0	10800	0	0		No	-
Paint	L0003	Wall Masonry Aqua Paint	34	A	0	300	0	0	Lead (Low)	Yes	-
Paint	L0004	Wall Drywall And Joint Compound Peach Paint	42	A	0	400	0	0		No	-
Paint	L0005	Wall Drywall And Joint Compound Blue Green Paint	13	A	0	0	0	100		No	-
PCB	P0001	Caulking Window Caulking	24	A	5	0	0	0	-	No	-
PCB	P0002	Caulking Window Caulking (expansion Joint)	24	A	1	0	0	0	-	No	-
PCB	P0003	Caulking Black Butyl Sealant	109	A	200	0	0	0	-	No	-
Hg	V9000	Fluorescent Light Tube	13,37	A	0	0	51	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	49	A	0	0	5	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	22,30,31,32,33,34,35,36,38,39,40,41,42 43,44,45,46,47,48	A	0	0	115	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	28,29	A	0	0	8	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	26,27	A	0	0	12	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	24,25	A	0	0	10	0	Hg	Yes	-
Hg	V9000	Fluorescent Light Tube	23,50	A	0	0	9	0	Hg	Yes	-

Legend:

Sample number	Units
S#### Asbestos sample collected	SF Square feet
L#### Paint sample collected	LF Linear feet
P#### PCB sample collected	EA Each
M#### Mould sample collected	% Percentage
V#### Material visually similar to numbered sample collected	
V0000 Known non Hazardous Material	
V9000 Material is visually identified as Hazardous Material	
V9500 Material is presumed to be Hazardous Material	

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: GSB: Goodman School of Business

Survey Date: 2014-07-24

HAZMAT	Sample No	System/Material/Sample Description	Locations	Bldg. Phase	LF	SF	EA	%	Type	Positive	Friability
Asbestos	V0001	Floor Vinyl Floor Tile And Mastic 12"x12" Vinyl Floor Tile, Beige With Black Streaks	7	A	0	1458	0	0	None Detected	No	
Asbestos	V0002	Ceiling Ceiling Tiles (lay-in) 24"x48" Lay-in Ceiling Tile, Pinhole And Fleck	7	A	0	4358	0	0	None Detected	No	
Asbestos	S0003	Other 1 Caulking Tan Caulking Around Window	23	A	1000	0	0	0	None Detected	No	
Asbestos	S0004	Other Two Caulking Butyl Tape Inside Window	23	A	500	0	0	0	None Detected	No	
Asbestos	S0005	Other Three Caulking Expansion Joint Caulking	23	A	200	0	0	0	None Detected	No	
Asbestos	S0006	Other Four Caulking Grey Door Caulking North Stairwell	23	A	30	0	0	0	None Detected	No	
Asbestos	S0007	Other, Other Five Caulking Butyl Tape On Doors	7,23	A	160	0	0	0	Chrysotile	Yes	NF
Asbestos	S0008	Other Six Caulking Grey Door Caulking East Stairwell	23	A	30	0	0	0	None Detected	No	
Asbestos	S0011	Other Caulking Butyl Taple Interior	7	A	25	0	0	0	Chrysotile	No	
Asbestos	V0000	Ceiling Ceiling Tiles (lay-in)	7	A	0	880	0	0	Non Asbestos	No	
Asbestos	V0000	Ceiling Plaster	23	A	0	1200	0	0	Non Asbestos	No	
Asbestos	V0000	Structure Fireproofing (cementitious)	7	A	0	0	0	100	Non Asbestos	No	
Asbestos	V0000	Wall Drywall And Joint Compound	7	A	0	0	0	100	Non Asbestos	No	

Legend:

Sample number	Units
S#### Asbestos sample collected	SF Square feet
L#### Paint sample collected	LF Linear feet
P#### PCB sample collected	EA Each
M#### Mould sample collected	% Percentage
V#### Material visually similar to numbered sample collected	
V0000 Known non Hazardous Material	
V9000 Material is visually identified as Hazardous Material	
V9500 Material is presumed to be Hazardous Material	

APPENDIX VI
HMIS All Data Report

Client: Brock University
Location: #13 : Corridor
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A205C
Last Re-Assessment: 0000-00-00

Area (sqft): 1943

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound, Joint compound			C	Y		1250			SF	S0029ABC DE	None Detected	N.D.	None	
Duct	Not Accessible	None Found														
Floor		Vinyl Floor Tile and Mastic			A	Y		1900			SF	S0006	None Detected	N.D.	None	
Floor		Rubber			A	Y		43			SF	V0000	Non-Asbestos		None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Piping	Not Accessible	None Found													[Presumed Asbestos]	
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	N										
Structure	Beam, Deck	Fireproofing (Cementitious)			C	N		1943(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Structure	Debris	Fireproofing (Cementitious)			C	N		100(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		42000			SF	S0030ABC DEFG	None Detected	N.D.	None	
Wall		Plaster			A	Y		100			%	V0028	None Detected	N.D.	None	
Wall	All	Paint, Aqua paint on masonry block			A	Y		450(7)			SF	S0033ABC	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #13 : Corridor
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A205C
Last Re-Assessment: 0000-00-00

Area (sqft): 1943

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	100		%	L0005	Blue green paint	Pb: <0.0053 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #13 : Corridor
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A205C
Last Re-Assessment: 0000-00-00

Area (sqft): 1943

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	46	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

**Site: 1812 Sir Isaac Brock Way, St. Catharines,
ON**

Building Name: MCA: MacKenzie Chown Block A

Location: #13 : Corridor

Floor: 200

Room #: A205C

Area (sqft): 1943

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	44	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #22 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A214
Last Re-Assessment: 0000-00-00

Area (sqft): 97

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		97			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		97			SF	S0007	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Not Found	None Found														
Piping	All	Fibreglass														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), Spayed fireproofing		Paint	C	Y		97(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		100			%	S0019A	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		40(7)			SF	S0032A	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #22 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A214
Last Re-Assessment: 0000-00-00

Area (sqft): 97

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	L0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #22 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A214
Last Re-Assessment: 0000-00-00

Area (sqft): 97

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #22 : Office
Survey Date: 2021-11-29

Floor: 200

Room #: A214
Last Re-Assessment: 0000-00-00

Area (sqft): 97

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #23 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A215
Last Re-Assessment: 0000-00-00

Area (sqft): 96

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		96			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		96			SF	V0007	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Piping	All	Fibreglass			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), Spray fireproofing		Paint	C	Y		96(7)			SF	S0020A	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound, Joint compound			A	Y		400			SF	V0019	None Detected	N.D.	None	
Wall		Masonry			A	Y										

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #23 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A215
Last Re-Assessment: 0000-00-00

Area (sqft): 96

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	400		SF	L0002	White paint	Pb: <0.0066 %	No	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #23 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A215
Last Re-Assessment: 0000-00-00

Area (sqft): 96

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #23 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A215
Last Re-Assessment: 0000-00-00

Area (sqft): 96

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #24 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A216
Last Re-Assessment: 0000-00-00

Area (sqft): 116

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		116			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		116			SF	S0007	None Detected	N.D.	None	
Floor	Base	Mastic, Baseboard mastic - brown			A	Y		60			LF	S0021A	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Not Found	None Found														
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), Sprayed fireproofing		Paint	C	Y		116(7)			SF	S0020B	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound, Joint compound			A	Y		100			%	V0019	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		40(7)			SF	S0032B	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Wall	Window	Caulking, Window caulking - black			A	Y		10			SF	S0022A	None Detected	N.D.	None	
Wall	Window	Caulking, Caulking in compression joint on window frame			A	Y		1			LF	S0023A	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #24 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A216
Last Re-Assessment: 0000-00-00

Area (sqft): 116

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #24 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A216
Last Re-Assessment: 0000-00-00

Area (sqft): 116

MERCURY				
Component	Quantity	Unit	Sample	Hazard
Fluorescent Light Tube	6	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

**Site: 1812 Sir Isaac Brock Way, St. Catharines,
ON**

Building Name: MCA: MacKenzie Chown Block A

Location: #24 : Office

Floor: 200

Room #: A216

Area (sqft): 116

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
CAULKING	5	LF	P0001	Window caulking	<0.2 mg/kg	No
CAULKING	1	LF	P0002	Window caulking (expansion joint)	3 mg/kg	No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #25 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A217
Last Re-Assessment: 0000-00-00

Area (sqft): 114

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		114			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		114			SF	S0007	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Not Found	None Found														
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), Sprayed fireproofing		Paint	C	Y		114(7)			SF	S0020C	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound, Joint compound			A	Y		400			SF	S0019B	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall	Window	Caulking			A	Y		5			LF	S0022B	None Detected	N.D.	None	
Wall	Window	Caulking			A	Y		1			LF	S0023B	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #25 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A217
Last Re-Assessment: 0000-00-00

Area (sqft): 114

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #25 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A217
Last Re-Assessment: 0000-00-00

Area (sqft): 114

MERCURY				
Component	Quantity	Unit	Sample	Hazard
Fluorescent Light Tube	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #26 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A218A
Last Re-Assessment: 0000-00-00

Area (sqft): 84

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Floor		Vinyl Floor Tile and Mastic			A	Y		84			SF	V0006	None Detected	N.D.	None	
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		84(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall (no compound)			A	Y										
Wall	All	Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #26 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A218A
Last Re-Assessment: 0000-00-00

Area (sqft): 84

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #26 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A218A
Last Re-Assessment: 0000-00-00

Area (sqft): 84

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	6	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #26 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A218A
Last Re-Assessment: 0000-00-00

Area (sqft): 84

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #27 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: 218
Last Re-Assessment: 0000-00-00

Area (sqft): 80

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		80			SF	V0000	Non-Asbestos		None	
Floor		Vinyl Floor Tile and Mastic			A	Y		80			SF	V0006	None Detected	N.D.	None	
Piping	All	Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		80(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		300			%	V0019	None Detected	N.D.	None	
Wall		Drywall (no compound)			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		150(7)			SF	S0032G	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #27 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: 218
Last Re-Assessment: 0000-00-00

Area (sqft): 80

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #27 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: 218
Last Re-Assessment: 0000-00-00

Area (sqft): 80

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	6	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #27 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: 218
Last Re-Assessment: 0000-00-00

Area (sqft): 80

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #28 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A219
Last Re-Assessment: 0000-00-00

Area (sqft): 100

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		100			SF	V0000	Non-Asbestos		None	
Floor		Vinyl Floor Tile and Mastic			A	Y		100			SF	V0007	None Detected	N.D.	None	
Floor	Base	Mastic, Baseboard mastic - brown			A	Y		60			LF	S0021B	None Detected	N.D.	None	
Piping	All	Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		100(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		400			%	S0019C	None Detected	N.D.	None	
Wall		Drywall (no compound)			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		100(7)			SF	S0032F	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Wall	Window	Caulking, Window caulking black			A	Y		5			SF	S0022C	None Detected	N.D.	None	
Wall	Window	Caulking, Expansion joint caulking			A	Y		1			SF	S0023C	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #28 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A219
Last Re-Assessment: 0000-00-00

Area (sqft): 100

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #28 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A219
Last Re-Assessment: 0000-00-00

Area (sqft): 100

MERCURY				
Component	Quantity	Unit	Sample	Hazard
Fluorescent Light Tube	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #29 : Communication Room

Floor: 200

Room #: A220

Area (sqft): 151

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic, 12x12 grey with grey fleck			B	Y		151			SF	S0024	None Detected	N.D.	None	
Mechanical Equipment	Not Found	None Found														
Other	Not Found	None Found														
Piping		Fibreglass	Straight		C	Y										
Piping		Parging Cement	Fitting		C	Y		10(7)			EA	V0025	Chrysotile	>75%	Confirmed Asbestos	F
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), New fire proofing - need to confirm			C	Y		151			SF	V0000	Non-Asbestos		None	
Wall		Wood			B	Y										
Wall		Masonry			B	Y										

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #29 : Communication Room

Floor: 200

Room #: A220

Area (sqft): 151

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #29 : Communication Room

Floor: 200

Room #: A220

Area (sqft): 151

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
Fluorescent Light Tube	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #30 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221
Last Re-Assessment: 0000-00-00

Area (sqft): 152

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Floor		Vinyl Floor Tile and Mastic			A	Y		152			SF	S0007	None Detected	N.D.	None	
Piping	All	Fibreglass			B	Y		4			LF					
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		152(7)			SF	S0020D	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		100			%	S0019E	None Detected	N.D.	None	
Wall		Drywall (no compound)			A	Y										

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #30 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221
Last Re-Assessment: 0000-00-00

Area (sqft): 152

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #30 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221
Last Re-Assessment: 0000-00-00

Area (sqft): 152

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	7	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #30 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221
Last Re-Assessment: 0000-00-00

Area (sqft): 152

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	5					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #31 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221A
Last Re-Assessment: 0000-00-00

Area (sqft): 89

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Floor		Vinyl Floor Tile and Mastic			A	Y		89			SF	V0006	None Detected	N.D.	None	
Piping	All	Fibreglass			C	Y		15			LF					
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		89(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall (no compound)			A	Y										
Wall	All	Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #31 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221A
Last Re-Assessment: 0000-00-00

Area (sqft): 89

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #31 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221A
Last Re-Assessment: 0000-00-00

Area (sqft): 89

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #31 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221A
Last Re-Assessment: 0000-00-00

Area (sqft): 89

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #32 : Research Assistant Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221B
Last Re-Assessment: 0000-00-00
Area (sqft): 82

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Floor		Vinyl Floor Tile and Mastic			A	Y		82			SF	V0006	None Detected	N.D.	None	
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		82(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	
Wall		Drywall (no compound)			A	Y										

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #32 : Research Assistant Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221B
Last Re-Assessment: 0000-00-00
Area (sqft): 82

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #32 : Research Assistant Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221B
Last Re-Assessment: 0000-00-00
Area (sqft): 82

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4		V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #32 : Research Assistant Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A221B
Last Re-Assessment: 0000-00-00
Area (sqft): 82

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #33 : Undergraduate and Graduate Lounge

Floor: 200

Room #:

Area (sqft): 214

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		214			SF	V0000	Non-Asbestos		None	
Floor	All	Vinyl Floor Tile and Mastic			A	Y		214			SF	V0006	None Detected	N.D.	None	
Piping	All	Cement Product, Parging cement	Fitting		C	Y		15(7)			EA	S0025	Chrysotile	>75%	Confirmed Asbestos	NF
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious), Sprayed fireproofing		Paint	C	Y		100(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall	All	Drywall and joint compound, Joint compound			A	Y		200			SF	S0019D	None Detected	N.D.	None	
Wall	All	Masonry			A	Y		500			SF					
Wall	All	Paint, Cream paint on masonry block			A	Y		500(7)			SF	S0032C	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #33 : Undergraduate and Graduate Lounge

Floor: 200

Room #:

Area (sqft): 214

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT								
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #33 : Undergraduate and Graduate Lounge

Floor: 200

Room #:

Area (sqft): 214

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	16	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #33 : Undergraduate and Graduate Lounge

Floor: 200

Room #:

Area (sqft): 214

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	8	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #34 : Photocopy Room
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A222
Last Re-Assessment: 0000-00-00
Area (sqft): 74

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Duct		Not Insulated			C	Y										
Floor	All	Vinyl Floor Tile and Mastic, 12x12 white with grey streak			A	Y		74			SF	S0026	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Piping	All	Fibreglass			C	Y										
Piping	Drain	Parging Cement	Fitting	Canvas	C	Y		1(7)			EA	V0025	Chrysotile	>75%	Confirmed Asbestos	F
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		74(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Masonry			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		300(7)			SF	S0032E	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present Fitting inaccessible due to counter below.

Client: Brock University
Location: #34 : Photocopy Room
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A222
Last Re-Assessment: 0000-00-00
Area (sqft): 74

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Masonry	300		SF	L0003	Aqua paint	Pb: 0.069 %	Lead (Low)	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present Fitting inaccessible due to counter below.

Client: Brock University
Location: #34 : Photocopy Room
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A222
Last Re-Assessment: 0000-00-00
Area (sqft): 74

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	2	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present Fitting inaccessible due to counter below.

Client: Brock University
Location: #34 : Photocopy Room
2022-01-18

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A222
Area (sqft): 74

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	1	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present Fitting inaccessible due to counter below.

Client: Brock University
Location: #35 : Faculty & Staff Meeting Room & Lounge
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A223
Area (sqft): 294
Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Duct		Not Insulated			C	Y										
Duct		Mastic	Joint		C	Y		40			LF	S0009	None Detected	N.D.	None	
Floor		Vinyl Floor Tile and Mastic			A	Y		294			SF	V0006	None Detected	N.D.	None	
Floor	All	Mastic, Baseboard mastic			A	Y		80			LF	S0021C	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		294(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		100			%	V0019	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall	All	Paint, Cream paint on masonry block			A	Y		500(7)			SF	S0032D	Chrysotile	0.5-5%	Confirmed Asbestos	NF

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #35 : Faculty & Staff Meeting Room & Lounge
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A223
Area (sqft): 294
Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #35 : Faculty & Staff Meeting Room & Lounge
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A223
Area (sqft): 294
Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	18	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

**Site: 1812 Sir Isaac Brock Way, St. Catharines,
ON**

Building Name: MCA: MacKenzie Chown Block A

**Location: #35 : Faculty & Staff Meeting Room &
Lounge**

Floor: 200

Room #: A223

Area (sqft): 294

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	9					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #36 : Undergraduate Study Lounge

Floor: 200

Room #: A224

Area (sqft): 96

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		96			SF	V0000	Non-Asbestos		None	
Floor		Vinyl Floor Tile and Mastic			A	Y		96			SF	V0006	None Detected	N.D.	None	
Piping	All	Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		96(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		200			SF	V0019	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall		Drywall (no compound)			A	Y										

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #36 : Undergraduate Study Lounge

Floor: 200

Room #: A224

Area (sqft): 96

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #36 : Undergraduate Study Lounge

Floor: 200

Room #: A224

Area (sqft): 96

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	6	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #36 : Undergraduate Study Lounge

Floor: 200

Room #: A224

Area (sqft): 96

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #37 : Graduate Study Room

Floor: 200

Room #: A225

Area (sqft): 90

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		90			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		90			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		90(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		250			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #37 : Graduate Study Room

Floor: 200

Room #: A225

Area (sqft): 90

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #37 : Graduate Study Room

Floor: 200

Room #: A225

Area (sqft): 90

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #37 : Graduate Study Room

Floor: 200

Room #: A225

Area (sqft): 90

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #38 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A227
Last Re-Assessment: 0000-00-00
Area (sqft): 122

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		122			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		122			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		122(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	
Wall		Plaster, Plaster on column			A	Y		15			SF	V0028	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #38 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A227
Last Re-Assessment: 0000-00-00
Area (sqft): 122

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #38 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A227
Last Re-Assessment: 0000-00-00
Area (sqft): 122

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	7	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #38 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A227
Last Re-Assessment: 0000-00-00
Area (sqft): 122

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	5	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #39 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A228
Last Re-Assessment: 0000-00-00
Area (sqft): 124

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		124			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		124			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		124(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	
Wall		Plaster, Plaster on column						15			SF	S0028C	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #39 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A228
Last Re-Assessment: 0000-00-00
Area (sqft): 124

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #39 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A228
Last Re-Assessment: 0000-00-00
Area (sqft): 124

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	7	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #39 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A228
Last Re-Assessment: 0000-00-00
Area (sqft): 124

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	5					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #40 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A229
Last Re-Assessment: 0000-00-00

Area (sqft): 94

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		94			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		94			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		94(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		250			SF	V0019	None Detected	N.D.	None	
Wall	All	Plaster			A	Y		15			SF	V0028	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #40 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A229
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #40 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A229
Last Re-Assessment: 0000-00-00

Area (sqft): 94

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #40 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A229
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #41 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A230
Last Re-Assessment: 0000-00-00

Area (sqft): 94

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		94			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		94			SF	S0005	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		94(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		200			SF	V0019	None Detected	N.D.	None	
Wall	All	Plaster, Plaster on column			A	Y		15			SF	S0028B	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #41 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A230
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #41 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A230
Last Re-Assessment: 0000-00-00

Area (sqft): 94

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #41 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A230
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #42 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A231
Last Re-Assessment: 0000-00-00

Area (sqft): 111

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		111			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		111			SF	S0005	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		111(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall	All	Drywall and joint compound			A	Y		200			%	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #42 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A231
Last Re-Assessment: 0000-00-00

Area (sqft): 111

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	400		SF	L0004	Peach paint	Pb: <0.0072 %	No	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #42 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A231
Last Re-Assessment: 0000-00-00

Area (sqft): 111

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #42 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A231
Last Re-Assessment: 0000-00-00

Area (sqft): 111

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #43 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A232
Last Re-Assessment: 0000-00-00

Area (sqft): 112

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		112			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		112			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		112(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		250			SF	V0019	None Detected	N.D.	None	
Wall	All	Plaster, Plaster on column			A	Y		30			SF	S0028A	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #43 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A232
Last Re-Assessment: 0000-00-00

Area (sqft): 112

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #43 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A232
Last Re-Assessment: 0000-00-00

Area (sqft): 112

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #43 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A232
Last Re-Assessment: 0000-00-00

Area (sqft): 112

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3					No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #44 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A233
Last Re-Assessment: 0000-00-00

Area (sqft): 93

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		93			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		93			SF	S0005	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		93(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall	All	Drywall and joint compound			A	Y		200			%	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #44 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A233
Last Re-Assessment: 0000-00-00

Area (sqft): 93

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #44 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A233
Last Re-Assessment: 0000-00-00

Area (sqft): 93

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #44 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A233
Last Re-Assessment: 0000-00-00

Area (sqft): 93

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #45 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A234
Last Re-Assessment: 0000-00-00

Area (sqft): 94

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		94			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		94			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		94(7)			SF	S0020G	Chrysotile	5-10%	Confirmed Asbestos	F
Wall	All	Drywall and joint compound			A	Y		200			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #45 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A234
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #45 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A234
Last Re-Assessment: 0000-00-00

Area (sqft): 94

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #45 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A234
Last Re-Assessment: 0000-00-00

Area (sqft): 94

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #46 : Research Assistant Office

Floor: 200

Room #: A235A

Area (sqft): 112

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		112			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Vinyl Floor Tile and Mastic			A	Y		112			SF	V0006	None Detected	N.D.	None	
Mechanical Equipment	Not Found	None Found														
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	N										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	N		112(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall (no compound)			A	Y										
Wall	All	Drywall and joint compound			A	Y		250			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #46 : Research Assistant Office

Floor: 200

Room #: A235A

Area (sqft): 112

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #46 : Research Assistant Office

Floor: 200

Room #: A235A

Area (sqft): 112

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #46 : Research Assistant Office

Floor: 200

Room #: A235A

Area (sqft): 112

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2					No

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #47 : Storage
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A235
Last Re-Assessment: 0000-00-00
Area (sqft): 84

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found				C	Y		84			SF					
Duct		Not Insulated			C	N										
Floor		Vinyl Floor Tile and Mastic			A	Y		84			SF	V0006	None Detected	N.D.	None	
Mechanical Equipment	Not Found	None Found														
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	N										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	N		84(7)			SF	S0020F	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall (no compound)			A	Y		100			%	V0000	Non-Asbestos		None	
Wall	All	Drywall and joint compound			A	Y		300			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #47 : Storage
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A235
Last Re-Assessment: 0000-00-00
Area (sqft): 84

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #47 : Storage
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A235
Last Re-Assessment: 0000-00-00
Area (sqft): 84

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	4	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #47 : Storage
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A235
Last Re-Assessment: 0000-00-00
Area (sqft): 84

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #48 : Test and Exam Room

Floor: 200

Room #: A235B

Area (sqft): 84

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound, Drywall compound			C	Y		84			SF	S0027	None Detected	N.D.	None	
Duct		Not Insulated			C	N										
Floor		Vinyl Floor Tile and Mastic			A	Y		84			SF	V0006	None Detected	N.D.	None	
Mechanical Equipment	Not Found	None Found														
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	N										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	N		85(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall (no compound)			A	Y										
Wall	All	Drywall and joint compound			A	Y		300			SF	S0019G	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #48 : Test and Exam Room

Floor: 200

Room #: A235B

Area (sqft): 84

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #48 : Test and Exam Room

Floor: 200

Room #: A235B

Area (sqft): 84

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	2	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON

Building Name: MCA: MacKenzie Chown Block A

Location: #48 : Test and Exam Room

Floor: 200

Room #: A235B

Area (sqft): 84

Survey Date: 2021-11-29

Last Re-Assessment: 0000-00-00

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	2	EA				No

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #49 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A236
Last Re-Assessment: 0000-00-00

Area (sqft): 88

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		88			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		88			SF	S0011	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping		Not Insulated			C	Y										
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		88(7)			SF	S0020E	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		400			SF	V0019	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #49 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A236
Last Re-Assessment: 0000-00-00

Area (sqft): 88

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #49 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A236
Last Re-Assessment: 0000-00-00

Area (sqft): 88

MERCURY				
Component	Quantity	Unit	Sample	Hazard
Fluorescent Light Tube	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical hangers, & piping, where present

Client: Brock University
Location: #50 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A237
Last Re-Assessment: 0000-00-00

Area (sqft): 112

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		112			SF	V0000	Non-Asbestos		None	
Duct		Not Insulated			C	Y										
Floor		Vinyl Floor Tile and Mastic			A	Y		112			SF	S0006	None Detected	N.D.	None	
Mechanical Equipment	Radiator	Not Insulated			A	Y										
Other	Fire Stop	Parging Cement			C	Y		2			SF	S0008	None Detected	N.D.	None	
Piping	Not Found	None Found														
Structure	Beam, Deck	Steel		Fireproofing (Cementitious)	C	Y										
Structure	Beam, Deck	Fireproofing (Cementitious)		Paint	C	Y		112(7)			SF	V0020	Chrysotile	5-10%	Confirmed Asbestos	F
Wall		Drywall and joint compound			A	Y		400			SF	S0019F	None Detected	N.D.	None	
Wall		Plaster			A	Y		100			%	V0003	None Detected	N.D.	None	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #50 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A237
Last Re-Assessment: 0000-00-00

Area (sqft): 112

PAINT									
System	Item	Good	Poor	Unit	Sample	Sample Description	Amount	Hazard	
Wall	Drywall and joint compound	200		SF	V0001	Brown paint	Pb: 0.042 %	Lead (Low)	
Wall	Drywall and joint compound	400		SF	V0002	White paint	Pb: <0.0066 %	No	

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #50 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A237
Last Re-Assessment: 0000-00-00

Area (sqft): 112

MERCURY				
Component	Quantity	Unit	Sample	Hazard
FLUORESCENT LIGHT TUBE	5	EA	V9000	Yes

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #50 : Office
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: 200

Building Name: MCA: MacKenzie Chown Block A
Room #: A237
Last Re-Assessment: 0000-00-00

Area (sqft): 112

PCB						
Component	Quantity	Unit	Sample	Sample Description	Amount	PCB
LIGHT BALLASTS	3	EA				No

Overspray from A-C fireproofing is on electrical, hangers & piping where present

Client: Brock University
Location: #108 : Roof
Survey Date: 2021-11-29

Site: 1812 Sir Isaac Brock Way, St. Catharines, ON
Floor: Roof

Building Name: MCA: MacKenzie Chown Block A
Room #:
Last Re-Assessment: 0000-00-00

Area (sqft): 0

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	Not Found	None Found														
Duct	Not Found	None Found														
Floor	Not Found	None Found														
Mechanical Equipment		Not Insulated			B	Y										
Other	Not Found	None Found														
Piping	Not Found	None Found														
Wall	Not Found	None Found														

Legend:

Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
L####	Paint sample collected	LF	Linear feet	V	Visible
P####	PCB sample collected	EA	Each	AP	Air Plenum
M####	Mould sample collected	%	Percentage	F	Friable material
V####	Material is visually identified to be identical to S####	LF	Linear feet	NF	Non Friable material
V0000	Known non hazardous material			PF	Potentially Friable material
V9000	Material visually identified as a Hazardous Material			Pb	Lead
V9500	Material is presumed to be a hazardous material			Hg	Mercury
				As	Arsenic
				Cr	Chromium

Access	
A	Accessible to all building occupants
B	Accessible to maintenance and operations staff without a ladder
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas
D	Not normally accessible

Condition	
Good	No visible damage or deterioration
Fair	Minor, repairable damage, cracking, delamination or deterioration
Poor	Irreparable damage or deterioration with exposed and missing material

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

Client: Brock University
Location: #7 : Office Area
Survey Date: 2014-07-24

Site: Brock University
Floor: 200

Building Name: 20 : GSB: Goodman School of Business
Room #: 204, 208-2
Last Re-Assessment: 2016-06-23

Area (sqft): 5238

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in)			C	Y		4358			SF	V0002	None Detected	N.D.	None	
Ceiling		Ceiling Tiles (lay-in)			C	Y		880			SF	V0000	Non-Asbestos		None	
Duct	All	Fibreglass			C	N										
Duct	All	Not Insulated			C	N										
Floor	All	Vinyl Floor Tile and Mastic			a	y		1458			SF	V0001	None Detected	N.D.	None	
Floor	All	Carpet			A	Y										
Mechanical Equipment		N/A														
Other ¹	Door	Caulking			A	Y		80(7)			LF	V0007	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Other	Window	Caulking			A	Y		25			LF	S0011	Chrysotile	<0.5%	None	
Piping	All	Fibreglass	ALL		C	N										
Piping	All	Not Insulated			C	N										
Structure	All	Fireproofing (Cementitious)			C	N		100			%	V0000	Non-Asbestos		None	
Structure	All	Metal			C	N										
Wall	All	Drywall and joint compound			A	Y		100			%	V0000	Non-Asbestos		None	
Wall	All	Masonry			A	Y										

O2 - Butyl tape inside windows

1 - Other two

Client: Brock University
Location: #23 : Exterior
Survey Date: 2014-07-24

Site: Brock University
Floor: NA

Building Name: 20 : GSB: Goodman School of Business
Room #:
Last Re-Assessment: 2016-06-23

Area (sqft): 0

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling	All	Plaster			C	Y		1200			SF	V0000	Non-Asbestos		None	
Duct		N/A														
Floor	All	N/A														
Mechanical Equipment		N/A														
Other 1	Window	Caulking			A	Y		1000			LF	S0003	None Detected	N.D.	None	
Other two	Window	Caulking			A	Y		500			LF	S0004	None Detected	N.D.	None	
Other three	All	Caulking			A	Y		200			LF	S0005	None Detected	N.D.	None	
Other four	Door	Caulking			A	Y		30			LF	S0006	None Detected	N.D.	None	
Other five	Door	Caulking			A	Y		80(7)			LF	S0007	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Other six	Door	Caulking			A	Y		30			LF	S0008	None Detected	N.D.	None	
Piping		N/A														
Structure	All	Concrete (poured)			A	Y										
Wall	All	Masonry			A	Y										
Wall	All	Metal			C	Y										

Plaster non-asbestos based on date of construction (1990).

- O1 - Tan window caulking
- O2 - Butyl tape inside windows
- O3 - Expansion joint caulking
- O4 - Grey door caulking (Stairwell A)
- O5 - Butyl tape in windows of exterior doors
- O6 - Grey door caulking (Stairwell B)

Legend:

Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
L####	Paint sample collected	LF	Linear feet	V	Visible
P####	PCB sample collected	EA	Each	AP	Air Plenum
M####	Mould sample collected	%	Percentage	F	Friable material
V####	Material is visually identified to be identical to S####	LF	Linear feet	NF	Non Friable material
V0000	Known non hazardous material			PF	Potentially Friable material
V9000	Material visually identified as a Hazardous Material			Pb	Lead
V9500	Material is presumed to be a hazardous material			Hg	Mercury
				As	Arsenic
				Cr	Chromium

Access	
A	Accessible to all building occupants
B	Accessible to maintenance and operations staff without a ladder
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas
D	Not normally accessible

Condition	
Good	No visible damage or deterioration
Fair	Minor, repairable damage, cracking, delamination or deterioration
Poor	Irreparable damage or deterioration with exposed and missing material

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

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Description of Work
- .2 Contract Method
- .3 Documents Provided
- .4 Schedule
- .5 Owner-Supplied Products
- .6 Owner Occupancy
- .7 Owner Ordered Work

1.2 DESCRIPTION OF THE WORK

- .1 Work of this Contract comprises of new building addition, interior renovation and all site work as described in the Contract Documents. The Work is for Phase 2 where Phase 1 (selective interior demolitions and hazardous material abatement) is complete.

1.3 CONTRACT METHOD

- .1 Construct Work under "**CCDC 8 Stipulated Price Contract 2020**" subject to Supplementary Conditions.
- .2 Refer to Section 01 21 00 for cash allowance amounts applicable to assignable contracts.
- .3 Assume responsibility for assigned contracts as Subcontracts forming part of the Work.
- .4 Contract Documents were prepared by the Consultant for the Owner. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Consultant accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions based on the Contract Documents.
- .5 For purposes of reference in these Contract Documents, the term "Contractor" shall mean the party in contract with the Owner.

1.4 DOCUMENTS PROVIDED

- .1 Contractor will be provided with access to pdf files of all Drawings and Specifications.
- .2 An electronic set of documents will be provided near the end of the Project for purposes of transferring changed information recorded on as-built documents to the electronic Record Documents.

1.5 SCHEDULE

- .1 Substantial Performance of the Work is required by **June 30, 2023**.

1.6 OWNER-SUPPLIED PRODUCTS

- .1 Receive Owner-supplied Products and equipment and store and protect products and equipment until installation. See Section 11 06 50.
- .2 Owner Responsibilities:

SUMMARY OF WORK

- .1 Arrange for delivery of Products to Site.
- .3 Contractor Responsibilities:
 - .1 Receive and unload Products at site.
 - .2 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
 - .3 Handle Products at site, including un-crating and storage.
 - .4 Protect Products from damage, and from exposure to elements.
 - .5 Assemble, install, connect, adjust, and finish Products.
 - .6 Repair or replace items damaged by Contractor or Subcontractor on site (under their control).
- .4 Schedule of Owner-supplied Products:
 - .1 Furniture
 - .2 IP clocks, monitors, monitor mounts, ceiling mounted projector, recessed retractable screen, photocopier/printer, refrigerator, workstation equipment

1.7 OWNER OCCUPANCY

- .1 Owner will occupy premises following Substantial Performance for installation of equipment and services.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
- .3 Maintain fire and life safety systems and public access to exits during all stages of the Work.
- .4 Work carried out during the Owner's standard operating hours shall not adversely affect the Owner's ongoing use and occupancy of the existing building and site. Otherwise work shall be carried out after hours. Schedule work with the Owner to minimize disruption to Owner's operations. Any shutdown affecting operations must be coordinated with the Owner's Project Manager. Contract Price to include all necessary overtime premium costs to ensure orderly progression of the Work.

1.8 OWNER ORDERED WORK

- .1 Owner has placed orders for Products with vendors for specific Products, to obtain early delivery and to expedite the Work and for other purposes in Owner's interests.
- .2 Refer to Section 01 21 00 for specifics.
- .3 On execution of Owner/Contractor Agreement, execute an agreement with designated vendor/supplier, in accordance with terms stated in attachment.
- .4 Contractor responsibility for purchase, handling, and installation for pre-ordered Products is same as for other Contractor - furnished Products.
- .5 Obtain necessary Shop Drawings from Owner for inclusion in maintenance manual in accordance with Section 01 78 10.

END OF SECTION

SPECIFICATIONS AND DOCUMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Words and terms.
- .2 Complementary documents.
- .3 Precedence of Documents.
- .4 Specification grammar.

1.2 RELATED DOCUMENTS

- .1 Document 00 in its entirety.
- .2 Document 00 72 01 – Form of Contract.
- .3 Document 00 08 00 – Supplementary General Conditions.
- .4 Section 01 10 00 – Summary of Work.
- .5 This section describes requirements applicable to all sections within Divisions 02 to 49.

1.3 WORDS AND TERMS

- .1 The following words and terms are applicable to the Contract Documents for this project:
 - .1 **Addendum:** A document that amends the Bid Documents during the Bidding Period and becomes part of the Contract Documents when a Contract is executed. (Plural: Addenda)
 - .2 **Agreement:** The signed and sealed legal instrument binding parties in a Contract, describing in strict terms their mutual arrangement, roles and responsibilities, commencement, and completion responsibilities.
 - .3 **Alternative Price:** The amount stipulated by a Bidder for an Alternative and stated as an addition, a deduction, or no change to the Bid Price.
 - .4 **Bid:** To offer as a Bid stating for what price a Contractor will assume a Contract.
 - .5 **Bid Documents:** A set of documents consisting of the Instructions to Bidders, Bid Form, Contract Documents, and other information issued for the benefit of Bidders to prepare and submit a Bid.
 - .6 **Bid Form:** The specific and detailed form used to collect information about a Bid.
 - .7 **Bidding:** The process of preparing and submitting a Bid.
 - .8 **Construction Documents:** The Drawings and Project Manual. When combined with a Contract and Contract conditions, these documents form the Contract Documents.
 - .9 **Contingency Allowance:** An additional monetary amount added to a Project cost estimate and designated to cover unpredictable or unforeseen items of Work. The amount is usually based on some percentage of the estimated cost and expended and adjusted by Change Order. It is not intended to cover additions to the scope of Work.
 - .10 **Cost Plus Contract:** A Contract under which a Contractor is reimbursed for the direct and indirect costs for the performance of a Contract and, in addition, is paid a Fee for services. The Fee is usually stated as a stipulated price or as a percentage of cost.
 - .11 **General Conditions:** That part of the Contract Documents which sets forth many of the rights, responsibilities and relationships of the parties involved in a Contract.
 - .12 **Instructions to Bidders:** Instructions contained in the Bid Documents to convey an Owner's expectations and criteria associated with submitting a Bid.

SPECIFICATIONS AND DOCUMENTS

- .13 **Itemized Price:** The amount stipulated by a Bidder for a portion of work that forms part of the base bid price.
- .14 **Provide:** Supply and Install.
- .15 **Section:** A portion of a Project Specification covering one or more segments of the total Work or requirements. Sections are included in a Project manual as required to meet Project requirements.
- .16 **Separate Price:** A separate price for work to be added to the base price if selected by the Owner. This price type is not a part of the base bid price.
- .17 **Standard:** A document describing a grade or a level of quality, which has been established by a recognized agency or organization, utilizing an internal voting process.
- .18 **Stipulated Price:** An amount set forth in a Stipulated Price Contract as the total payment for the performance of the Work. Sometimes referred to as a stipulated sum or a lump sum stipulated price.
- .19 **Tender:** A term that was formally abandoned by CCDC and the Canadian Construction industry in the early 1980's in favour of the preferred term Bid.
- .20 **Unit Price:** The amount payable for a single unit of Work as stated in a Schedule of Prices.
- .21 **Install:** To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
- .22 **Supply:** To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

1.4 COMPLEMENTARY DOCUMENTS

- .1 Generally, drawings indicate graphically, the dimensions and location of components and equipment. Specifications indicate specific components, assemblies, and identify quality.
- .2 Drawings, specifications, diagrams and schedules are complementary, each to the other, and what is required by one, to be binding as if required by all.
- .3 Should any conflict or discrepancy appear between documents, which leaves doubt as to the intent or meaning, obtain guidance or direction from Architect.
 - .1 Trades are advised that all items, systems and information described in the Specifications, and all lines, surfaces, items and information noted on the Drawings (referred to as items) have a value associated with them. The Trades price must include a price for all items noted.
 - .2 If a discrepancy within the Contract Documents is discovered, a Site Instruction will be issued by the Architect clarifying the discrepancy and, if in the opinion of the Architect, the clarification involves the deletion of an item from the Contract, a Contemplated Change Notice will be issued and a credit to the Contract will be determined.
- .4 Examine all discipline drawings, specifications, schedules, diagrams and related Work to ensure that Work can be satisfactorily executed.
- .5 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.5 PRECEDENCE OF DOCUMENTS

- .1 In the event of conflict within and between the Contract Documents, the order of priority within specifications and drawings for this project are - from highest to lowest:
 - .1 the Agreement and Definitions between the Owner and the Contractor,
 - .2 the Definitions,
 - .3 Supplementary Conditions,

SPECIFICATIONS AND DOCUMENTS

- .4 the General Conditions,
- .5 Sections of Division 01 of the specifications,
- .6 Sections of Divisions 02 through 49 of the specifications,
- .7 Schedules and Keynotes:
 - .1 Material and finishing schedules within the specifications, then
 - .2 Material and finishing schedules on drawings, then
 - .3 Keynotes [and definitions thereto], then
- .8 Diagrams,
- .9 Drawings:
 - .1 Drawings of larger scale shall govern over those of smaller scale of the same date, then
 - .2 Dimensions shown on drawings shall govern over dimensions scaled from drawings, then
 - .3 Location of utility outlets indicated on architectural detail drawings takes precedence over positions or mounting heights located on mechanical or electrical drawings.
- .10 Later dated documents shall govern over earlier documents of the same type.
- .2 In the event of conflict between documents, the decision of the Architect shall be final.

1.6 SPECIFICATION GRAMMAR

- .1 Specifications are written in the imperative (command) mode, in an abbreviated form.
- .2 Imperative language of the technical sections is always directed to the Contractor identified as a primary constructor, as sole executor of the Contract, unless specifically noted otherwise.
 - .1 This form of imperative (command) mode statement requires the primary constructor to perform such action or Work.
 - .2 Perform all requirements of the Contract Documents whether stated imperatively or otherwise.
- .3 Division of the Work among subcontractors, suppliers, or others is solely the prime constructor's responsibility. The Consultant(s) and specification authors assume no responsibility to function or act as an arbiter to establish subcontract scope or limits between sections or divisions of Work.

END OF SECTION

SPECIFICATIONS AND DOCUMENTS

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ALLOWANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Cash allowances include:
 - .1 Geotechnical and structural testing and inspections.
 - .2 Roofing and building envelope testing and inspections.
 - .3 Finishing hardware allowances.
 - .4 Signage allowance.
 - .5 Other allowances as requested by the Owner or Consultant.

1.2 RELATED SECTIONS

- .1 Section 01 29 00 - Payment Procedures.
- .2 Section 01 62 00 - Product Exchange Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 CASH ALLOWANCES

- .1 Costs Included in Cash Allowances: Cost of Product to Contractor, less applicable trade discounts; delivery to site, and applicable taxes.
- .2 If a Cash Allowance item described in the Allowances Schedule below indicates the inclusion of installation, include in the Cash Allowance amount, provision for Product handling at the site, including unloading, un-crating, storage, protection of Products from elements and from damage, labour for installation and finishing, insurance, labour costs, taxes, bonding if applicable, equipment rental, overhead and profit.
- .3 If a Cash Allowance item described in the Allowances Schedule below indicates supply only, include in the Contract Price costs not included in Cash Allowances but included in the Contract Price: Product handling at the site including unloading, un-crating, storage, protection of Products from elements and from damage, labour for installation and finishing, insurance, labour costs, taxes, bonding if applicable, equipment rental, overhead and profit.
- .4 Contractor Responsibilities:
 - .1 Assist Consultant in selection of Products, suppliers and installers.
 - .2 Obtain proposals from suppliers and installers and offer recommendations.
 - .3 On notification of selection by Consultant or Owner, execute purchase agreement with designated supplier and installer.
 - .4 Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - .5 Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

Section/Division:	Work:	Amount:
Section 01 45 00	Geotechnical and Structural Testing and Inspections	\$ 1,500.00
Section 03 35 10	Floor flatness of existing concrete slab	\$ 5,000.00
Section 08 71 00	Door hardware, supply only	\$ 62,000.00
Section 07 52 16	Roofing testing and inspections	\$ 2,000.00
Division 07	Envelope inspections	\$ 2,000.00
	Signage – supply & install	\$ 5,000.00

ALLOWANCES

END OF SECTION

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PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Schedule of values.
- .2 Applications for progress payments.
- .3 Release of hold-back procedures.
- .4 Substantial performance procedures.
- .5 Payment of hold-back upon substantial performance of the Work.
- .6 Final payment.

1.2 SCHEDULE OF VALUES

- .1 Submit a printed schedule of values on CCDC paper forms to permit an authorized signature.
- .2 Submit Schedule of Values within fifteen (15) days after date of Owner-Contractor Agreement.
- .3 Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the primary associated specification section. Also identify site mobilization, bonds and insurance, hoarding, supervision, etc.
- .4 Include in each line item, the amount of Allowances specified in this section.
- .5 Include within each line item, the Contractor's overhead and profit.
- .6 Revise schedule to list approved Change Orders, with each Application For Payment.

1.3 APPLICATIONS FOR PROGRESS PAYMENT

- .1 Submit a CCDC 24 electronic form using an authorized electronic signature.
- .2 Make applications for payment on account as provided in Agreement monthly as Work progresses.
- .3 Accompany applications with a CCDC 9A-2001 Statutory Declaration form.
- .4 Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work as of that date.
- .5 Submit to Architect for review, minimum fifteen (15) calendar days before first application for payment, schedule of values for parts of Work, Cash-flow projections, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.
- .6 Submit required support documentation with applications for payment, including statutory declarations, workers' compensation clearance certificates, updated construction schedule and cash-flow projections and summary of change orders and change directives.
- .7 Architect will issue to Owner, no later than ten (10) working days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Architect determines to be properly due.
- .8 If Architect amends application, Architect will give notification in writing giving reasons for amendment.

1.4 PROGRESSIVE RELEASE OF HOLD-BACK

- .1 Where legislation permits, if Architect has certified that Work has been performed prior to Substantial Performance of the Work, Owner will pay hold-back amount retained for such Work, or products supplied, on day following expiration of hold-back period for such Work stipulated in lien legislation applicable to Place of the Work.
- .2 Notwithstanding provisions of preceding paragraph, and notwithstanding wording of such certificates, ensure that Subcontract Work or Products is protected pending issuance of final certificate for payment and be responsible for correction of defects

PAYMENT PROCEDURES

or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.5 SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 Submit a schedule of payments on CCDC 24 printed copy with an authorized signature.
- .2 Accompany applications with a CCDC 9A-2001 Statutory Declaration form.
- .3 Prepare and submit to Architect a comprehensive list of items to be completed or corrected. Failure to include an item on the list does not alter responsibility to complete the Contract.
- .4 Request Architect review to establish Substantial Performance of the Work.
- .5 Where permitted by local lien legislation, Contractor may apply for substantial performance of a designated portion of the Work, subject to Owner acceptance of that portion of the Work being substantially performed.
- .6 No later than twenty (20) calendar days after receipt of list and application, Architect will review Work to verify validity of application, and will notify Contractor if the Work, or the designated portion of the Work, is substantially performed in writing, or will issue a certificate of substantial performance.
- .7 Architect will state in their certificate the date of Substantial Performance of the Work, or the date of the designated portion of the Work, as applicable.
- .8 Immediately following issuance of certificate of Substantial Performance of the Work, in consultation with Architect, establish reasonable date for finishing Work.

1.6 PAYMENT OF HOLD-BACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 After issuance of certificate of Substantial Performance of the Work:
 - .1 Submit an application for payment of hold-back amount.
 - .2 Submit sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of the Work and for which Owner might in any way be held responsible have been paid in full, except for amounts properly retained as hold-back or as identified amount in dispute.
- .2 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of hold-back amount.
- .3 Where hold-back amount has not been placed in a separate hold-back account, Owner will, ten (10) calendar days prior to expiry of hold-back period stipulated in lien legislation applicable to Place of the Work, place hold-back amount in bank account in joint names of Owner and Contractor.
- .4 Amount authorized by certificate for payment of hold-back amount is due and payable on day following expiration of hold-back period stipulated in lien legislation applicable to Place of the Work.
 - .1 Where lien legislation does not exist or apply, hold-back amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties.
 - .2 Owner may retain out of hold-back amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of the Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.7 FINAL PAYMENT

- .1 Submit an application for final payment on a CCDC 24 electronic form using an authorized electronic signature. [Printed form copy with an authorized signature.]
- .2 Architect will, no later than ten (10) calendar days after receipt of an application for final payment, review Work to verify validity of application. Consultant will give

PAYMENT PROCEDURES

- notification that application is valid or give reasons why it is not valid, no later than seven (7) days after reviewing Work.
- .3 Architect will issue final certificate for payment when application for final payment is found valid.

END OF SECTION

PAYMENT PROCEDURES

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CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Schedules, form, content, submission.
- .2 Construction progress scheduling.
- .3 Critical path scheduling.
- .4 Progress photographs.
- .5 Submittals schedule.

1.2 SCHEDULES

- .1 Submit schedules as follows:
 - .1 Submittal Schedule for Shop Drawings and Product Data.
 - .2 Submittal Schedule for Samples.
 - .3 Submittal Schedule for timeliness of Owner-furnished Products.
 - .4 Product Delivery Schedule.
 - .5 Cash Allowance Schedule for acquiring Products only or Products and Installation, or Installation only.
 - .6 Shutdown or closure activity.
 - .7 Inspection and Testing Schedule
- .2 Schedule Format
 - .1 Prepare schedule in form of a horizontal Gantt bar chart.
 - .2 Provide a separate bar for each item of work.
 - .3 Split horizontally for projected and actual performance.
 - .4 Provide horizontal time scale identifying first Working Day of each week.
 - .5 Format for listings: chronological order of start of each item of work.
 - .6 Identification of listings: By systems description.
- .3 Schedule Submission
 - .1 Submit initial format of schedules within 15 days after award of Contract.
 - .2 Submit schedules in electronic format, through e-mail as *.pdf files.
 - .3 Submit one (1) hard copy to be retained by Consultant.
 - .4 Consultant will review schedule and return review copy within 10 working days after receipt.
 - .5 Resubmit finalized schedule within 7 days after return of review copy.
 - .6 Submit revised progress schedule with each application for payment.
 - .7 Distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
 - .8 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.
- .4 Employ a Schedule for LEED® Submittals for individual credit verification process. Retain all documentation necessary to support figures submitted in Schedules.

1.3 CONSTRUCTION PROGRESS SCHEDULING

- .1 Submit initial schedule in duplicate within fifteen (15) days after date of Owner-Contractor Agreement.
- .2 Revise and resubmit as required.
- .3 Submit revised schedules with each Application for Payment, identifying changes since previous version.

CONSTRUCTION PROGRESS DOCUMENTATION

- .4 Submit computer generated network analysis diagram using the critical path method.
- .5 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- .6 Indicate estimated percentage of completion for each item of Work at each submission.
- .7 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.
- .8 Indicate projected percentage of completion of each item as of first day of month.
- .9 Indicate progress of each activity to date of submission schedule.
- .10 Indicate changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .11 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.4 CRITICAL PATH SCHEDULING

- .1 Include complete sequence of construction activities.
- .2 Show projected percentage of completion of each item as of first day of month.
- .3 Indicate progress of each activity to date of submission schedule.
- .4 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .5 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.5 PROGRESS PHOTOGRAPHS

- .1 Digital Photography
 - .1 Submit electronic copy of colour digital photography in *.jpg format, minimum 10 megapixel resolution.
 - .2 Identification: name and number of project and date of exposure indicated.
- .2 Frequency: minimum monthly with progress statement.
- .3 Co-ordinate with Architect what photographs are required for LEED® certification and provide those photographs in addition to regular progress photographs.

CONSTRUCTION PROGRESS DOCUMENTATION

1.6 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, samples,
- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
- .3 Include dates when delivery will be required for Owner furnished products.
- .4 Include dates when reviewed submittals will be required from Architect.

END OF SECTION

CONSTRUCTION PROGRESS DOCUMENTATION

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SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ADMINISTRATIVE

- .1 Submit to Architect submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not manufactured or produced in SI Metric units, converted values within the metric measurement tolerances are acceptable.
- .5 Review submittals prior to submission to Architect. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
- .6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .7 Notify Architect, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify that field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Architect's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Architect review.
- .11 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 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 design drawings and specifications.
- .3 Allow ten (10) working days for Architect's review of each submission.
- .4 Adjustments made on shop drawings by Architect are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

SUBMITTAL PROCEDURES

- .5 Make changes in shop drawings as Architect may require, consistent with Contract Documents. When resubmitting, notify Architect in writing of any revisions other than those requested.
- .6 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.
- .7 Submissions shall 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 field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to other parts of the Work.
- .8 After Architect's review, distribute copies.
- .9 Submit two (2) paper copies of the shop drawings to the General Contractor. The shop drawings must be named as per the naming standards below AND they must include on the front cover or on large format drawings - in the bottom right hand corner – a space for the General Contractors Stamp, and spaces for EACH of the reviewing consultants stamps.
- .10 The two paper copies are submitted to the General Contractor, one is kept by the General Contractor, the other single copy and one digital *.pdf copy is sent to the primary consultant for the trade (i.e. the steel drawings will go first to the Structural Engineers), and the owner. The primary consultant then forwards the marked up drawing and/or *.pdf to the next consultant for review, and so on, until the final review is performed by the Architect. The architect returns the submission to the General Contractor. The General Contractor then scans/digitizes the drawings, names the resultant *.pdf as per the naming standards, and distributes to all parties.
- .11 Drawing Names and Numbers MUST follow the following system. *.pdf's must also be named using the same convention to allow for easy electronic filling and retrieval.

Example: 04 20 00 D01-2 Brick Ties .Pdf

- .1 Section Number
04 20 00 D01-2 Brick Ties.Pdf
- .2 Submission and drawing number for the item in the shop drawing
04 20 00 **D01**-2 Brick Ties.Pdf
- .3 Submission revision or version number for the item in the shop drawing
04 20 00 D01-**2** Brick Ties.Pdf
- .4 Title of the item in the shop drawing

SUBMITTAL PROCEDURES

04 20 00 D01-2 **Brick Ties**.Pdf

- .12 Submit one (1) copy of product data sheets or brochures for requirements requested in specification sections and as requested by Architect where shop drawings will not be prepared due to standardized manufacture of product.
- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Architect, 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 re-submission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 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.
- .3 Notify Architect 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 Architect are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .6 Change samples as required by Architect, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1
- .2 Immediately after award of Contract, submit Workers' Compensation Board status.
- .3 Submit transcription of insurance immediately after award of Contract.

1.7 LEED® SUBMITTALS

- .1 Not applicable.

END OF SECTION

SUBMITTAL PROCEDURES

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HEALTH AND SAFETY

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Safety requirements and adherence.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Province of Ontario: Occupational Health and Safety Act, including requirements for a "Prime Contractor" as defined by the Act.

1.4 SAFETY PLAN

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Architect may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.5 RESPONSIBILITY

- .1 The "Prime Contractor" according applicable local jurisdiction, is 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 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.
- .3 Should any unforeseen or peculiar safety related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province having jurisdiction. Advise Architect verbally and in writing.

1.6 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site specific Health and Safety Plan: Within seven (7) days after date of 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 one (1) copy of Contractor's authorized representative's work site health and safety inspection reports to Consultant.
 - .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 Material Safety Data Sheets (MSDS) to Architect.
- .3 Architect will review Contractor's site specific Health and Safety Plan and provide comments to Contractor within seven (7) days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within three (3) days after receipt of comments from Architect.

HEALTH AND SAFETY

- .4 Architect'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.
- .5 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 Architect.

1.7 SAFETY ACTIVITIES

- .1 Perform site specific safety hazard assessment related to project.
- .2 Schedule and administer Health and Safety meeting with Architect prior to commencement of Work.
- .3 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8 HEALTH AND SAFETY COORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have minimum two (2) years' site related working experience specific to activities associated with construction in a hospital setting.
 - .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.

1.9 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.

1.10 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction, Owner or by Architect.
- .2 Provide Owner and Architect with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Architect may stop Work if non-compliance of health and safety regulations is not corrected.

1.11 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.

1.12 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 Burning rubbish and construction waste materials is not permitted on site.

END OF SECTION

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Site fires.
- .2 Site drainage.
- .3 Site clearing and plant protection.
- .4 Work adjacent to waterways.
- .5 Pollution control.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.4 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 metres.
- .3 Protect roots of designated trees to drip-line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated, or as designated by Architect.

1.6 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authority's emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

END OF SECTION

ENVIRONMENTAL PROTECTION

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WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Waste goals.
- .2 Waste management plan.
- .3 Third party responsibilities.
- .4 Waste management plan implementation.
- .5 Disposal of waste.
- .6 Forms for documenting program.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 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 but not limited to, building materials, packaging, trash, debris, and rubble resulting from construction, re-modelling, repair and demolition operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including, but not limited to, ignitability, corrosiveness, toxicity or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including, but not limited to, ignitability, corrosiveness, toxicity, or reactivity.
- .5 Non-toxic: Neither immediately poisonous to humans nor poisonous 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 re-manufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the Project site to another site for re-manufacture 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 throughout-gassing:
 - .1 Solvents in paints and other coatings,
 - .2 Wood preservatives; strippers and household cleaners,
 - .3 Adhesives in particle board, fibreboard, 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.

WASTE MANAGEMENT AND DISPOSAL

- .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 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 land-filled.

1.4 OWNER WASTE MANAGEMENT GOALS

- .1 Owner has established this Project is to generate the least amount of waste possible. This requires that construction processes ensure as little waste as possible, either due to error, poor planning, breakage, mishandling, contamination, or other factors.
- .2 Owner recognizes that waste in any project is inevitable but indicates that as much of the waste materials as economically feasible. Reused, salvage, or recycle as required.
- .3 Minimize waste disposal to landfills.

1.5 WASTE MANAGEMENT PLAN

- .1 Draft Waste Management Plan: Within ten (10) days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner.
- .2 Submit a Draft Waste Management Plan to Consultant for review, refer to sample at the end of this Section.

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Consultant.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

1.7 SCHEDULING

- .1 Coordinate work with other activities at site to ensure timely and orderly progress of the Work.

PART 2 PRODUCTS

2.1 NOT USED.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- .1 Construction Manager: Designate an on-site party responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for Project.

WASTE MANAGEMENT AND DISPOSAL

- .2 Distribution: Distribute copies of the Waste Management Plan to the Job Site Foreman and each Subcontractor.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by parties at appropriate stages of Project.
- .4 Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

3.3 DISPOSAL OF WASTE

- .1 Burying of rubbish and waste materials is prohibited.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, and, paint thinner into waterways, storm, or sanitary sewers is prohibited.

3.4 CLEANING

- .1 Remove tools and waste materials on completion of work, leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

WASTE MANAGEMENT AND DISPOSAL

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REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Laws, notices, permits and fees.
- .2 Discovery of hazardous materials.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 LAWS, NOTICES, PERMITS AND FEES

- .1 The laws of the Place of the Work shall govern the Work.
- .2 The Owner shall obtain and pay for the building permit, permanent easements and rights of servitude. The Contractor shall be responsible for permits, licenses or certificates necessary for the performance of the Work which were in force at the date of executing the Agreement.
- .3 Give the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.
- .4 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes.
- .5 Determine detailed requirements of authorities having jurisdiction.
- .6 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.

1.4 HAZARDOUS MATERIAL DISCOVERY

- .1 Should any subsurface construction or objects containing Hazardous Materials or any Hazardous Materials be encountered during the Work of this contract, notify the Architect and Owner and do not proceed with removal or cutting until directed.

1.5 PERSONNEL SMOKING

- .1 Comply with regulatory and Owner imposed smoking restrictions during execution of the Work within or outside the premises.

END OF SECTION

REGULATORY REQUIREMENTS

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REFERENCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 References and standards.
- .2 Standards producing industry organizations and their addresses.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 For Products or quality specified by association, trade, or other references or consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- .2 Conform to reference standard by date of issue current on date of Contract Documents except where a specific date is established or required by code.
- .3 Obtain copies of standards where required by product specification sections.
- .4 Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Consultant shall be altered from the Contract Documents by mention or inference otherwise, in any reference document.

1.4 STANDARDS PRODUCING INDUSTRY ORGANIZATIONS

- .1
- .2 The following associations and organizations are cited in specification sections. Acronym, name, address, and Internet URL addresses are as follows.
- .3 Canadian Organizations:
 - .1 ACEC - Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616, Ottawa, ON, K1P 5G4 URL <http://www.acec.ca>
 - .2 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, Alberta T1V 1B6 URL <http://www.awmac.com>
 - .3 Canada Green Building Council; 330 - 55 rue Murray Street, Ottawa, ON, K1N 5M3; Tel: 613-241-1184 Fax: 613-241-5750, URL: www.cagbc.org
 - .4 CCA - Canadian Construction Association, 75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL <http://www.cca-acc.com>
 - .5 CCDC - Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC; www.CCDC.org
 - .6 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2 URL <http://www.dnd.ca/admie/dgcps/CFFMe.htm>
 - .7 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL <http://www.cga.ca>
 - .8 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 0S5 URL <http://w3.pwgsc.gc.ca/cgsb>
 - .9 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL <http://www.cisc-icca.ca>
 - .10 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL <http://www.cla-ca.ca>

REFERENCES

- .11 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL <http://www.canadanursery.com>
 - .12 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, Ontario K1P 6L1 URL <http://www.roofingcanada.com>
 - .13 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL <http://www.csa-international.org>
 - .14 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, Ontario M5A 4K2 URL <http://www.csc-dcc.ca>
 - .15 CSDMA - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, Ontario M5E 1W7; <http://www.csdma.org/>
 - .16 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cspi.ca>
 - .17 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cssbi.ca>
 - .18 CUFCA - Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, Manitoba, R3C 4E7 URL <http://www.cufca.ca>
 - .19 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL <http://www.cwc.ca>
 - .20 EC - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, Québec K1A 0H3 URL <http://www.ec.gc.ca>
 - .21 EFC - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL <http://www.electrofed.com>
 - .22 EIMA - EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL <http://www.eima.com>
 - .23 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL <http://www.paintinfo.com>
 - .24 NABA - National Air Barrier Association, PO Box 2747, Winnipeg, Manitoba R3C 4E7 URL <http://www.naba.ca>
 - .25 NLGA - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, B.C. V3M 6G2; <http://www.nlga.org/>
 - .26 NRC - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, Ontario K1A 0R6 URL <http://www.nrc.gc.ca>
 - .27 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL <http://www.pwgsc.gc.ca/cgsb>
 - .28 RAIC - Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL <http://www.raic.org>
 - .29 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL <http://www.scc.ca>
 - .30 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 URL <http://www.ttmac.com>
 - .31 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL <http://www.ulc.ca>
- .4 USA Organizations:
- .1 AA - Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 URL <http://www.aluminum.org>
 - .2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL <http://www.aashto.org>

REFERENCES

- .3 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois, U.S.A. 60067 URL : <http://www.hardboard.org>
- .4 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112 URL <http://www.aitc-glulam.org>
- .5 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004-1893 URL <http://www.amca.org>
- .6 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, New York, U.S.A. 10036 URL <http://www.ansi.org>
- .7 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington, U.S.A. 98411-0700 URL <http://www.apawood.org>
- .8 API - American Petroleum Institute, 1220 L St. Northwest, Washington, D.C., U.S.A. 20005-4070 URL <http://www.api.org>
- .9 ARI - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200, Arlington, Virginia, U.S.A. 22203 URL <http://www.ari.org>
- .10 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL <http://www.ashrae.org>
- .11 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, New York, U.S.A. 10016-5990 URL <http://www.asme.org>
- .12 ASTM International, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL <http://www.astm.org>
- .13 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600, Falls Church, VA, U.S.A. 22046 URL <http://www.awci.org>
- .14 AWPAA - American Wire Producer's Association, 801 N Fairfax Street, Suite 211, Alexandria, VA U.S.A. 22314-1757 URL <http://www.awpa.org>
- .15 AWPAA - American Wood Preservers' Association, P.O. Box 5690, Granbury Texas, U.S.A. 76049-0690 URL <http://www.awpa.com>
- .16 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL <http://www.amweld.org>
- .17 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL <http://www.awwa.org>
- .18 ISAP - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul, MN 55102 U.S.A. URL <http://www.asphalt.org>
- .19 IEEE - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, New York U.S.A. 10016-5997 URL <http://www.ieee.org>
- .20 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A. 22180-4602 URL <http://www.mss-hq.com>
- .21 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL <http://www.naamm.org>
- .22 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL <http://www.nema.org>
- .23 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101 Quincy, Massachusetts, U.S.A. 02269-9101 URL <http://www.nfpa.org>
- .24 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL <http://www.nfsa.org>
- .25 NHLA - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN, U.S.A 38184-0518 URL <http://www.natlhardwood.org>

REFERENCES

- .26 NSPE - National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL <http://www.nspe.org>
- .27 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606-6938 URL <http://www.pci.org>
- .28 PEI - Porcelain Enamel Institute, PO Box 920220, Norcross, GA U.S.A. 30010 URL <http://www.porecelainenamel.com>
- .29 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pennsylvania 15222-4656 URL <http://www.sspc.org>
- .30 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL <http://www.tpinst.org>
- .31 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062-2096 URL <http://www.ul.com>

END OF SECTION

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Written and electronic reports.
- .6 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 21 00 - Allowances.
- .3 Section 01 43 00 - Quality Assurance.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 ISO/IEC 17025:2005 - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 SCC (Standards Council of Canada).

1.4 QUALITY ASSURANCE

- .1 Cooperate with testing organizations.
- .2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.
- .3 Comply with applicable procedures and standards of the certification sponsoring association.
- .4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.5 INSPECTION BY AUTHORITY

- .1 Allow Authorities Having Jurisdiction access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

1.6 REVIEW BY ARCHITECT

- .1 Architect may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

QUALITY CONTROL

1.7 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection and Testing Agencies will be engaged by Owner for purpose of inspecting and testing portions of Work. Cost of such services will be borne as a Cash Allowance.
- .2 Testing Organizations: Listed by SCC within info.palcan@scc.ca listings.
- .3 Allocate Costs: To Section 01 21 00.
- .4 Provide equipment required for executing inspection and testing by appointed agencies.
- .5 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .6 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Architect at no cost to Owner. Pay costs for retesting and re-inspection.

1.8 ACCESS TO WORK

- .1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Cooperate to provide reasonable access and facilities for such access.

1.9 PROCEDURES

- .1 Notify appropriate agency and Architect in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.10 REJECTED WORK

- .1 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 in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Architect it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Architect.

1.11 REPORTS

- .1 Submit one (1) electronic copy of signed inspection and test reports to Architect.
- .2 Provide signed paper copies to Subcontractor of work being inspected or tested.

1.12 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

QUALITY CONTROL

1.13 MOCK-UP

- .1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to Architect.
- .3 Prepare mock-ups for Architect's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.14 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.15 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

END OF SECTION

QUALITY CONTROL

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TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Temporary utilities.
- .2 Salvaging products for reuse.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 52 00 - Construction Facilities.
- .3 Section 01 53 00 - Temporary Construction.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Salvage and assist in recycling products for potential reuse.
- .3 Remove from site all such work after use.

1.4 DEWATERING

- .1 General Contractor is ultimately responsible for providing temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Make arrangements with the Owner for connection of existing water service for a continuous supply of potable water for construction use, separate from water required for fire protection.

1.6 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel. Required during hazardous substance abatement period only. Thereafter permanent heating may be used.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless 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 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 temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied 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 manner that will not result in harmful exposure to persons.

TEMPORARY UTILITIES

- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 On completion of Work for which permanent heating system is used, replace filters.
- .7 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
- .8 Pay costs for maintaining temporary heat, when using permanent heating system.
- .9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform to 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.
- .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

- .1 Provide a source for and pay the costs of temporary power during construction for temporary lighting and operating of power tools, as required.
- .2 ~~Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.~~ Temporary power can be connected to main building power.
- .3 If required, relocation of temporary power source during construction is the responsibility of the Electrical Contractor.
- .4 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.
- .5 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than 162 lx.
- .6 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Architect provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.

1.8 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary communications as required for own use.

END OF SECTION

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Project identification.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 01 in its entirety.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 CAN/CSA-Z321- 96: Signs and Symbols for the Occupational Environment.

1.4 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.5 SCAFFOLDING

- .1 Provide and maintain scaffolding, ramps, ladders, platforms, temporary stairs and access as required to perform Work.

1.6 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists and cranes shall be operated by qualified operators.

1.7 ELEVATORS/LIFTS – NOT REQUIRED THIS PROJECT

1.8 USE OF THE WORK

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with Products.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.9 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work subject to parking rates set by the Owner.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads where necessary and provide snow removal during period of Work.

CONSTRUCTION FACILITIES

1.10 SECURITY

- .1 Provide and pay for responsible security personnel to guard site, premises and materials if required when the site can't be properly secured at all times other than when supervised work is in progress.

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 layout table.
- .2 Provide a clearly marked and fully stocked first-aid case and A.E.D.(Automated External Defibrillator) in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.
- .4 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
- .5 Maintain in clean condition.
- .6 Location(s) to be approved by Owner.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a 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 a manner to cause least interference with work activities.
- .3 Location(s) to be 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 such precautions as required by local health authorities.
- .3 Except where connected to municipal sewer system, periodically remove wastes from Site.
- .4 Permanent facilities may not be used.
- .5 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

TEMPORARY CONSTRUCTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Site enclosure.
- .2 Guardrails and barriers.
- .3 Weather enclosures.
- .4 Protection for off-site and public property.
- .5 Protection of applied finishes and surrounding Work.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 01 in its entirety.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 SITE ENCLOSURE

- .1 Contractor to secure site.
- .2 Provide barriers around trees and plants designated to remain.

1.5 GUARD RAILS AND BARRIERS

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and other fall hazards.
- .2 Provide as required by governing authorities.

1.6 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; enclose building interior work for temporary heat.

1.7 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.

1.8 PROTECTION OF APPLIED FINISHES

- .1 Provide protection for finished and partially finished surfaces and equipment during performance of Work.
- .2 Confirm with Architect locations and installation schedule five days prior to installation.
- .3 Be responsible for damage incurred due to lack of or improper protection.

END OF SECTION

TEMPORARY CONSTRUCTION

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TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SUMMARY

- .1 Create an erosion and sediment control plan.
- .2 Prevent loss of soil during construction by storm water runoff and wind erosion.
- .3 Protect stockpiled topsoil.
- .4 Prevent sedimentation of storm water and receiving streams.
- .5 Prevent pollution of the air with dust and particulate matter.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 00 in its entirety.
- .3 Section 31 – See drawings C2.1 and C2.2.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Storm Water Management for Construction Activities, Document No. EPA 832/R-92-005 (September 1992), Chapter 3 Sediment and Erosion Control, United States Environmental Protection Agency (EPA) Office of Water.

1.4 DEFINITIONS

- .1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.
- .2 Rain or Rain Storm: An event defined causing the pooling of water on road or other impervious surfaces.
- .3 Sediment: Particulate matter transported and deposited as a layer of solid particles within a body of water.
- .4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or when environmental conditions causing snow on the ground to melt.

1.5 SUBMITTALS

- .1 Provide requested information in accordance with Section 01 33 00 – Submittals.
- .2 Provide within seven (7) days of date established for commencement of the Work.

PART 2 PRODUCTS

2.1 SILT FENCING

- .1 Posts: Steel "T" cross section, of lengths as required.
- .2 Geotextile: Woven polypropylene filter fabric, resistant to ultra-violet degradation.

PART 3 EXECUTION

3.1 STOCKPILING

- .1 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by rain storm, snow melt or wind.
- .2 Install silt fencing.
- .3 Maintain silt fencing at a height of no less than 400 mm above grade, and no greater than 800 mm.

TEMPORARY EROSION AND SEDIMENT CONTROL

- .4 Extend geotextile filter fabric 150 mm below grade, and return 150 mm towards the opposite direction of flow.
- .5 Space posts not further than 1800 mm apart.
- .6 Limit operation of vehicles on site to paved surfaces or temporary gravel surfaces in order to avoid the disturbing soil.

3.2 MUNICIPAL STORM WATER

- .1 Protect catch basins, drains, culverts and other points of entry into municipal storm water collection systems.

3.3 INSPECTION

- .1 Each Week: Inspect for erosion and sediment control measures, to ensure proper functions are not damaged,

END OF SECTION

PROJECT IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Construction signage.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 PROJECT SIGN

- .1 Provide and erect, within three (3) weeks of signing Contract, a project sign in a location designated by Owner and Consultant.
- .2 Construction sign:
 - .1 Size: 2.44m x 3.65m,
 - .2 wood frame and plywood construction,
 - .3 paint surfaces of signboard with one coat alkyd primer and two coats alkyd enamel.
 - .4 exhibit lettering produced by a professional sign painter.
- .3 Indicate on sign:
 - .1 name of Owner with vinyl plastic logo,
 - .2 name of all Consultants,
 - .3 name of Contractor,
 - .4 sign design style established by Architect.
- .4 Locate project identification sign as directed by Owner and constructed as follows:
 - .1 Set concrete foundation at and below frost line, erect framework, attach signboard to framing.
 - .2 Apply vinyl logo overlay to painted signboard face to installation instructions supplied.
- .5 Signs and notices for safety and instruction in English.
- .6 No other signs or advertisements, other than safety and warning signs, are permitted on site.
- .7 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 Architect.

1.4 GENERAL SIGNAGE

- .1 General signage, other than a site sign specified above, is not permitted anywhere on site except by specific written permission by the Owner.
- .2 Signs for safety purposes or for traffic flow, are permitted where appropriate.

END OF SECTION

PROJECT IDENTIFICATION

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PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Product substitution procedures.
- .3 Manufacturer's instructions.
- .4 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 42 00 - References and Definitions: Other terms used in the Project Manual.
- .3 Section 01 62 00 - Product Exchange Procedures.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TERMINOLOGY

- .1 New: Produced from new materials.
- .2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .3 Defective: A condition determined exclusively by the Architect or Owner.

1.4 PRODUCT QUALITY

- .1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.
- .2 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 own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Architect.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 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.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 If delays in supply of Products are foreseeable, notify Architect of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .3 In event of failure to notify Architect at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Architect reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

PRODUCT REQUIREMENTS

1.6 STORAGE AND PROTECTION

- .1 Store and protect Products in accordance with manufacturers' written instructions.
- .2 Store with seals and labels intact and legible.
- .3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.
- .4 For exterior storage of fabricated Products, place on sloped supports above ground.
- .5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- .6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- .7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 TRANSPORTATION AND HANDLING

- .1 Transport and handle Products in accordance with manufacturer's written instructions.
- .2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- .3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 PRODUCT CHANGES

- .1 Change in Product(s): Submit request for substitution or alternative in accordance with Section 01 62 00.

1.9 EXISTING UTILITIES

- .1 When connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.
- .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.

1.10 MANUFACTURER'S WRITTEN INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect Products in accordance with manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify Architect in writing, of conflicts between specifications and manufacturer's instructions, so that Architect may establish course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Architect to require removal and re-installation at no increase in Contract Price or Contract Time.

1.11 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. Immediately notify Architect if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Architect reserves right to require dismissal from site any workers deemed incompetent or careless.

PRODUCT REQUIREMENTS

- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Architect, whose decision is final.

1.12 COORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.13 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Architect if there is interference. Install as directed by Architect.

1.14 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.15 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Architect of conflicting installation. Install as directed.

1.16 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.

1.17 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 Type 304 or 316 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.

PRODUCT REQUIREMENTS

1.18 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of any part of the Project.
- .2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Architect.

END OF SECTION

PRODUCT EXCHANGE PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Substitutions.
- .2 Identified Prices.
- .3 Alternative Prices.
- .4 Separate Prices.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 21 00 - Allowances.
- .3 Section 01 29 00 - Payment Procedures.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBSTITUTIONS

- .1 Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .2 Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- .3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .4 A request constitutes a representation that the Bidder;
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- .5 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- .6 Substitution Submittal Procedure:
 - .1 Submit three (3) copies of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.
 - .2 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
 - .3 The Architect will notify Contractor in writing of decision to accept or reject request.

1.4 IDENTIFIED PRICES

- .1 Reserved

1.5 ALTERNATIVE PRICES

Alternate Price #1: In lieu of new curtain wall mullions at west wall removal of existing curtain wall, modify the existing vertical mullions as

PRODUCT EXCHANGE PROCEDURES

required by removing the bottom portion to suit new support.
Reuse existing horizontal mullions.

1.6 SEPARATE PRICES

Reserved

END OF SECTION

EXAMINATION AND PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Field engineering survey services to measure and stake site.
- .2 Recording of subsurface conditions found.
- .3 Survey services to determine measurement inverts for the Work.
- .4 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Owner's identification of existing survey control points and property limits.

1.4 SUBMITTALS

- .1 On request of Architect, submit documentation to verify accuracy of field engineering work.
- .2 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform with Contract Documents.

1.5 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in the Place of the Work.

1.6 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on Drawings.
- .2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Consultant.
- .4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.7 SURVEY REQUIREMENTS

- .1 Delete items below when acceptable control points or bench marks are located on site.
- .2 Establish two (2) permanent bench marks on site, referenced to established bench marks by survey control points.
- .3 Record locations, with horizontal and vertical data in Project Record Documents.
- .4 Establish lines and levels, locate and lay out, by instrumentation.
- .5 Stake for grading, fill and topsoil placement and landscaping features.
- .6 Stake slopes and berms.
- .7 Establish pipe invert elevations.
- .8 Stake batter boards for foundations.
- .9 Establish foundation column locations and floor elevations.
- .10 Establish lines and levels for mechanical and electrical work.

EXAMINATION AND PREPARATION

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify Architect in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
- .2 Advise the Architect of a reasonable assumption of probable conditions when determined.

1.9 EXAMINATION

- .1 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of the Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

1.10 PREPARATION

- .1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.11 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 Architect 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.

1.12 SURVEY RECORD

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

END OF SECTION

EXECUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Submittal requirements associated with connecting to new and existing facilities.
- .2 Execution requirements for all Work.

1.2 RELATED SECTIONS

- .1 Document 0 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TOLERANCES

- .1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.
- .2 Do not permit tolerances to accumulate beyond effective or practical limits.
- .3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Architect before proceeding.
- .4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching to complete the Work.
- .2 Perform all required excavation and fill to complete the Work.
- .3 Fit several parts together, to integrate with other Work.
- .4 Uncover Work to install ill-timed Work.
- .5 Remove and replace defective or non-conforming Work.
- .6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.
- .7 Provide openings in non-structural elements of Work for penetrations of mechanical, electrical, and associated Work. Limit opening dimensions to minimal sizes required and performed in a neat and clean fashion.
- .8 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .9 Employ competent qualified workers to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .10 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry or concrete work without prior approval.
- .11 Restore work with new products in accordance with requirements of Contract Documents.
- .12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire-stopping material, for full thickness of the constructed element to match the rating of the assembly being penetrated. Provide consultant with UL/ULC test number for each type of penetration.
- .14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.
- .15 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

END OF SECTION

EXECUTION

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CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Requirements and limitations for cutting and patching of Work.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 61 00 - Product Requirements.
- .3 Division 01 in its entirety.
- .4 Section 04 20 00 – masonry.
- .5 Section 07 84 00 - Firestopping.
- .6 Individual Product Specification Sections:
 - .1 Cutting and patching incidental to work of the section.
 - .2 Advance notification to other sections of openings required in Work of those sections.
 - .3 Limitations on cutting structural members.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather exposed or moisture resistant element.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight exposed elements.
 - .5 Work of Owner or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Necessity for cutting or alteration.
 - .4 Description of proposed Work and Products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Primary Products: Those required for original installation.
- .2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 62 00.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering existing Work, assess conditions affecting performance of work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

CUTTING AND PATCHING

3.2 PREPARATION

- .1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- .2 Provide protection from elements for areas which may be exposed by uncovering work.
- .3 Maintain excavations free of water.

3.3 CUTTING

- .1 Execute cutting and fitting including excavation and fill to complete the Work.
- .2 Uncover work to install improperly sequenced work.
- .3 Remove and replace defective or non-conforming work.
- .4 Remove samples of installed work for testing when requested.
- .5 Provide openings in the Work for penetration of mechanical and electrical work.
- .6 Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- .7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING

- .1 Execute patching to complement adjacent Work.
- .2 Fit Products together to integrate with other Work.
- .3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- .4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
- .5 Restore work with new Products in accordance with requirements of Contract Documents.
- .6 Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated UL/ULC tested assemblies in accordance with Section 07 84 00 to full thickness of the penetrated element.
- .8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Division 01 in its entirety.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

- .1 Cleaning Agents and Materials: Low VOC content.

PART 3 EXECUTION

3.1 PROGRESSIVE CLEANING

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Architect. Do not burn waste materials on site, unless approved by Consultant.
- .3 Clear snow and ice from area of construction, bank or pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Containers:
 - .1 Provide on-site steel framed containers for collection of waste materials and debris.
 - .2 Provide and use clearly marked, separate bins for recycling.
 - .3 Refer to Section 01 35 41.
- .6 Remove waste material and debris from site at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finish 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 enclosure 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.

3.2 CLEANING PRIOR TO ACCEPTANCE

- .1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

CLEANING

- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Architect. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 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.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Clean and polish surface finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; replace filters of mechanical equipment.
- .18 Clean roof surfaces, down-spouts, and drainage components.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to facilities.

3.3

FINAL PRODUCT CLEANING

- .1 Execute final cleaning prior to final project assessment. Refer to Section 01 74 00.
- .2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- .3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- .4 Replace filters of operating equipment.
- .5 Clean site; sweep paved areas, rake clean landscaped surfaces.
- .6 Remove waste and surplus materials, rubbish, and construction facilities from the site.

END OF SECTION

START-UP PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Starting equipment in preparation for adjusting and commissioning.
- .2 To bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.
- .3 Contractor's and Owner's responsibilities during each of the following successive sub phases of facility start-up:
 - .1 Contractor start-up which leads to Interim Acceptance of the Work.
 - .2 Performance Testing which leads to Practical Completion of the Work.

1.2 RELATED SECTIONS

- .1 Document 0 in its entirety.
- .2 Section 01 75 19 - Testing, Adjusting and Balancing.
- .3 Section 01 79 00 - Demonstration and Training.
- .4 Section 01 91 00 - Commissioning.
- .5 Division 01 in its entirety.
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBMISSIONS

- .1 Advise Commissioning Agent of report forms required for equipment and systems but not yet supplied by the commissioning agent.
- .2 Provide a sample of manufacturer's start-up forms for equipment or systems not included.
- .3 Submit and completed and verified commissioning manual to the Owner with all data entered and sign-offs, prior to Substantial Completion of the Work.

PART 2 PRODUCTS

2.1 NOT USED.

PART 3 EXECUTION

3.1 STARTING SYSTEMS

- .1 Coordinate schedule for start-up of various equipment and systems.
- .2 Notify Architect and Owner seven days prior to start-up of each item.
- .3 Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- .4 Verify tests, metre readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- .5 Verify that wiring and support components for equipment are complete and tested.
- .6 Execute start-up under supervision of applicable [manufacturer's representative] [Contractors' personnel] in accordance with manufacturers' written instructions.
- .7 When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- .8 Submit a written report that equipment or system has been properly installed and is functioning correctly.

START-UP PROCEDURES

3.2 START-UP REPORT

- .1 Commissioning agent will provide start up report forms (check sheets) with the exception of controls.
- .2 Contractor to develop, complete and provide the report forms for all control points, software and hardware
- .3 Submit completed report forms to commissioning agent for review within ninety (90) days of award of contract.
- .4 Commissioning agent will assemble completed report forms into a "commissioning manual" on the following subjects:
 - .1 Each mechanical system (except for controls).
 - .2 Each electrical system
- .5 Refer to Owner for a sample of the commissioning report form.
- .6 Include manufacturer's equipment start-up reports and test certificates as an appendix to the commissioning manual.
- .7 The commissioning manual will be kept on site for use by appropriate contractors and the commissioning agent.
 - .1 Maintain this manual current.
 - .2 Maintain a schedule for work of the commissioning agent in conjunction with the commissioning schedule.
- .8 The report forms are divided into three parts:
 - .1 Technical Data
 - .2 Static Checks
 - .3 Operational Checks
- .9 Contractor is to complete each part prior to verification by the commissioning agent.
- .10 Contractor is responsible for completing the report forms as follows and as indicated on the attached sample:
 - .1 Technical Data
 - .1 Specified: Commissioning Agent
 - .2 Shop Drawing: Contractor
 - .3 Installed: Contractor
 - .4 Verified: Commissioning Agent
 - .5 Date/Checked By: Contractor to sign when all shop drawing and installed information is completed.
 - .2 Static Checks
 - .1 Confirmation of Completion: Contractor to confirm all items listed are completed prior to verification by the commissioning agent.
 - .2 Date / Checked By: Contractor to sign when the installation of the equipment and or systems are complete and ready for the commissioning agent to verify.
 - .3 Operational Checks
 - .1 Operational checks will be performed by the commissioning agent using the balancing report and control's forms.

3.3 CONTRACTOR START UP

- .1 Contractor to perform the following during start-up:
 - .1 Start equipment and systems.
 - .2 Test, adjust and balance equipment and systems as specified in Section 01 75 19.
 - .3 Demonstrate equipment and systems as specified in Section 01 79 00.
- .2 Complete and submit start-up reports including:
 - .1 Contractor's system and equipment start up reports.
 - .2 Manufacturers' equipment start up reports.

START-UP PROCEDURES

- .3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.
- .4 Correct Contract deficiencies and defects identified as a result of the foregoing and as may be identified by the Owner.
- .5 Execute and complete approved Change Orders.
- .6 Perform other work and activities required for fulfillment of prerequisites to Interim Acceptance of the Work.
- .7 Commissioning Agent will perform the following during start-up:
 - .1 Perform preliminary interim inspections as necessary.
 - .2 Witness manufacturers' equipment start-up.
 - .3 Verify starting, testing, adjusting and balancing by Contractor.
 - .4 Provide start-up reports for all systems and equipment and review and approve Contractor start-up reports.
 - .5 Cooperate in systems and equipment demonstration and instruction.
 - .6 Initiate Change Orders as required.
 - .7 Verify correction of Contract deficiencies and defects by Contractor.
 - .8 Verify execution of Change Orders performed by Contractor.
 - .9 Perform other activities related to Substantial Completion of the Work as specified in Section 01 91 00.
- .8 The following will be performed to an on-going cycle of:
 - .1 Owner's inspections.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract Deficiencies and execution of Change Orders as required.
 - .5 Verification of results.

3.4 PERFORMANCE TESTING

- .1 Performance testing will be performed by the Commissioning Agent and:
 - .1 completed prior to Substantial Completion,
 - .2 completed when all systems have been balanced and tested and are operating to the satisfaction of the Commissioning Agent, and
- .2 Contractor to perform the following during Performance Testing:
 - .1 Correct Contract deficiencies and defects previously outstanding and those identified during performance testing.
 - .2 Execute Change Orders.
- .3 The following will be performed to an on-going cycle of:
 - .1 Performance testing.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract deficiencies, defects and execution of Change Orders as required.
 - .5 Verification of results.

3.5 SEASONAL CONSTRAINTS

- .1 Notwithstanding requirements in this section, additional separate cycles of Contractor start-up, performance testing and fine tuning may be necessitated at a later time on equipment and systems whose full operation is dependent on seasonal conditions.
- .2 Contractor's responsibilities with respect to later facility start-up activities are specified in this section.

START-UP PROCEDURES

3.6 PARTIAL UTILIZATION OF WORK

- .1 When partial utilization of the Work is required, the applicable requirements specified in this section apply to the part(s) of the Work to be utilized.

END OF SECTION

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Adjusting products and equipment required by all specifications sections for this Project.

1.2 RELATED SECTIONS

- .1 Document 0 in its entirety.
- .2 Section 01 74 00 - Cleaning.
- .3 Section 01 75 16 - Start-Up Procedures.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 PURPOSE

- .1 Perform testing adjusting and balancing of operating systems in contract by an agency that will be selected by the Owner and consigned to this Contract:
- .2 Prior to start of balancing, ensure systems are:
 - .1 piped, ducted, wired and wireless services and systems, including components and equipment forming part thereof,
 - .2 manually and mechanically operated, including components and equipment forming any part,
 - .3 testing, adjusting and balancing will not be started until after all static checks have been completed for the system being balanced and signed off on the commissioning report forms,
 - .4 Contractor to ensure systems are operated at designated times, under conditions required for proper testing, adjusting, and balancing,
 - .5 report any deficiencies or defects which may affect the balancing or noted during testing, adjusting and balancing, which cannot be promptly corrected.

PART 2 PRODUCTS

2.1 NOT USED.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Prepare each system and item of equipment for testing, adjusting and balancing.
- .2 Verify that each system and equipment installation is complete and in functional operation.
- .3 Verify appropriate ambient conditions.

3.2 TESTING

- .1 Tests will be conducted to confirm compliance with requirements of Contract Documents. Take corrective action as necessary

TESTING, ADJUSTING AND BALANCING

3.3 ADJUSTING

- .1 Adjust operating Products and equipment to ensure smooth and unhindered operation.
- .2 Provide equipment required to ensure proper, efficient and safe operation of all equipment including belts and sheaves.

3.4 BALANCING

- .1 Cooperate with, and assist the balancing agent to ensure that the various parts of system are in a proper state of equilibrium.

END OF SECTION

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Inspections and declarations.
- .2 Closeout submittals
- .3 Operation and maintenance manual format.
- .4 Contents each volume.
- .5 Recording actual site conditions.
- .6 Record (as-built) documents and samples.
- .7 Record documents.
- .8 Final survey.
- .9 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 79 00 - Demonstration and Training.
- .5 Division 01 in its entirety.
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSPECTIONS AND DECLARATIONS

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Architect in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Architect's Inspection.
- .2 Architect 's Inspection: Architect and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - ~~.5 Statements for verifying LEED credit application.~~
 - .6 Operation of systems have been demonstrated to Owner's personnel.
 - .7 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner and Architect, and Contractor. If Work is deemed incomplete by Owner and Architect, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Owner and Architect consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.
- .6 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
- .7 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

CLOSEOUT SUBMITTALS

- .8 Final Payment: When Owner and Architect consider final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.
- .9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Architect's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Architect, four final copies of operating and maintenance manuals in Canadian English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- ~~.6 Summary audit documents associated with requirements for LEED® classification documentation.~~
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: Digital and indexed subdirectories including Adobe Acrobat *.pdf files on USB flash drive.
- .3 Identification: Identify the primary directory with title 'Project Record Documents'; list title of project.
- .4 Primary directory to have Table of Contents and subdirectories.
- .5 Arrange content by systems under subdirectories with applicable Section numbers and sequence of Table of Contents.
- .6 Include Certificate of Substantial Performance as its own section.
- .7 Provide cover page for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: Manufacturer's printed data, or typewritten data.
- .9 Drawings: Integrated with applicable product and system.

1.6 CONTENTS - EACH VOLUME

- .1 Table of Contents: Provide title of project;
 - .1 date of submission;
 - .2 names, addresses, and telephone numbers of Architect and Contractor with name of responsible parties; and
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

CLOSEOUT SUBMITTALS

- .5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate, pressure vessel acceptance.
- .6 Training: Refer to Section 01 79 00.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly 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, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly 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, and field test records, required by individual specifications sections.

1.8 AS-BUILT DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Architect and Owner one record copy each of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Architect.

CLOSEOUT SUBMITTALS

1.9 RECORD DOCUMENTS

- .1 Prior to Substantial Performance of the Work, provide on USB Flash drive the marked up information from the as-built documents to a master set of drawing and specification files provided by the Architect, as follows:
 - .1 Drawings: AutoCAD Release 2018.
 - .2 Specifications: Adobe Acrobat *.pdf.
- .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions, with special emphasis on mechanical, electrical, structural steel, and reinforced concrete.
- .3 Employ a competent computer draftsman to indicate changes on the electronic set of record drawings.
- .4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Adobe Acrobat pdf.
- .5 Submit completed record documents to Owner on a USB flash drive.

1.10 FINAL SURVEY – NOT REQUIRED THIS PROJECT

- .1 Submit final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance or non-conformance with Contract Documents.
- .2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 WARRANTIES AND BONDS

- .1 Separate each warranty or bond keyed to Table of Contents listing.
- .2 List subcontractor, supplier and manufacturer with name, address and telephone number of responsible principals.
- .3 Obtain warranties and bonds within ten (10) days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Inspections and declarations.
- .2 Closeout submittals
- .3 Operation and maintenance manual format.
- .4 Contents each volume.
- .5 Recording actual site conditions.
- .6 Record (as-built) documents and samples.
- .7 Record documents.
- .8 Final survey.
- .9 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 33 00 - Submittal Procedures – Not Used this Project
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 79 00 - Demonstration and Training – Not Used this Project
- .5 Division 01 in its entirety.
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSPECTIONS AND DECLARATIONS

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
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- .2 Architect 's Inspection: Architect and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.
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 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - ~~.5 Statements for verifying LEED credit application.~~
 - .6 Operation of systems have been demonstrated to Owner's personnel.
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CLOSEOUT SUBMITTALS

- .8 Final Payment: When Owner and Architect consider final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.
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- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Architect's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Architect, four final copies of operating and maintenance manuals in Canadian English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- ~~.6 Summary audit documents associated with requirements for LEED® classification documentation.~~
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT – NOT USED THIS PROJECT

- .1 Organize data in the form of an instructional manual.
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- .5 Arrange content by systems under subdirectories with applicable Section numbers and sequence of Table of Contents.
- .6 Include Certificate of Substantial Performance as its own section.
- .7 Provide cover page for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: Manufacturer's printed data, or typewritten data.
- .9 Drawings: Integrated with applicable product and system.

1.6 CONTENTS - EACH VOLUME – NOT USED THIS PROJECT

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 - .1 date of submission;
 - .2 names, addresses, and telephone numbers of Architect and Contractor with name of responsible parties; and
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

CLOSEOUT SUBMITTALS

- .5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate, pressure vessel acceptance.
- .6 Training: Refer to Section 01 79 00.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly 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, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly 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, and field test records, required by individual specifications sections.

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 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Architect.

CLOSEOUT SUBMITTALS

1.9 RECORD DOCUMENTS – NOT USED THIS PROJECT

- .1 Prior to Substantial Performance of the Work, provide on USB Flash drive the marked up information from the as-built documents to a master set of drawing and specification files provided by the Architect, as follows:
 - .1 Drawings: AutoCAD Release 2018.
 - .2 Specifications: Adobe Acrobat *.pdf.
- .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions, with special emphasis on mechanical, electrical, structural steel, and reinforced concrete.
- .3 Employ a competent computer draftsman to indicate changes on the electronic set of record drawings.
- .4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Adobe Acrobat pdf.
- .5 Submit completed record documents to Owner on a USB flash drive.

1.10 FINAL SURVEY – NOT USED THIS PROJECT

- .1 Submit final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance or non-conformance with Contract Documents.
- .2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 WARRANTIES AND BONDS

- .1 Separate each warranty or bond keyed to Table of Contents listing.
- .2 List subcontractor, supplier and manufacturer with name, address and telephone number of responsible principals.
- .3 Obtain warranties and bonds within ten (10) days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

MAINTENANCE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Equipment and systems.
- .2 Materials and finishes.
- .3 Spare parts.
- .4 Maintenance manuals.
- .5 Special tools.
- .6 Storage, handling and protection.

1.2 RELATED SECTIONS

- .1 Document 0 in its entirety.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 91 00 - Commissioning.
- .4 Division 01 in its entirety.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. 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. Include regulation, control, stopping, shut-down, and emergency instructions. 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 Section 01 90 10.
- .15 Additional requirements: As specified in individual specification sections.

MAINTENANCE REQUIREMENTS

PART 2 PRODUCTS

2.1 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. 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 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
- .5 Additional Requirements: as specified in individual specifications sections.

2.2 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 Receive and catalogue all items. Submit inventory listing to Architect. Include approved listings in Maintenance Manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

2.3 MAINTENANCE 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 Receive and catalogue all items. Submit inventory listing to Architect. Include approved listings in Maintenance Manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

2.4 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 Receive and catalogue all items. Submit inventory listing to Architect. Include approved listings in Maintenance Manual.

PART 3 EXECUTION

3.1 DELIVER TO SITE

- .1 Deliver to site; place and store.

3.2 STORAGE, HANDLING AND PROTECTION

- .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.

MAINTENANCE REQUIREMENTS

- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

END OF SECTION

MAINTENANCE REQUIREMENTS

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DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.
- .2 Seminars and demonstrations.

1.2 RELATED SECTIONS

- .1 Document 00 in its entirety.
- .2 Section 01 91 00 - Commissioning.
- .3 Division 01 in its entirety.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection.
- .2 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Architect's approval.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.6 CONDITIONS FOR DEMONSTRATIONS

- .1 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 00, and equipment and systems are fully operational.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 PREPARATION

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.
- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.

DEMONSTRATION AND TRAINING

- .8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

- .1 Prepare agendas and outlines including the following:
 - .1 Equipment and systems to be included in seminar presentations.
 - .2 Name of companies and representatives presenting at seminars.
 - .3 Outline of each seminar's content.
 - .4 Time and date allocated to each system and item of equipment.
 - .5 Provide separate agenda for each system.

3.3 SEMINAR ORGANIZATION

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

- .1 Explain design philosophy of each system. Include following information:
 - .1 An overview of how system is intended to operate.
 - .2 Description of design parameters, constraints and operational requirements.
 - .3 Description of system operation strategies.
 - .4 Information to help in identifying and troubleshooting system problems.

3.5 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

DEMONSTRATION AND TRAINING

3.6 TIME ALLOCATED FOR INSTRUCTION

- .1 Allocate time required for instruction of each item of equipment or system as follows:
 - .1 Architectural Hardware: 1.0 hour of instruction.
 - .2 Mechanical Systems:
 - .1 Fire Protection and Suppression Systems: 1.0 hours of instruction.
 - .2 HVAC and Boiler Systems: 3.0 hours of instruction.
 - .3 Direct Digital Controls: 2.0 hours of instruction.
 - .4 Variable Refrigerant Flow (VRF) Systems: 7.5 hours of instruction.
 - .3 Electrical Systems:
 - .1 Arc Flash: 2.0 hours of instruction.
 - .2 Lighting Controls: 2.0 hours of instruction.
 - .3 Clock System: 1.0 hours of instruction.
 - .4 Fire Alarm System: 4.0 hours of instruction.

END OF SECTION

DEMONSTRATION AND TRAINING

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COMMISSIONING (Cx)

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 The contractor shall provide all required information for the commissioning.
- .2 Comply with Division 1 requirements and documents referred to therein as applicable.
- .3 Contractor shall be responsible for the proper performance of the Work
- .4 Provide labour, materials, products, equipment and services for commissioning of building systems to ensure building is operating according to requirements of Contract documents.

1.2 RELATED SECTIONS

- .1 Document 0 in its entirety.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 70 00 - Examination and Preparation.
- .4 Section 01 79 00 - Demonstration and Training.
- .5 Division 01 in its entirety.
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 ASHRAE Guideline 1-1996 HVAC Commissioning Process

1.4 DEFINITIONS

- .1 Commissioning Authority (CA): Owners appointed commissioning professional
- .2 Facilities Manager: Owners authorized personnel responsible for day-to-day management and operation of the building.
- .3 Consultant: member of the design team
- .4 Owners Project Requirements (OPR): The owners design brief detailing design objectives, and criteria, summarized in the LEED Scorecard, addresses envelope, lighting, indoor air quality, energy efficiency, water use efficiency, and environmental responsiveness.
- .5 TAB: Testing, Adjusting, and Balancing
- .6 BAS: Building Automation System

1.5 GENERAL REQUIREMENTS

- .1 Conform to the general requirements of Division 01.
- .2 Conform to the mechanical general provisions in specification section 23 05 00.
- .3 The commissioning team consists of the design team, the Contractors and the Commissioning Authority.
- .4 Provide labour and materials to conduct the commissioning process as outlined in this specification section.
- .5 The Building Owner has engaged a Commissioning Authority (CA) who will provide services and conduct tests as identified in this specification section.
- .6 The Mechanical Contractor shall coordinate and co-operate with the CA.
- .7 The Mechanical Contractor shall hire an Air and Water Balancing Contractor who will conduct tests on the air and water systems as identified in the Division 22 05 93 AND 23 05 93 specification and this specification section. The Mechanical Contractor and the Air and Water Balancing Contractor shall coordinate and co-operate with the CA.
- .8 The commissioning process shall include planning, scheduling and providing the services identified in this specification section and the testing and commissioning identified in the various sections of the Division 22 00 00 – 23 99 99 specifications.

COMMISSIONING (Cx)

Part 2 PRODUCTS

- .1 The Mechanical Contractor and manufacturers technicians shall provide all instrumentation and equipment necessary to conduct the tests specified. The Mechanical Contractor shall advise the Mechanical Consultant and CA of instrumentation to be used and the dates the instruments were calibrated. All certification shall be traceable to a national standard, and performed within the past year.

Part 3 EXECUTION

3.1 THE COMMISSIONING PROCESS

- .1 The commissioning process shall consist of but not be limited to:
 - .1 Shop drawings and record drawings
 - .2 Providing a commissioning schedule
 - .3 Installation inspections and equipment verification
 - .4 Plumbing and drainage system testing
 - .5 Testing of piping systems
 - .6 Testing and cleaning of ductwork
 - .7 Testing of gas piping
 - .8 Testing of refrigeration piping
 - .9 Flushing and cleaning of piping systems
 - .10 Coordination and testing of electrical installations
 - .11 Testing of equipment and systems
 - .12 Commissioning meetings and reporting
 - .13 Contractor's testing of water and air systems
 - .14 Contractor's performance testing
 - .15 Independent contractor's testing and balancing of water systems
 - .16 Independent contractor's testing and balancing of air systems
 - .17 BAS commissioning
 - .18 Systems demonstrations
 - .19 CA performance testing
 - .20 Operating and maintenance manuals
 - .21 Operator training
 - .22 Coordination with the CA and CA responsibilities
 - .23 Test forms
 - .24 Systems turnover
 - .25 Warranties and outstanding work
 - .26 Seasonal performance testing.

3.2 SHOP DRAWING AND RECORD DRAWING SUBMITTAL & REVIEW PROCEDURES

- .1 Conform to specification section 23 05 00 for requirements for shop drawings, as-built shop drawings and as-built installation drawings.
- .2 The Mechanical Contractor shall forward a copy of all energy-related equipment/system shop drawings to the CA for his review.

3.3 COMMISSIONING SCHEDULE

- .1 The Mechanical Contractor shall prepare a testing and commissioning schedule.
- .2 The schedule shall identify each test type, by area or system. The start and completion dates shall be identified. Coordination requirements with other trades shall be identified.

COMMISSIONING (Cx)

3.4 INSTALLATION INSPECTIONS AND EQUIPMENT VERIFICATION.

- .1 The Mechanical Contractor shall coordinate with the manufacturer of all major equipment who will inspect the mechanical installations to ensure their equipment is installed in accordance with their recommendations. Refer to relevant mechanical specification sections for each piece of equipment. All equipment shall be started by the manufacturer's representative.
- .2 The Mechanical Contractor shall complete the equipment verification forms for each piece of equipment. The original forms shall be included in the operating and maintenance manuals. The equipment data shall include but not be limited to:
 - .1 Manufacturers name, address and telephone number
 - .2 Distributors name, address and telephone number
 - .3 Make, model number and serial number
 - .4 Pumps - RPM, impeller size, rated flow
 - .5 Fans - belt type and size, sheave type and size, RPM, rated flow
 - .6 Electrical - volts, amps, fuse size, overload size
 - .7 Name and number of equipment
 - .8 Any other special characteristics.

3.5 PLUMBING AND DRAINAGE SYSTEM TESTING

- .1 The plumbing and drainage systems shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the following specification sections:
 - .1 Mechanical general provisions, testing piping – 22 05 00
 - .2 Domestic water supply piping,
 - .3 Sanitary, storm and pumped drainage piping
 - .4 Drainage and vent piping,
 - .5 Plumbing specialties –
 - .6 Pumps, plumbing –
- .2 The Mechanical Contractor shall notify the Building Inspector and the CA when systems are available for testing. The Mechanical Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Mechanical Consultant and CA as they are completed for review.

3.6 TESTING OF PIPING SYSTEM.

- .1 Test all piping systems in accordance with all applicable Codes and the following specification sections:
 - .1 Mechanical general provisions – 23 05 00
- .2 Test all sprinkler and standpipe piping in accordance with the NFPA standards and the following specification sections:
 - .1 Fire protection - general – 21 13 00
 - .2 Wet pipe sprinkler system – 21 13 00
 - .3 Dry pipe sprinkler system – 21 13 00
- .3 All tests for each system shall be performed in the presence of the Mechanical Consultant or the CA. The Mechanical Contractor shall fill in the testing forms and forward copies to the Mechanical Consultant and the CA as they are completed.
- .4 For testing of fuel oil system, refer to specification section 23 11 13.
- .5 For testing of refrigeration piping, refer to specification section 21 thru 25.

3.7 FLUSHING AND CLEANING OF PIPING SYSTEMS

- .1 Conform to specification sections 23 21 13

COMMISSIONING (Cx)

- .2 The Mechanical Contractor shall flush the piping systems as defined in the specification sections. The Mechanical Contractor shall inform the Mechanical Consultant and the CA of when this work will be scheduled.
- .3 The Mechanical Contractor shall hire GE-Betz, Drew or Glengarry Chemicals, as specified, to conduct tests on the water and to direct the Mechanical Contractor to add chemicals as required. Chemically treat water systems in accordance with Section 23 25 00.
- .4 The Mechanical Contractor shall inform the Mechanical Consultant and the CA of when the water is to be tested. The completed analysis reports shall be forwarded to the Mechanical Consultant and the CA for his review.

3.8 COORDINATION AND TESTING OF ELECTRICAL INSTALLATIONS

- .1 Conform to specification section 26 thru 28 for coordination and testing requirements of electrical installations supplied by the Mechanical Contractor.

3.9 TESTING AND CLEANING OF DUCTWORK

- .1 Conform to specification sections 21 thru 25 for testing and cleaning requirements of ductwork.

3.10 TESTING OF GAS PIPING

- .1 Conform to specification section 22 16 00 for testing requirements of gas piping.
- .2 Conform to specification sections for coordination of inspection/service connections of gas piping, valves and fittings.

3.11 TESTING OF REFRIGERATION PIPING

- .1 Conform to specification section 23 81 20 for system start-up, checkout and adjustment of refrigeration piping and fittings.

3.12 THE MECHANICAL CONTRACTOR'S TESTING OF WATER AND AIR SYSTEMS

- .1 Conform with the various specification sections in Division 22 05 93 and 23 05 93 for Plumbing and HVAC systems.
- .2 The Mechanical Contractor shall inform the Mechanical Consultant and the CA of when tests are to be scheduled. All tests shall be performed in the presence of the Mechanical Consultant or the CA. The Mechanical Contractor shall complete the testing forms and forward copies to the Mechanical Consultant and the CA for his review.

3.13 THE INDEPENDENT CONTRACTOR'S TESTING AND BALANCING OF WATER SYSTEMS

- .1 Conform with specification section 22 05 93 for water systems.
- .2 The Independent Contractor shall be hired by the Mechanical Contractor and shall coordinate with the CA.

3.14 THE INDEPENDENT CONTRACTOR'S TESTING AND BALANCING OF AIR SYSTEMS

- .1 Conform with specification section 23 05 93 for HVAC systems.
- .2 The Independent Contractor shall be hired by the Mechanical Contractor and shall coordinate with the Mechanical Consultant and CA.

COMMISSIONING (Cx)

3.15 TESTING OF EQUIPMENT AND SYSTEMS

- .1 The Mechanical Contractor shall hire the services of the manufacturers' technician to test the motor equipment and associated systems detailed in the 23 05 13 specification section. The technician shall record the results of the tests on the start-up forms. The tests shall be witnessed by the Mechanical Consultant or the CA. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms. A copy of each form shall be forwarded to the Mechanical Consultant and the CA for his review. The originals shall be inserted into the O&M manuals.
- .2 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed by the CA, at his discretion.
- .3 Tests which have not been witnessed shall not be accepted and shall be repeated, except for terminal heating units, packaged units, fire dampers and VAV boxes.
- .4 The Mechanical Contractor shall conduct tests on the following equipment as a minimum:
 - .1 Variable frequency drives
 - .2 Electric reheat coils
 - .3 Electric heat tracing
 - .4 Fire protection systems
 - .5 Sprinkler systems
 - .6 Hot water boilers and pumps
 - .7 Water treatment systems
 - .8 Fuel oil system
 - .9 Emergency generator ventilation system
Chillers and pumps
 - .10 Refrigerant leak detection system
Cooling towers and pumps
Humidification systems
 - .11 Terminal heating units
 - .12 Air conditioning units
 - .13 Snow melting and radiant floor systems
 - .14 Packaged (eg smoke exhaust) & custom air handling units
 - .15 Dampers fire & smoke
 - .16 VAV terminal units
 - .17 CO/NO₂ detection system
 - .18 Building automation system (BAS)
- .5 Refer to the individual specification sections for test procedures.

3.16 COMMISSIONING MEETINGS AND REPORTING

- .1 The Mechanical Contractor shall include the schedule for all static tests and equipment start-up tests in the overall construction schedule.
- .2 The CA will conduct an initial commissioning scoping meeting with the entire team in attendance. Commissioning requirements, procedures, responsibilities and schedules shall be reviewed.
- .3 Ongoing commissioning meetings shall occur during the regular construction meetings. The testing schedules, coordination, planning and the results of all tests shall be reviewed. During the performance testing process separate commissioning meetings shall be held. The CA shall chair these meetings and distribute minutes.
- .4 All testing forms and reports associated with the mechanical systems shall be forwarded to the Mechanical Consultant with copies to the CA for his review.
- .5 The forms and reports to be issued shall include but not be limited to
 - .1 Shop drawings, issued and accepted
 - .2 Equipment verification forms

COMMISSIONING (Cx)

- .3 Testing schedule
- .4 Testing forms
- .5 Reports resulting from tests
- .6 Minutes of commissioning meetings
- .7 Manufacturers certificates

3.17 BAS COMMISSIONING

- .1 Conform to specification section 25 05 01 and 25 30 01 for the requirements of BAS commissioning.
- .2 The BAS Contractor shall conduct the tests; complete the forms and forward copies to the Mechanical Consultant and the CA for his review.

3.18 MECHANICAL CONTRACTOR'S PERFORMANCE TESTING

- .1 When the Mechanical Contractor has completed all tests on the mechanical systems, they shall run all equipment and verify that all equipment and systems are operating to the requirements of specification section 21 thru 25.

3.19 THE BUILDING COMMISSIONING CONSULTANT (CA) RESPONSIBILITIES AND CONTRACTOR CO-OPERATION.

- .1 A CA has been engaged by the Building Owner.
- .2 The CA responsibilities shall include but not be limited to:
 - .1 reviewing/documenting the design intent and basis of design
 - .2 preparing the commissioning plan
 - .3 preparing a test forms manual
 - .4 reviewing contractor submittals
 - .5 chairing commissioning meetings
 - .6 coordinating with the contractor to schedule tests
 - .7 witnessing selected tests
 - .8 receiving all test documents
 - .9 reviewing and approving 'close-out' documentation
 - .10 coordinating and assessing the contractors training
 - .11 conducting performance tests
 - .12 conducting warranty repair verification
 - .13 conducting seasonal performance tests
 - .14 preparing and implementing post-occupancy complaint monitoring plan
- .3 The Mechanical Contractor and equipment manufacturers/technicians shall cooperate with the CA.
- .4 The Mechanical Contractor shall provide assistance to the CA and have personnel available during the performance testing and warranty repair stages. Each mechanical system shall be tested in each specified operational mode.
- .5 Performance testing shall begin when all systems have been completed and tested by the Contractor and the Mechanical Consultant has completed their final review.

3.20 MECHANICAL SYSTEMS DEMONSTRATION

- .1 Refer to specification section 21 thru 25 and the various equipment and systems sections of the specification.
- .2 Each system demonstration to the Mechanical Consultant and the CA shall occur when:
 - .1 The installation is complete
 - .2 The Mechanical Contractor's performance testing is complete
- .3 The system demonstrations shall be conducted by the Mechanical Contractor and equipment and systems manufacturers. The demonstrations shall cover a physical

COMMISSIONING (Cx)

overview of equipment installation and operation. The systems shall include but not be limited to:

- .1 Plumbing systems
- .2 Heating systems
- .3 Cooling systems
- .4 Fuel handling systems
- .5 Air handling units and associated equipment
- .6 Exhaust systems
- .7 Sprinklers and standpipe
- .8 Building automation system (BAS)

3.21 THE CA'S INDEPENDENT PERFORMANCE TESTING

- .1 When the BAS contractor has completed their tests, as per specification section 25 05 01 and 25 30 01, the CA will begin their performance testing process.
- .2 The CA shall verify each point, the operation of each device, the calibration of each device, the operation of each control system, the functionality of each program, and each graphic. The CA shall prepare a deficiency list, if any are found, and shall submit them to the Mechanical Consultant to issue to the BAS contractor. When written confirmation has been received that deficiencies have been completed, the CA shall retest the failed items.

3.22 TEST FORMS

- .1 The Mechanical Contractor and manufacturers/technicians shall fill out the forms created by the CA or provide their own forms. Their forms must be approved by the Mechanical Consultant and the CA before they are used.

3.23 OPERATING AND MAINTENANCE MANUALS

- .1 Conform to the specification section 21 thru 28 and the equipment and system sections of the specification for the requirements of the mechanical O&M manuals.
- .2 The Mechanical Consultant and CA shall review the manuals for completeness and that they fulfill the requirements of the specification. The CA shall review the contents from a commissioning perspective.

3.24 SYSTEM TURNOVER

- .1 Refer to the specification section 21 thru 28 for details on system turnover requirements.

3.25 OPERATOR TRAINING

- .1 Conform to section 21 thru 28 and the equipment and system sections of the specification for requirements for instruction to operating staff for each system and individual equipment.
- .2 The CA shall provide a draft schedule for training to the Mechanical Contractor.
- .3 The training shall be provided by qualified technicians and shall be conducted in a classroom for major equipment such as chillers, boilers and BAS and at the equipment or system location.
- .4 Training shall begin when the operating and maintenance manuals have been delivered to the Building Owner and approved by the Mechanical Consultant and the CA.
- .5 Each training session shall be structured to cover as a minimum:
 - .1 Equipment/system design intent
 - .2 The operating and maintenance manual (including controls/schematics)

COMMISSIONING (Cx)

- .3 Operating procedures
- .4 Maintenance procedures
- .5 Trouble-shooting procedures
- .6 Spare parts
- .7 Interactions with other systems (as applicable)
- .8 Optimizing methods for energy conservation (as applicable)
- .9 Relative health and safety issues
- .6 Submit a course outline to the Mechanical Consultant and the CA before training commences. Provide course documentation for up to eight people.
- .7 The training sessions shall be scheduled and coordinated by the Mechanical Contractor with assistance from the CA.
- .8 Training shall be provided for the following systems but not be limited to:
 - .1 Variable frequency drives
 - .2 Fuel oil system
 - .3 HVAC water treatment systems
 - .4 Fire protection systems
 - .5 Hot water boilers
 - .6 HVAC pumps
 - .7 Custom AHUs
 - .8 Humidification systems
 - .9 BAS
- .9 The BAS training requirements have been described in specification section 21 thru 26. The time allotted shall also include for as a minimum:
 - .1 A walk-through of the installations for all operators to review the installations and equipment
 - .2 Operation of the central computer
 - .3 Operation of portable terminals
 - .4 Review of control sequences and graphics
 - .5 Report set-up and generation
 - .6 Managing the system
 - .7 Maintenance requirements
- .10 The training requirements for the mechanical systems shall include for walk-throughs of the building by the Mechanical Contractor. During the walk-throughs the Contractor shall as a minimum:
 - .1 Identify equipment
 - .2 Identify starters and disconnects associated with equipment
 - .3 Identify valves and balancing dampers
 - .4 Identify motorized dampers
 - .5 Identify access doors
 - .6 Review the general maintenance procedures
 - .7 Review drain points in pipework systems
 - .8 Identify maintenance items
- .11 When each training session has been completed The Building Owner or the CA shall sign the associated form to verify completion.
- .12 Ensure amount of time required for instruction of each item of equipment or system is as follows:
 - .1 ~~Overhead Doors: _____~~ 1.0 hours of instruction.
 - .2 ~~Loading Dock Equipment: _____~~ 0.5 hours of instruction.
 - .3 Filtering Equipment: 1.0 hours of instruction.
 - .4 Plumbing System: 0.5 hours of instruction.
 - .5 Heating System: 2.0 hours of instruction.
 - .6 Cooling System: 2.0 hours of instruction.
 - .7 Ventilation System: 1.0 hours of instruction.
 - .8 Control System: 6.0 hours of instruction.
 - .9 Electrical System: 3.0 hours of instruction

COMMISSIONING (Cx)

3.26 WARRANTIES AND OUTSTANDING WORK

- .1 Equipment and system warranties shall not begin until the system demonstrations and turnover has been conducted successfully and accepted by the Mechanical Consultant and the CA.
- .2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.
- .3 Refer to all specification sections for the requirements during the warranty period.
- .4 The CA shall visit the site between 8 to 10 months after occupancy. The CA shall review building and space operations with the facilities staff to address any outstanding commissioning and/or operational issues. In addition, the CA shall re-verify the correct operation of equipment/systems repaired under warranty.
- .5 The CA shall report on and create a plan to resolve any outstanding commissioning related issues.

3.27 SEASONAL PERFORMANCE TESTING

- .1 The Mechanical Contractor and the BAS contractor shall visit the building during the winter season and during the summer season. The visits shall be coordinated by the CA. The visits shall have a minimum of two, eight hour days each.
- .2 During each visit the Mechanical Contractor and BAS contractor shall provide assistance to the CA who shall conduct seasonal performance tests.

END OF SECTION

COMMISSIONING (Cx)

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DEMOLITION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to Division 01, General Requirements.

1.2 DESCRIPTION

- .1 Work Included
 - .1 Demolition and removal of existing building components not required in final Work.
 - .2 Temporary shoring and bracing.
 - .3 Remove all debris from the site.

1.3 REGULATORY REQUIREMENTS

- .1 Conform to applicable codes and regulations for demolition or partial demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.
- .2 Obtain required permits from Authorities Having Jurisdiction.
- .3 Notify affected utility companies before starting Work and comply with their requirements.
- .4 Do not close or obstruct roadways, sidewalks, or utilities without permits.

1.4 SUBMITTALS

- .1 Submit shop drawings indicating required shoring and bracing bearing the stamp and seal of a Professional Engineer licensed in the Province of Ontario.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Unless otherwise indicated, all materials requiring demolition and not forming a permanent part of Work shall be removed from site.
- .2 The lump sum price includes the cost of removal and legal disposal of all surplus excavated material. The excavated material shall be removed to locations arranged by the Contractor at his own expense, in conformity with all applicable provincial legislation, with Ontario Provincial Standard Specification (OPSS) 180.
- .3 In addition, Contractor must make every effort to divert construction waste from landfill. It is the responsibility of the contractor to:
 - .1 Separate waste on-site and send it to specific receiving facilities (e.g. concrete and wood in separate bins)

DEMOLITION

- .2 If necessary, contract a waste hauler who is able to provide off-site sorting of waste products from construction.
- .3 Maximize waste diversion rate - target a diversion rate of 100%. Contractor to take responsibility for tracking and documenting diversion rates.
- .4 Contractor to provide copies of all weigh tickets, disposal receipts, etc. to town representative.
- .4 Work on site cannot begin until Contractor has provided separate marked bins on site.
- .5 Contractor shall leave Site in a condition equivalent to the existing condition prior to Work.

Part 3 EXECUTION

3.1. PREPARATION

- .1 Follow procedures as outlined in Section 00870 for the safe removal and disposal of designated hazardous substances present within the existing structure.
- .2 Remove all contaminates, handle and dispose of from the site, according to Ontario Regulations.
- .6 Provide, erect, and maintain temporary barriers and security devices as required.

3.2. DEMOLITION REQUIREMENTS

- .1 Conduct demolition to minimize interference with adjacent lands.
- .2 Conduct operations with minimum interference to public or private accesses. Maintain egress and access at all times.
- .3 Sprinkle Work with water to minimize dust.
- .4 Arrange with hydro, telephone, gas, water utilities to have all abandoned services disconnected, capped off and removed and made safe as applicable to Authorities.
- .5 When contaminated or dangerous material is encountered, remove from Site and dispose of by safe means so that no danger is involved at job Site or in disposing operations. Selling from Site is not permitted.

3.3. DEMOLITION

- .1 Remove demolished materials from site.
- .2 Leave site in clean condition.

END OF SECTION

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.
2. Provide the Unit Prices as listed in the 'Schedule of Structural Unit Prices' in Division 1.

1.02 SCOPE OF WORK

1. Refer to the Contract Drawings for detailed requirements.
2. Supply all materials; provide all labour and equipment to place the reinforcing steel as shown or required by the drawings or specifications. The principal items include but are not limited to:
 1. Reinforcing steel for concrete walls, slabs, beams, columns, foundations,
 2. Reinforcing steel for slabs on composite and non-composite metal decks,
 3. Reinforcing steel for mechanical and electrical housekeeping pads and bases.
 4. Supply reinforcing steel for installation by Division 04 Masonry.
3. Related Work Specified Elsewhere:
 1. Cast-In-Place Concrete - Section 03 30 00.
 2. Concrete bases & pads for mechanical & electrical equipment - Division 15 & 16.

1.03 REFERENCE STANDARDS

1. All standards to be latest issue with amendments.
2. Maintain current copies of the following standards on site at all times for the reference of the Contractor and the Consultant.
3. Ontario Building Code.
4. C.S.A. Standard CSA-A23.1, Concrete Materials and Methods of Construction@.
5. C.S.A. Standard W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
6. Current Reinforcing Steel Manual of Standard Practice by Canadian Reinforcing Steel Institute.
7. Current Manual of Standard Practice by the Concrete Reinforcing Steel Institute.
8. Construction Safety Act or any other regulations of the Ontario Ministry of Labour relating to the work of this section.

1.04 SHOP DRAWINGS

1. Examine all drawings forming a part of this contract and conform to the requirements of all such drawings.
2. The Consultant reserves the right to relocate reinforcing prior to and during the approval of placing diagrams for the purpose of clearing openings for ducts, piping, wall inserts, etc., and to finalize the location of mechanical or electrical openings, etc. at no additional cost to the Owner. Any cost involved in revisions to placing diagrams or bar lists as a result of these changes shall be borne by this Contractor.
3. Submit shop drawings in accordance with the General Conditions for review prior to fabrication. Any fabrication executed before review of shop drawings shall be at the Contractor's risk. Fabrication shall be assumed to begin when material is cut to length whether this is by the fabricator or at the mill to the fabricator's orders.
4. The Consultant's review of shop drawings will not relieve the Contractor from his responsibility for ensuring that his work is complete, accurate and in accordance with the drawings and specifications.
5. The use of reproduced copies of the Consultant's drawings for erection diagrams will not be allowed.
6. Submit shop drawings in accordance with the General Conditions except as noted below.
7. Submit one ADOBE PDF file, (Adobe Portable Document Format) for each erection diagram, complete with the General Contractor's shop drawing review stamp and with the required information completed, for review by consultant.
8. At the completion of the work, provide a complete set of ADOBE PDF files, (Adobe Portable Document Format) for both placing diagrams and barlist.

1.05 DESIGN & DETAILING CRITERIA

1. Design and detail the bending, placing, spacing, splicing and protection of reinforcing steel to satisfy the limits strength design criteria of the Reference Standards unless specifically shown otherwise on the drawings or in this Section.
2. At column splice locations, provide a minimum tensile strength at each face equal to one-fourth the area of vertical reinforcement in that face multiplied by the yield strength, if not detailed otherwise. The minimum column reinforcing steel lap and embedment length are shown on the drawings.

3. Unless otherwise shown or as required due to congestion of reinforcing at splice locations, column reinforcing may be lap spliced as shown on Drawings. Alternative mechanical splicing details as required due to congestion of reinforcing at splice locations and/or at the Contractor's option are to be taper threaded type, with hexagonal couplers or butt splices made with filler material and enclosing steel sleeves.
4. Lap splicing of beam, slab, temperature, and horizontal wall reinforcing to be Class B splices as shown in Table 1 on drawing S-401, unless specifically noted otherwise. Lap all WWM one full mesh plus 50 mm.
5. Provide additional column ties at cranked vertical bar locations.
6. Note that the first beam stirrup from the face of the support is at one half spacing as is first column tie above floor level.
7. At wall vertical construction joints horizontal reinforcing steel;
 1. Passing through the joint must
 - i) Extend at least a full anchorage length each side of the joint, OR,
 - ii) Lap not less than a Class B splice length with the reinforcing beyond the construction joint.
 2. To be discontinued at the joint is to stop 80 mm clear of the joint.
8. Additional bars as detailed on the drawings are required around all openings through slabs and through walls. At wall openings and free edges of walls, column ties are also required around the added steel.
9. For suspended reinforced concrete flat slabs or plates, detail additional reinforcing through construction joints as shown on drawings, but not less than 15M @ 500 x 1200 long top and bottom.

1.06 SPECIAL CONDITIONS

1. The site is adjacent to the existing college. The Contractors attention is drawn to the fact that the building is fully operational and must be kept operational. The presence of existing buildings, fire & vehicle routes, roadways and site works which may affect the work of this Section including hoisting, delivery and the availability of lay-down areas.
2. The Contractor's attention is drawn to the presence of an existing service tunnel adjacent to the area of the new link addition. The roof of the existing tunnel is not to be used as a thoroughfare for construction traffic, the storage of materials or a setup location of mobile crawler or wheeled cranes.

1.07 CO-ORDINATION & CO-OPERATION

1. Co-ordinate the work of this Section with the work of other Sections and co-operate with other Sections to ensure an uninterrupted sequence of construction.

1.08 SUBMITTALS

1. Provides mill certificates for all reinforcing steel used.
2. Upon request of the Consultant, submit ladle analysis for reinforcing steel used.
3. Welding company's CWB certification, certified CWB weld procedure and welder's CWB certificate for type of weld being performed.

PART 2: PRODUCTS

2.01 MATERIALS

1. Reinforcing Steel (plain): Weldable low alloy deformed steel bars conforming to C.S.A. Standard G30.18, Grade 400,
2. Reinforcing Steel (Epoxy Coated): Weldable low alloy deformed steel bars conforming to C.S.A. Standard G30.18, Grade 400, Epoxy coating in accordance with ASTM A775. All shop and/or field cut ends to be coated in accordance with ASTM M775 and MTO Form 1443.
3. All deformed bars to have the grade or guaranteed yield strength rolled into the bar.
4. Welded wire fabric in accordance with current C.S.A. Standard G30.5 with a minimum guaranteed yield point of 400 MPa. **-Supply in flat sheets only.**
5. Slab bolsters, chairs, spacers and bar supports in accordance with Concrete Reinforcing Steel Institute Manual of Standard practice.
6. All bar supports to be Class B - Pre-galvanized Bar Supports or Class C - Plastic Protected Bar Supports, Solid Plastic or Precast Concrete Block Bar Supports, as called for under Part 3.
7. Butt splices made with taper threaded reinforcing and hexagonal couplers are to be Lenten System installed in accordance with the specifications and recommendations of Enrico Incorporated.
8. Butt splices made with filler metal and enclosing steel sleeves are to be Cadweld Rebar Splices installed in accordance with the specifications and recommendations of Enrico Incorporated. Cadweld C-Series for 125% of yield strength.

2.02 FABRICATION OF REINFORCING STEEL

1. All reinforcing steel to be provided and bent by a supplier approved by the Consultant.

2. Fabricate reinforcing to C.S.A. Standard CSA-A23.1.
3. Fabrication tolerances for reinforcing steel to 'Reinforcing Steel Manual of Standard Practice' by Reinforcing Steel Institute of Canada.
4. Obtain Consultant's approval for location of reinforcement splice if different than shown on structural drawings.
5. Ship bundles of bar reinforcement, clearly identified in accordance with bar list.
6. Welding in accordance with current C.S.A. Standard W186. Both the welding company and the welder performing the welding are to be fully certified by the C.W.B. for the type of welding being performed.
7. Supply **all** necessary slab bolsters, high chairs, support bars, blocking and other accessories necessary for the proper placing and support of reinforcing.
8. Taper thread bar ends with coupler manufacturer's bar threader to ensure proper taper and thread engagement with the coupler.

2.03 SHOP QUALITY CONTROL

1. All materials and fabrication are subject to test or inspection by the Consultant or his designated representative.
2. Provide such samples of materials, ladle analysis and mill test reports as may be requested by the Consultant or his designated representative, at no additional cost to the Owner.
3. Cost of testing and inspection will be paid from the Testing & Inspection Allowance in accordance with Division 1.

PART 3: EXECUTION

3.01 PLACING OF REINFORCING STEEL

1. When reinforcing bars and welded wire mesh are placed, they are to be free from loose or flaking rust, mud, oil or other coatings which would reduce the bond.
2. All reinforcing steel is to be kept clean until the concrete is poured.
3. Unless specifically shown or noted otherwise on the structural drawings, placing, spacing, splicing, bending, and concrete protection of reinforcement is to be in accordance with the current C.S.A. Standard CSA-A23.1.
4. Install and space chairs, bolsters and other bar supports in accordance with the 'Manual of Standard Practice' by the Concrete Reinforcing Steel Institute as a minimum.
 - 1 Provide additional supports as required to maintain reinforcing in its proper

- position during the pour. Maximum spacing between support bars to be 1200.
- 2 For slabs on grade,
 - i) Set wire mesh on 100 x 100 x 54 concrete bricks spaced at 1200 on centre each way.
 - ii) Set reinforcing support bars on chairs of a type and in a manner which will not puncture the vapour barrier.
 - 4 For slabs on steel deck, set wire mesh on suitable support chairs a minimum of 25mm clear of the top flutes.
 - 5 For footings, the practice of 'dropping' a required reinforcing bar from the bottom upper layer, below the bottom lower layer to act as support bars is not permitted.
5. Wire ties are to be no less than 18 gauge. (Epoxy coated or nylon ties for epoxy bars).
 6. Butt splices of reinforcing bars may be made with full penetration butt welds by the electric-arc process, by a mechanical butt splicing method using filler metal and an enclosing steel sleeve or by taper threaded couplers.
 7. All butt splices are to develop 125% of the specified yield strength of the smaller bar at the splice.
 8. For taper threaded connections, torque to manufacturer's directions.
 9. All welding of reinforcing steel in accordance with the current C.S.A. Standard W186. Do **NOT** tack weld reinforcing bars.
 10. Provide solid plastic or plastic coated chairs, bolsters and other supports where these will be exposed in the finished structure. All other bar supports may be plastic coated or pre-galvanized.
 11. Obtain Consultant's approval of reinforcing steel placement before placing concrete. Allow at least 24 hours notice in advance of any scheduled pour for this review.
 12. During the pour, maintain on site, an adequate number of rod men consistent with the pour size to make any necessary repairs in the event of dislodged reinforcing and or remedial action as directed by the Consultant.
 13. Use padded nylon ropes and slings for handling of epoxy coated rebar.
 14. Repair damaged epoxy coatings or cut ends by field applied epoxy coatings in strict accordance with the epoxy manufacturer's instructions.

3.02 MAKING GOOD & CLEAN-UP

1. Make good all work required by the work of this Section.

2. During the construction period, remove from time to time, all building rubbish and waste material applicable to this Section from the site, to maintain safe working conditions.
3. At the completion of the work, remove from the site, all materials applicable to this Section which are not 'built-in'.

END OF SECTION

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.
2. Provide the Unit Prices as listed in the 'Schedule of Structural Unit Prices' in Division 1.

1.02 SCOPE OF WORK

1. Refer to the Contract Drawings and Documents for detailed requirements.
2. Supply all materials, provide all labour and equipment required by the drawings and specifications. The principal items include, but are not limited to:
 1. Concrete walls, slabs, beams, columns and foundations
 2. Concrete for mechanical and electrical housekeeping pads and bases.
 3. Supply, hoisting, (cranes and/or pumping), placing, finishing and curing of all concrete, including sandblasting

1.03 RELATED WORK SPECIFIED ELSEWHERE

1. Building Excavation – Section 31 23 00
2. Concrete Reinforcement - Section 03 20 00.
4. Bituminous Dampproofing and Waterproofing - Section 07 13 00.
5. Exterior concrete curbs, pavement (see Site Services drawing).

1.04 WORK INSTALLED UNDER THIS SECTION, SUPPLIED BY OTHER SECTIONS

1. Setting of anchors for structural steel-Section 05 12 23.
2. Grouting of base/bearing plates and building in of iron and steel items - Section 05 12 23.
3. Setting of anchors for mechanical and electrical trades - Division 15 and 16.
4. Setting of anchors and other hardware to be cast into the concrete including but not limited to curtain wall anchors and embeds for Division 05, mechanical and electrical.

1.05 REFERENCE STANDARDS

1. Maintain current copies of the following standards on site at all times for the reference of the Contractor and the Consultant.
2. Unless otherwise stated, the applicable provisions of these reference standards are to be considered as part of this specification.
3. Ontario Building Code.
4. C.S.A. Standard CSA-A23.1, "Concrete Materials and Methods of Construction".
5. C.S.A. Standards CSA-A23.2, "Methods of Test for Concrete".
6. C.S.A. Standards CAN-A23.3, "Design of Concrete Structures".
7. A.C.I. Standard 302, "Recommended Practice for Concrete Floor and Slab Construction".
8. A.C.I. Standard 347, "Recommended Practice for Concrete Formwork".
9. A.C.I. Standard 301, "Specification for Structural Concrete for Buildings".
10. Construction Safety Act or any other regulations of the Ontario Ministry of Labour relating to the work of this section.

1.06 CO-ORDINATION

1. Co-ordinate the work of this Section with the work of other sections and advise other trades when materials to be built into the forms will be required.
2. Co-operate with other sections to ensure an uninterrupted sequence of construction.
3. Ensure that conduit and fixture boxes for electrical and/or controls and/or communications and/or information technology are not embedded or recessed into the concrete slabs-on-grade, suspended slabs or beams, columns except as indicated below.
 1. No conduit or fixture box is permitted in columns.
 2. No conduit in walls without prior approval from the structural Consultant.
 3. No conduits or cable trays in the slab-on-grade. Conduits or cable trays are to be recessed into granular immediately below slab-on-grade maintaining full slab thickness. Alternately conduits or cable trays may be cast into a mud-slab immediately below slab-on-grade maintaining the full slab thickness.
 4. No conduit is permitted in slabs on composite or non-composite steel deck.

5. Conduit up to 40mm in diameter is permitted in suspended slabs, provided:
 - a) it is placed in one layer on the bottom upper layer of reinforcing steel
 1. when placed parallel to reinforcing bar the conduit is 75 millimeters clear of the bar,
 2. located at least 600 mm from slab supports,
 - b) locate conduits beyond drop panels, (the thickened portion of slab at slab supports)
 - c) Conduits are to be spaced such that there is 300 millimeters of concrete between parallel conduit runs.
 - d) No more than two conduits may crossover at any point
 - e) Crossovers are to be spaced such that there is 300 millimeters of concrete between crossovers.
 - f) The contractors intending to place conduits shall provide a plan drawing of all conduit runs and sizes prior to construction.

6. The General contractor is to inform the Electrical Contractor of these requirements.

4. Install any items furnished by others, miscellaneous iron work, anchors, anchor bolts, pipe sleeves, precast hardware, etc., that are to be built into the concrete work.
5. Form only those holes and/or openings shown on the structural drawings or those required to accommodate the work of other trades that have been reviewed by the consultant.
6. Make good all openings left in construction around pipes, openings for crane, anchorages, etc. for other trades in such a way as to maintain full fireproofing and soundproofing.

1.07 SHOP DRAWINGS

1. Examine all drawings forming a part of this Contract and conform to the requirements of all such drawings.
2. Submit shop drawings in accordance with the General Requirements.
3. **Submit fully dimensioned wall, beam and column form elevation drawings clearly locating all cast in steel plates for the connection of all structural steel members. Co-ordinate this work with that of Division 05.**
4. As requested by the Consultant, submit shop drawings for the proposed formwork, falsework, shoring and re-shoring for review. If such drawings are not satisfactory to the Consultant, make all required changes prior to the start of the work.

5. Submitted shop drawings for the proposed formwork, falsework, shoring and re-shoring are to show assumed values for all loads, types and grades of materials, dimensions, sizes and connection details. Where reshoring is required, provide sequence and details of shoring, reshoring, or leaving original shores in place as forms are stripped. Shop drawings for formwork, falsework and shoring are to be signed and sealed by a Professional Engineer, who will be responsible for the design and implementation of these structural systems, including field review.
6. When patented methods of shoring are used, the manufacturer's recommendations as to load-carrying capacities and bracings may be followed, but only if supported by test reports.
7. For exposed concrete, such as stairwells and retaining walls, submit for the Consultants' review, shop drawings to show panel layouts, joint details, tie locations and tie types.
8. The Consultant's review of the shop drawings does not relieve this Contractor of his responsibility for ensuring that all forming systems are constructed properly and are maintained in position as long as necessary to ensure the integrity of the structure during construction.

1.08 DESIGN CRITERIA - FORMWORK

1. Formwork, falsework and shoring is to be designed, erected, braced and maintained so that it will safely support:
 1. The liquid weight of the concrete.
 2. All applied construction loads, such as equipment, personnel, runways, and wind loads to which the system may be subjected.
 3. All supported loads including reshored slabs.
2. Follow the provisions of the Construction Safety Act as amended to-date and the recommendations of the current A.C.I. Standard 347.
3. As requested by the Consultant, submit structural calculations for the design of formwork, falsework, shoring and reshoring for a review by the Consultant. These calculations are to be signed and sealed by a registered Engineer and are to include all major loading conditions, types and quality of materials and design stresses.
4. Composite Metal deck will not be shored.
5. Tolerances within C.S.A. Standard CSA-A23.1 except that columns and wall alignment in vertical direction to be within 1 to 600, but total variation not to exceed 25 mm for total height of building. In addition, exterior face of spandrel girders to be 'true' both vertically and horizontally to +/- 5 mm in any one bay. Stair risers and treads to be within the tolerances of the OBC.

1.09 DESIGN CRITERIA - CONCRETE

1. Design all concrete mixes for the compressive strength and slump requirements as specified in "Proportioning" of this section. Allow for the appropriate coefficient of variation for each strength class for the batch plant supplying the concrete.
2. Submit detailed mix designs for each class of concrete for review by the Consultant at least two weeks prior to the commencement of concreting. Submit up to date statistical data for the batch plant confirming the coefficient of variation for each strength class.
3. Note that concrete that is to be stained is not to have any supplemental cementitious materials in the mix.

1.10 SPECIAL CONDITIONS

1. The site is adjacent to the existing college. The Contractors attention is drawn to the fact that the building is fully operational and must be kept operational. The presence of existing buildings, fire & vehicle routes, roadways and site works which may affect the work of this Section including hoisting, delivery and the availability of lay-down areas.
2. The Contractor's attention is drawn to the presence of an existing service tunnel adjacent to the area of the new link addition. The roof of the existing tunnel is not to be used as a thoroughfare for construction traffic, the storage of materials or a setup location of mobile crawler or wheeled cranes.
3. All horizontal surfaces which are to be steel floated or steel trowelled are to be finished by a sub-contractor specializing in concrete finishing. This sub-contractor must have a minimum of 5 years experience specializing in the finishing of horizontal concrete surfaces with power actuated finishing equipment and be *satisfactory* to the Consultant. General Contractor's own forces will not be accepted for this work.

1.11 SAMPLES

1. Construct representative samples for each type of concrete element exposed to view for approval of the Consultant with respect to finish, tie patterns, rustication, etc.
2. Samples are to be large enough to provide proper representation of the final element with interior and exterior corners, soffits, rustication and any other special features.
3. At the discretion of the Consultant, samples may be a part of the actual building, located in a non-exposed area. Additional samples may be required until the desired finish is achieved, at no additional cost to the Owner.

1.12 SUBMITTALS

1. Mix Designs
 1. Submit proposed mix designs for each class of concrete for review by the consultant.

PART 2: PRODUCTS

2.01 MATERIALS

1. Cement
 1. Type 10, normal in accordance with C.S.A. Standard A5.
 2. Supplementary cementing materials in accordance with C.S.A. Standard A23.5.
 3. Limit supplementary cementing materials to 20% for floors with special finishes (such as Retroplate), to be compatible with the finish
 3. 30% maximum supplementary cement for suspended slabs and beams. The use of supplementary cement in the concrete mix will reduce set times and reduce the rate of strength gain. The general contractor is responsible for the coordination and control of the mixes to ensure finishing can be done within reasonable working hours and within the time limitations set by the owner, and to ensure 75% strength is achieved before stripping forms from suspended concrete elements and loading imposed on any anchor bolts supporting structural steel, including erection.
No supplementary cementing materials are permitted for concrete which is to be stained or architecturally exposed. Refer to Architectural Finish Schedules
2. Aggregates:
 1. Fine and coarse aggregate materials and grading in accordance with C.S.A. Standard A23.1. Maximum size of coarse aggregate to suit spacing of reinforcing bars in accordance with C.S.A. Standard A23.1.
3. Admixtures
 1. Use only those chemical admixtures and air entraining agents currently approved for use by the M.T.O. in accordance with OPSS Form 1303, Material Specifications for Air Entraining Agents and Chemical Admixtures.
 2. Chemical admixtures shall be type 1, Water Reducing Admixtures.
 3. Admixtures to be compatible with the air entraining agent.
 4. Do not use admixtures containing chlorides.
4. Spray-Applied Curing and Sealing Compounds for: Meadows Vocomp 20 or Masterkure N-Seal-W by Master Builder, or Sonneborn Kure-N-Seal W. Verify compatibility with flooring adhesives where applicable.
5. Penetrating Concrete Hardener Finish: (PCF) Meadows Liqui-Hard to be applied

just before project completion.

6. Lumber, Plywood: and other formwork materials to C.S.A. Standard A23.1, Article 11.3, except as noted.
7. Contact surfaces of forms for concrete which will be exposed to view in the completed structure to be new, minimum thickness 20mm, plywood form panels, overlaid with resin impregnated kraft paper.
8. Circular Column Forms: to be polyethylene lined by Polypermaform vertical seam.
9. Form Oil: colourless, non-staining, mineral oil, free of kerosene.
10. Form Ties:
 1. For general hidden wall areas, removable or snap-off metal ties that after removal of forms, no metal is within 25 mm of the finished surface.
 2. On exposed sides of stairwell walls and retaining walls, metal ties with plastic cone formers to suit architectural details together with suitable plugs. For members exposed to weather, ties to be stainless. For interior exposed architectural concrete, ties to be nickel plated.
11. Grout: (for steel base plates) V-3 by Meadows or Masterflow 713 by Master Builders - all pre-mixed.
12. Non-Metallic Dry Shake Hardener: to be gray >Mastercron= by BASF or Surfex by Euclid, or Durag Premium by Sika
13. Dovetail Anchor Slots: 24 gauge galvanized steel with Styrofoam filler.
14. Slab on Grade Sawcut Sealant: Sikaflex Self Leveling Sealant by Sika, or Quikjoint 200 by Euclid Chemicals.
15. Sand-Cement Sack Rub A: Blend clean fine sand passing a No. 71 sieve, with Portland Cement proportioned 1:1, and Meadows Intralok or Ablitol with water proportioned 1:1. Blend Medusa white Portland cement as required to match colour for surfaces to remain unpainted.
16. Underslab Vapour Barrier: to be “PERMINATOR 15” as manufactured by W. R. Meadows. Provide “Perminator Tape”, minimum width 100 mm for laps.
17. Underslab Vapour Retarder: to be “Sealtight Premoulded Membrane with Plasmatic Core” as manufactured by W. R. Meadows. Provide “Sealtight Catalytic Bonding Asphalt” for laps and “Sealtight Pointing Mastic” for sealing at walls, columns and slab penetrations.
18. Hydrophilic Watershop to be “Volclay Waterstop RX-101T” as manufactured by Cerco. Do not mechanically fasten.
19. Waterstop Sealant/Adhesive to be “Setseal” as manufactured by Cerco.

20. Chemical Corrosion Inhibitor Migrating Corrosion Inhibitors (MCI) MCI-2005NS at a dosage rate of 1 litre per cubic meter or to be calcium nitrite meeting the requirements of ASTM C 494, Type C - DCI Corrosion Inhibitor by Grace Construction Products or Rheocrete CNI by Master Builders-BASF at a dosage rate of not less than 15 litres per cubic meter.
21. Isolation Pad for use in the Mechanical Room under the 2 inch topping is to be either ISO-SEP 25F as distributed by “AcoustiGuard – WILREP Ltd.” or GenieMat FF-25 manufactured by “Pliteq.” Provide all necessary including but not limited to, perimeter isolation strips, tape, sealer.

2.02 PROPORTIONING OF CONCRETE - GENERAL

1. Job-mixed concrete will not be allowed on this project.
2. Provide mixed-transit, ready-mixed concrete in accordance with C.S.A. Standard CSA-A23.1, obtained from a supplier approved by the Consultant for use on this project.
3. Mix all concrete with materials so graded and proportioned to produce a plastic mass of such consistency that it will flow slowly under its own weight and which can be readily worked into corners of forms and under and around reinforcing without forming voids or honeycombed surfaces.
4. Furnish to the Contractor, a >delivery ticket= for each batch of concrete delivered to the site, which shall be kept on record for the inspection of the Consultant. Each ticket shall show the following:
 1. Date and truck number.
 2. Contractor's name.
 3. Job designation.
 4. Specified concrete strength, slump, air content and admixtures.
 5. Batch volume.
 6. Time of batching.
5. For concrete mixes requiring entrained air, do not pre-mix the air entraining agent with a chemical admixture solution. Where both an air entraining agent and chemical admixture are used, dispense the two materials separately.
6. Accelerating or retarding chemical admixtures shall only be used with the prior approval of the Consultant or at the Consultant=s written request. Do not use calcium chloride or products containing calcium chloride.
7. Chemical admixtures and air entraining agents shall be supplied by the same manufacturer and be compatible. Use in strict accordance with the manufacturer=s directions.

8. The compressive strength of all concrete is to be determined from test cylinders made in accordance with C.S.A. Standard CSA-A23.2.
9. Minimum truck load: 1.5 m³.

2.03 PROPORTIONING OF CONCRETE - PROPERTIES

1. Proportion the materials in accordance with the mix designs supplied under Article 1.09 of this Section to provide the following specified design strengths, slumps and air contents.

ONCRETE PROPERTIES					
LOCATION	28 DAY COMPRESSIVE STRENGTH	Water to Cement Ratio	SLUMP ⁽¹⁾	AIR CONTENT ⁽²⁾	CLASS of EXPOSURE
	MPa	--	mm	%	--
Mud Slabs & Lean Fill	10	--	125	--	N
Underpinning Blocks	25	--	100	--	N
Strip Footings, Isolated Column Footings, Raft Slab Footings ⁽³⁾	25	--	100	--	N
Foundation Walls, Piers & Grade Beams– exterior	25	0.55	100	4 – 7	F-2
Foundation Walls, Piers & Grade Beams– interior	25	--	100	--	N
Exterior Slabs, Columns and Retaining walls	35 ⁽⁴⁾	0.40	100	5 – 8	C-1
Interior Slabs on Grade	25	0.45	75	--	N
Housekeeping Pad	25	--	100	--	N

Footnotes

- 1) Slump shown in table is maximum value prior to addition of water reducing agent.
- 2) If concrete is placed by pumping, addition sampling and air content testing is required at pump discharge.
- 3) Unless noted otherwise in Column and Footing Schedule
- 4) 56 day compressive strength.

2.04 QUALITY CONTROL

1. All materials, batching and mixing procedures are subject to test or inspection by the Consultant or his designated representatives.
2. Provide samples of materials as may be required at no additional cost to the Owner.

3. Provide access to pits, batch plants, etc., as may be required by the Consultant or his designated representatives.
4. The cost of testing will be paid from the Testing & Inspection Allowance in accordance with Division 1.

PART 3: EXECUTION

3.01 EXAMINATION

1. Examine and obtain all necessary measurements of previously executed and existing work which may affect the work of this section prior to commencing operations.
2. Report any discovered discrepancies to the Consultant so that instructions can be given for the necessary remedial action.
3. Examine Mechanical and Electrical drawings for required housekeeping pads for supply and installation by this Section.

3.02 ERECTION OF FORMS

1. Construct all forms to have sufficient strength, stability and rigidity to prevent bulging or deflection under the liquid weight of concrete and to support in addition, all construction loads to which they may be subjected including equipment, runways and wind forces in accordance with A.C.I. Standard 347.
2. Erect forms to the lines, dimensions and elevations shown on the drawings such that the completed work is within the tolerance limits for reinforced concrete buildings in accordance with Sub-Section 1.07 of this Section.
3. Use new, minimum thickness 20mm, plywood form panels, overlaid with resin impregnated kraft paper for all concrete exposed to view in the completed structure. Maximum 4 re-uses in exposed areas.
4. Provide for all openings, offsets, risers, brackets, haunches, depressions and curbs as shown or required in the formwork.
5. For columns exposed to view in the completed structure, horizontal joints are to be above the ceiling. For exposed circular columns, forms must not leave spiral appearance.
6. For typical wall surfaces, arrange form ties such that after removal of the forms, no metal is within 25mm of the finished surface.
7. On the exposed sides of beams, stairwell walls, and retaining wall, install metal ties with plastic cone formers of the required depth and diameter to suit the

- architectural details. Provide vertical and horizontal feature strips to suit architectural details. Ensure that forms for these walls are tight to avoid bleeding at form joints or onto previously executed work. Seal, tape or caulk all form panel joints, including panel butt joints to prevent seepage of paste for Architectural Concrete.
8. For exposed surfaces of canopies, slabs, beams, etc., provide vertical and horizontal feature strips to suit architectural details. Ensure that form joints are smooth, tight and accurately placed to provide a suitable finish.
 9. Clean forms of all debris prior to concreting. Provide temporary openings at the base of walls, column forms and at other locations where necessary to facilitate cleaning and inspection. Place openings so that wash water will have a clear run to the outside of the forms.
 10. Provide 25mm x 25mm chamfers on all corners of concrete, exposed to view in the finished structure.
 11. Coat forms with a non-staining mineral oil prior to the placing of reinforcing steel in accordance with C.S.A. Standard CSA-A23.1. Where concrete surfaces are to receive a final coat of stain, paint, plaster, etc., omit the form oil and wet down the forms just prior to concreting.
 12. Place continuous dovetail anchor slots as required to support the ends of abutting masonry walls and vertically at 600mm on centre (maximum) on concrete surfaces which are faced with masonry, including walls, column faces, beam faces and slab edges.
 13. Place anchors required for the support of mechanical or electrical equipment, precast hardware, curtain wall hardware, and miscellaneous iron which is to be cast into the concrete as supplied by other Divisions.
 14. Immediately prior to concreting, inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, thoroughly clean, properly treated and free of snow, ice or other foreign materials. Ensure the temperature of the formwork and reinforcing are above freezing. Do not use chemicals for snow/ice control.
 15. Place wedge inserts for support of angle and bent plate shelf angles.
 16. Formwork approved for concreting shall be properly protected until concrete is placed.
 17. Do not form openings in concrete beams, slabs, columns or walls without prior approval of the Consultant unless they are shown on the structural drawings.
 18. Set screeds with true and straight top edges to proper elevation. Provide camber for structural beams and slabs as detailed on the drawings with smooth uniform curve.

19. Forms for the interior surfaces of stairwells are not to be plastic coated or other non-absorbent material.
20. Accurately set and secure in position, all wedge inserts and other concrete inserts required for the work.
21. All column and wall footings to be formed. Earth forms are not permitted.

3.03 FORM REMOVAL

1. The proper time for the removal of forms is to be approved by the Consultant. Do not remove shoring until the supported member has reached sufficient strength to support safely both its own weight and the loads on it and in no case less than 75% of the specified strength.
2. The sequence and timing for stripping and reshoring of slabs and beams is to be based on actual field concrete strengths verified by Lok Tests or Maturity Testing performed by a certified testing company . Field cured cylinders may be used to supplement the Lok Test or Maturity Test method. The cost of all testing for verification of field concrete strength is to be paid by the Contractor.
3. Remove forms in accordance with C.S.A. Standard CSA-A23.1. Exercise care to ensure that exposed corners and edges are not chipped or damaged in the stripping operation.
4. Reshore suspended slabs and beams immediately after form removal. Do not strip in advance of reshoring by more than one bay. All slabs are to be reshored within eight hours of form removal. Composite metal deck does not require shoring.
5. Refer to A.C.I. Standard 347 for the **minimum** periods for which forms must be left in place.
6. The contractor shall be responsible for the safety of the structure before, during and after form removal.

3.04 CONCRETE PLACING

1. For concrete slabs on steel deck or on formwork, concrete thickness to be established by 'dip-stick' method.
2. Prior to placing concrete for slabs-on-grade, install underslab vapour retarder.
3. Install Vapour Barrier at all slabs-on-grade locations as noted on the drawings over a level granular subgrade. Follow manufactures instructions. Overlap 152 millimeters and seal laps using Perninator Tape. Extend up walls and columns full thickness of slab. Provide Perminator Collar and Perminator Tape as per manufacture's recommendations at all slab penetrations.

4. Do not start concrete placing until the Consultant has reviewed reinforcing steel.
5. All conveying, depositing, compaction and vibration is to be done in accordance with the current C.S.A. Standard CSA-A23.1.
6. Maximum elapse of time between charging and placing is not to exceed 12 hours. Reject concrete which exceeds this limit. In hot weather, this time period may have to be reduced as directed by the Consultant.
7. Place concrete carefully around all accessories, such as pipes, sleeves and conduits.
8. When concrete is to be placed in restricted locations, take special precautions to ensure close contact between the concrete and steel. Take care to exclude air-pockets and honeycombed areas. Use of a superplasticizer may be required for proper placement.
9. Where normal-size aggregate concrete can not be successfully placed in a congested area, use concrete with a smaller top aggregate size.
10. Place a minimum depth of 150mm of concrete of 12mm nominal top size aggregate in the bottom of each lift of concrete walls or columns, exceeding 2000 mm in height. Concrete to be of the same strength as specified for the wall and/or columns.
11. Use “elephant trucks” for high lift concrete to prevent segregation.
12. When buggies are used for placing concrete in slabs on soil, they are to be supported on runways and not directly on the reinforcing steel and/or membrane.
13. Maintain a sufficient number of internal mechanical vibrators on site to properly compact the concrete within 15 minutes of placing, but not less than two vibrators for any pour.
14. Mechanical vibrators which are applied to the outside of the forms are not permitted, without prior approval of the Consultant.
15. Thoroughly compact all concrete during placing to ensure that the finished concrete is free of voids or other defects.
16. Ensure that reinforcement, hardware and inserts are not disturbed during concrete placement.
17. Place concrete for drop panels and/or column capitals with the slab concrete, not with the column.
18. Strike off floor surfaces at the level shown on the drawings by means of previously set, continuous pipe screeding, set on adequate supports.

19. Notify the Consultant at least 24 hours in advance of any scheduled pour.

3.05 CURING AND PROTECTION

1. Protection and curing of concrete in accordance with Section 7 of C.S.A. Standard CSA-A23.1.
2. Maintain all equipment and materials for the protection and curing of concrete on site, ready to use before concrete placing is started.
3. Cover walls, piers, columns, beams, and slab edges with wet burlap or tightly wrap with properly lapped 4 mil polyethylene sheeting, immediately after stripping to continue the curing periods. (Surfaces which will not be exposed to view or which will not have other surface treatment may be sprayed with curing compound after stripping).
4. Completely cover floor and roof slabs with 4 mil polyethylene sheeting, properly lapped at side and edge laps and weighted down immediately after finishing.
5. Cover sidewalks, curbs, gutters, and exterior paved areas with wet burlap or polyethylene sheeting.
6. A sprayed-on membrane curing compound may be used for surfaces listed under paragraph 3, 4, and 5, in lieu of polyethylene sheeting for concrete poured between April 1st and October 14th except as follows:
 - 1 Floor areas or wall surfaces which are to have topping or other specialty surface treatments are not to have spray-applied compounds employed, but must be polyethylene cured. Coordinate with the flooring contractor to ensure compatibility with flooring adhesives.
7. Freshly finished floors are not to be used for seven (7) days after completion and only light use is permitted for an additional 7 days.

3.06 COLD WEATHER REQUIREMENTS

1. All concreting operations during cold weather in accordance with Section 7.1.2 of CSA-A23.1. Carefully protect all corners and edges.
2. Exercise particular care to ensure that previously placed concrete and reinforcing steel are adequately heated to prevent freezing of new concrete placed directly against it.
3. Exercise care to avoid rapid temperature changes (thermal shock) when removing an area from temporary heating conditions.
4. Remove and replace all concrete damaged by frost or freezing at the direction of the Consultant at no cost to the Owner.
5. Accelerating chemical admixtures shall not be used without the written approval of

the Consultant.

3.07 HOT WEATHER CONCRETING

1. All concreting operations during hot weather in accordance with Section 7.1.1 of C.S.A. Standard CSA-A23.1.
2. Exercise particular care to prevent surface crazing of floor slabs due to combined high temperatures and drying winds.
3. The use of a water reducing-retarding chemical admixture in the concrete mix may be required at the Consultant's discretion.

3.08 FINISHING OF HORIZONTAL SURFACES

1. Floors
 1. Refer to A.C.I. Standard 302 for recommended procedure for concrete floor and slab construction and finishing.
 2. Refer to C.S.A. Standard CSA-A23.1. Maintain surface tolerances for all slabs in accordance with that Standard for Class B. Finish all floors to achieve surface flatness as tested by the straightedge method to a maximum tolerance of $\pm 5\text{mm}$ (3/16") in accordance with CSA-A23.1 Section 22.
 3. Concrete floors which are to receive carpet, resilient flooring, mosaic tile or be left exposed, shall be steel floated with a disc type power floating machine, having a 600mm disc, and weighing at least 130 kg. Continue the floating operation until sufficient moisture is brought to the surface to fill all voids. After floating when the floor has hardened sufficiently so that excess fines will not be brought to the surface, trowel with a steel trowel to a smooth level surface free of all pinholes, trowel, and 'chatter' marks. See ACI Standard 301, Section 11.7.
 4. Concrete floor areas designated for dry shake hardener, in the room schedule to be left exposed shall be finished as per Item 3 above with the addition of a factory pre-mixed non-metallic hardener. Apply in two separate shakes in strict accordance with the manufacturer's instructions for a combined application of 3.5 kg/m^2 . Following finishing operations, apply unthinned sprayed-on curing and sealing compound in strict accordance with the manufacturer's instructions. Just prior to turn-over, clean these areas and apply one coat of compatible floor sealer in strict accordance with the manufacturer's instructions.
 5. Concrete floor areas designated in the room schedule for penetrating hardener are to be left exposed and finished per item 3 above and finished with concrete penetrating hardener in strict accordance with the manufacturer's procedures. Ensure the excess residual liquid gel is

thoroughly washed from the surface to eliminate stains. Immediately remove any spray from adjacent glass or metal surfaces to avoid etching. Perform this operation as near as possible to the final completion of the project to maintain a clean and polished finish.

6. Concrete floors which are to receive terrazzo finish, quarry tile or concrete toppings shall be screeded level, darbied and after attaining a partial set, brushed with a coarse wire broom to remove laitance and to score the surface to assure bond of the topping.

2. Roof Areas

1. Provide smooth power float finish suitable for the installation of the finish materials.

3.09 TREATMENT AND REPAIRS FOR FORMED SURFACES

1. After removal of forms, the surfaces of concrete are to be given one or more of the finishes specified hereafter. Methods used are to be in accordance with Section 7.9 of C.S.A. Standard CSA-A23.1.
2. When, in the opinion of the Consultant, satisfactory repairs cannot be made, then the defective work is to be cut out and replaced as directed by the Consultant.
3. Treatment of honeycombed areas is to be carried out as directed by the Consultant. Do not treat such areas prior to receiving instructions from the Consultant.
4. Form Tie Holes:
 - .1 Where removable through wall bolts or tapered ties are used, fill the hole full depth of wall with packed non-shrink grout.
 - .2 Where coil style ties are used, use extended coils to install concrete gray threaded plastic inserts, recessed 6mm.
 - .3 Where snap ties are used, twist and break tie off below wall surface with custom tool supplied by tie manufacturer. For exterior side of foundation walls or surfaces exposed to view, patch flush with "sand-cement repair mortar."
5. Sack Rub A - All concrete surfaces (external or internal) exposed to view in the finished structure including underside of slabs and stairs shall receive a sack rubbed sand-cement finish on the hardened concrete. All necessary patching shall have been done immediately after the forms have been removed and fins and ridges ground flush. Follow the preparation, application, materials and curing procedures of Clause 7.9.4.4 of C.S.A. Standard CSA-A23.1 to produce smooth, unsanded uniform surface with all holes filled. Two applications may be required to ensure bug holes are finished flush. Pre-shrink mortar cement for 1 hr before use. See Architectural drawings for location of exposed concrete.

3.10 CONSTRUCTION JOINTS

1. Construction joints in walls and floors shall be placed in locations approved by the Consultant or shown on the drawings. All joints in exposed work to be carefully detailed and constructed.
2. Construction joints shall be keyed and doweled to the adjoining pour as detailed on the drawings.
3. Before placing adjoining, concrete at construction joints, clean the existing surface of dirt, laitence and loose aggregate.
4. Where additional resistance to horizontal shear is required, mortises or keys shall be formed in the concrete. The pouring sequence and the location of construction joints shall be as shown on the plans, noted herein, or as approved by the Consultant.

3.11 CONTROL JOINTS

1. Provide control joints where shown and noted on the drawings in foundation and retaining walls and in floor slabs. Control joints in floor slabs shall be sawcut to the depth shown as soon after placing the concrete as the surface will allow without chipping but not later than 24 hours after placing. Clean sawcuts with compressed air. Fill sawcut joints exposed to view, with sawcut filler no earlier than 30 days after the pour. Joints should be cleaned free of debris with compressed air before filling.

3.12 GROUTING OF COLUMN BASE AND BEAM BEARING PLATES

1. Rough finish the top of walls or slabs which receive steel columns, or steel beams.
2. After the erection and alignment of columns and beams, fill the space beneath the plates with a none-shrink grout. Take particular care to ensure that air pockets or voids are eliminated.
3. Mix and place the grout in strict accordance with the manufacturer=s directions.

3.13 INSTALLATION OF MECHANICAL ROOM ISOLATION PAD

1. Finish base slab of mechanical room in accordance with clause “3.08.1. Finishing Of Horizontal Surfaces – Floors”
2. Install perimeter isolation strips to all walls and curbs at slab openings and columns.
3. Tape joints as per manufacturer’s instructions.
4. Place 2 inch thick concrete topping with welded wire mesh.

5. Finish topping in accordance with “3.08.1. Finishing Of Horizontal Surfaces – Floors”

3.14 FIELD QUALITY CONTROL

1. All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the Consultant.
2. Cost of testing and inspection will be paid from the Testing and Inspection Allowance in accordance with Division 1 except as noted hereafter.
3. Provide unhindered access to the project for purposes of inspection and testing. Provide storage space and the necessary protection for test specimens against damage or loss while on site.
4. Provide representative samples of the materials as requested by the testing and inspection company at no cost to the Owner.
5. All field tests for concrete quality and all criteria relating to failure to meet test requirements in accordance with the Ontario Building Code and C.S.A. Standard CSA-A23.1, Section 4.4, except as follows:
 1. Each test shall consist of three standard cylinders, accompanied by a slump test and measurement of air content (where applicable). Unless otherwise directed by the Consultant, one cylinder shall be tested at 7 days and the remaining two at 28 days.
 2. The inspection company shall take concrete test for:
 - a. not less than one test for each class of concrete placed each day, and,
 - b. not less than one test for each 100 cubic meters or portion thereof placed in any day.
6. The cost of any additional testing and/or the cost of replacement of any part of the structure resulting from failure of the concrete to meet the test requirements shall be borne by the Contractor.
7. Notify the testing company of the pouring schedule sufficiently in advance so that tests may be made.

3.15 CLEAN-UP

1. At the completion of the work of this Section, remove from the site any excess materials, debris, and equipment.

END OF SECTION

CONCRETE FLOOR FINISHING

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Finishing concrete slabs and separate floor toppings.
.2 Surface treatment with concrete hardener, sealer, and coatings.
- 1.3 RELATED SECTIONS
- .1 Section 03 30 00 - Cast-in-place Concrete.
.2 Section 07 90 00 - Joint Sealants.
- 1.4 REFERENCES
- .1 CSA-A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.
.2 ACI 302 - Guide for Concrete Floor and Slab Construction.
.3 ASTM E1 155-96(2008) - Determining FF Floor Flatness and FL Floor Levelness Numbers.
.4 ASTM E1 155M-96(2008) - Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric).
- 1.5 SUBMITTALS
- .1 Product Data: Provide data on compatibilities, and limitations of product.
.2 Maintenance Data: Provide data on maintenance of installed system of applied coatings.
- 1.6 QUALITY ASSURANCE
- .1 Perform Work in accordance with CAN/CSA-A23.1/A23.2.
.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years and approved by the manufacturer.
- 1.7 MOCK-UP
- .1 Provide 1.0 m long by 1.0m wide mock-up area under conditions similar to those which will exist during actual placing, with coatings applied.
.2 Locate where directed by Consultant.
.3 Approved mock-up may remain as part of the Work.
- 1.8 ENVIRONMENTAL REQUIREMENTS
- .1 Do not finish floors until interior heating system is operational.
.2 Temporary Heat: Ambient temperature of 10 degrees C minimum.

CONCRETE FLOOR FINISHING

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufactures are accepted subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 Master Builders Technologies.
 - .2 Sika Canada Inc
 - .3 W.R. Meadows of Canada

2.2 COMPOUNDS - HARDENERS AND SEALERS

- .1 Hardeners: where interior concrete floors are to remain exposed (see Room Finish Schedule):
 - .1 Non-metallic Hardener: Daimag >7' by Sternson Limited or Mastercron Aggregate by The Master Buildings Ltd.
 - .1 SC-1 standard duty,
 - .2 SC-2 number 6 hardness.
 - .2 Coloured Non-metallic Hardener: Colorcron by The Master Buildings Ltd. or Colorplete by Sternson Limited.
- .2 Curing and Sealing Agents:
 - .1 Non-coloured Floors; Flortex by Sternson Ltd., ACS-309" By W.R. Meadows, or an approved alternate.
 - .2 Coloured Floors: Masterkure CR by Master Builders Ltd., or Florseal By Sternson Ltd
- .3 Sealant: For filling sawcuts and cracks in floors: Conforming to CAN2-19.24-M, Type 1, Class B.

2.3 SLIP RESISTANT TREATMENT – NOT REQUIRED THIS PROJECT

- .1 Non-slip Inserts: 60 mm wide, 10 mm deep Carborundrum or fine aluminum oxide strips cast into concrete at stair treads and landings. Submit samples for review.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that floor surfaces are acceptable to receive the work of this section.

3.2 FLOOR FINISHING

- .1 Finish concrete floor surfaces in accordance with CAN/CSA-A23.1/A23.2.
- .2 Wood float surfaces which will receive thin set tile.
- .3 Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring.
- .4 Steel trowel surfaces which are scheduled to be exposed.
- .5 In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains and as indicated on drawings.

3.3 FLOOR SURFACE TREATMENT

- .1 Sealer: Apply one coat of curing and sealing compound in accordance with manufacturer's instructions.

CONCRETE FLOOR FINISHING

- .2 Floor Hardener:
 - .1 Apply at rate recommended by manufacturer.
 - .2 Apply first shake consisting of two-thirds of total specified. Begin application at door openings, around walls, columns and such other areas where early drying would occur and where hand finishing is required.
 - .3 As soon as first shake darkens from moisture, work into slab surface using power-float or hand floating where required.
 - .4 Uniformly broadcast the balance of the hardener onto the floated surface at right angles to first shake. Float surface a second time.
 - .5 When water sheen from second floating disappears, execute final steel towelling to produce specified finish.

- 3.4 TOLERANCES
 - .1 Measure for floor flatness (FF) and floor levelness (FL) tolerances for floors in accordance with ASTM E1155M and ASTM E115, within 48 hours after slab installation.
 - .2 Finish concrete to achieve the following tolerances:
 - .1 Under Resilient Finishes: F (FF) 75 and F (FL) 50.
 - .2 Exposed to View and Foot Traffic: F (FF) 75 and F (FL) 40.
 - .3 Correct the slab surface if the actual F (FF) or F (FL) number for the floor installation measures less than required.
 - .4 Correct defects in the defined traffic floor by grinding or removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

- 3.5 CLEANING
 - .1 Keep premises clean and free of debris at all times.
 - .2 Remove spatter from adjoining surfaces, as necessary.
 - .3 Repair damages to surface caused by cleaning operations.

END OF SECTION

CONCRETE FLOOR FINISHING

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MORTAR

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 This Section includes the mortars used in the masonry division, including mortars for masonry veneer and concrete block.
- 1.3 RELATED SECTIONS
- .1 Section 04 20 00 - Unit Masonry
- 1.4 REFERENCE
- .1 The following published references shall govern where appropriate:
- .1 CAN/CSA-A5-93 Portland Cement
- .2 CAN/CSA-A8-93 Masonry Cement
- .3 CSA A179-04(R2009) Mortar and Grout for Unit Masonry
- 1.5 DELIVERY AND STORAGE OF MATERIALS
- .1 All cement, lime and other packaged materials shall be delivered in original unbroken and undamaged packages with the maker's name and brand distinctly marked thereon, and upon delivery stored in a shed until used on the work.
- .2 Store and pile sand on a plank platform and protect from dirt and rubbish. Mortar materials and sand shall be stored in such a manner as to prevent deterioration or contamination by foreign materials.
- 1.6 SUBMITTALS
- .1 Product Data: Provide data on compatibilities, and limitations of product.
- .2 Maintenance Data: Provide data on maintenance of installed system.
- PART 2 PRODUCTS
- 2.1 ACCEPTABLE MANUFACTURERS
- .1 Masonry Cement: Canada Masonry or Lake Ontario
- .2 Mortar Pigment: Northern Pigment
- .3 Plasticizer: Sealbond
- .4 Colourant: Betomix by Daubois
- 2.2 MATERIALS
- .1 Portland Cement: freshly made Portland Cement of Canadian manufacture, complying with CAN/CSA A5-93.
- .2 Masonry cement: freshly made masonry cement complying with CAN/CSA A8-93
- .3 Sand: natural pit sand consisting of clean gritty particles graded from fine to coarse to the approval of the Consultant. Sand shall be free from loam, clay,

MORTAR

- vegetable or organic material, acid, alkali, salt or other soluble or deleterious material and be uniform in colour. Sand shall comply with CSA A82.56.
 - .4 Plasticizer: added to all mortar mixes in accordance with manufacturer's instructions.
 - .5 Water: potable, clean and free of deleterious amounts of acids, alkalis or organic materials.
 - .6 Hydrated Lime: CSA A82.43.
- 2.3 MIXES
- .1 Type 'M' Mortar: conforming to CSA A179-04(R2009), for the top 200mm (8") of all parapet walls. Compressive strength at 28 days shall be 16.4 MPa unless noted otherwise on drawings.
 - .2 Type 'S' Mortar: conforming to CSA A179-04(R2009), for all concrete block walls above grade. Compressive strength at 28 days shall be 12.4 MPa unless otherwise noted.
 - .3 Type 'N' Mortar: conforming to CSA A179-04(R2009), for all Pioneer Brick and Clay Brick walls. Compressive strength at 28 days shall be 5.2 MPa unless otherwise noted.
 - .4 Coloured Mortar Mixes: Betomix by Daubois or equal by St. Lawrence Cement Company, Canada Cement, St. Mary Cement or Lake Ontario Portland Cement Company. Mortar mixes shall conform to mix requirements specified.
 - .1 Colour to be selected at a later date by Architect.
- PART 3 EXECUTION
- 3.1 APPLICATION
- .1 All cementitious materials and aggregate shall be mixed for at least 3 minutes and not more than 5 minutes in a mechanical batch mixer, with the maximum amount of water to produce a workable consistency. Clean the mixer after each batch, and at the end of the day. Mix dry ingredients to homogeneous mix of uniform colour, then add water slowly as required. Add colour pigment as required by Manufacturer's specifications.
 - .2 Mortars that have stiffened because of evaporation of water from the mortar shall be re-tempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in final position within 2-1/2 hours after initial mixing when the temperature is 27° C (80 F) or higher; use within 3-1/2 hours when the temperature is below 27° C (80 F).
 - .3 No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.
 - .4 No air-entraining admixtures or cementitious material containing air-entraining admixtures shall be used in the mortar.
 - .5 Calcium chloride or admixtures containing calcium chloride shall not be used in mortar which reinforcement, metal ties or anchors are embedded, or in walls containing hollow metal door frames.
 - .6 Do not use cement which has absorbed moisture to the extent of making it lumpy or granulated when dry.

END OF SECTION

MASONRY

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Concrete masonry, Brick units.
 - .2 Reinforcement, anchorage, and accessories.
- 1.3 RELATED SECTIONS
- .1 Section 04 04 05 - Mortar and Masonry Grout: Mortar and grout.
 - .2 Section 07 21 13 - Board Insulation.
 - .3 Section 07 27 00 - Air Barriers.
 - .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
 - .5 Section 07 84 00 - Firestopping.
 - .6 Section 07 92 00 - Joint Sealants.
- 1.4 REFERENCES
- .1 ASTM B370-03 - Copper Sheet and Strip for Building Construction.
 - .2 ASTM C1330-02 (R2007) – Cylindrical Sealant Backing for Cold-Applied Sealants.
 - .3 CSA-A370-04 – Connectors for Masonry.
 - .4 CSA-A371-04 - Masonry Construction for Buildings.
 - .5 CSA-S304.1-04 - Design of Masonry Structures.
 - .6 ULC (Underwriters Laboratories of Canada) - List of Equipment and Materials for:
- 1.5 SUBMITTALS
- .1 Product Data: Provide data on compatibilities, and limitations of product.
 - .2 Maintenance Data: Provide data on maintenance of installed system.
 - .3 Samples: Submit samples, illustrating sizes, colour range and texture, markings, surface finish.
 - .4 Provide detailed control joint plan prior to proceeding with the work.
- 1.6 QUALITY ASSURANCE
- .1 Perform Work in accordance with CSA-A371.
 - .2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- 1.7 MOCK-UP – NOT USED THIS PROEJCT
- .1 Provide 2.4 m long by 1.8 m high masonry wall panel, including mortar and accessories, structural backup, wall openings, flashings, wall insulation, air barrier.
 - .2 Locate where directed by Consultant.
 - .3 Accepted mock-up may remain as part of the Work.

MASONRY

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Cold and Hot Weather Requirements: CSA-A371 - Masonry Construction for Buildings.

PART 2 PRODUCTS

2.1 CONCRETE UNIT MASONRY

- .1 Standard Concrete Block: size to suit existing masonry block, autoclaved or carboclaved, conforming to CAN3-A165 Series-94, Concrete Masonry Units:
 - .1 Standard Block: H or S/15/A/M, load-bearing and non-load-bearing;
 - .2 Lightweight Block: H or S/15/B/M, made of concrete conforming to: L220S.
- .2 Coloured Architectural Concrete Block: NOT USED THIS PROJECT - metric modular size, autoclaved or carboclaved, conforming to CAN3-A165 Series-94, standard smooth or split-face finish, colours selected by Architect from manufacturer complete range.
 - .1 Day & Campbell, Brampton Brick, or equal.
 - .2 Basis of Design: Day & Campbell, Modern Masonry, Canola 302.
 - .3 Finish/Type: 80% split face, 20% polished.
- .3 Fire Separation Ratings: Where concrete block walls are required to act as fire separations or barriers, units shall conform to Ontario Building Code with respect to equivalent thickness and type of concrete.
- .4 Steel Bearing Masonry: Solid, and as specified above.

2.2 ANCHORAGE AND REINFORCEMENT

- .1 By Dur-O-Wall/ or Fero or Hohmann & Barnard:
 - .1 DA515 Adjustable Wall Ties/ or Block Shear at masonry back-up.
 - .2 DA 801 Adjustable Speed-set/ or Rap-Tie at existing masonry back-up.
 - .3 DA213 Adjustable Veneer Anchor/ or Stud Shear or 2-Seal Thermal Wing Nut Anchor at steel stud back-up.
 - .4 MSSA Anchors/ or Cat-Tie at steel structural elements.
 - .5 Stainless steel.

2.3 FLASHINGS – NOT USED THIS PROJECT

- .1 Flexible Flashings: Blueskin WP 200 manufactured by Bakor.
- .2 Sheet Metal Flashing: Minimum 0.71 mm core thickness (24 gauge) where exposed to view, or as noted on drawings 0.56 mm core thickness (26 gauge) where concealed, commercial quality steel, prefinished where exposed to view, ASTM A526, galvanized to Z275 zinc coating. Lap Cement for Sheet Metal Flashing: CGSB 37.4M or CGSB 37.5M.

2.4 ACCESSORIES – NOT USED THIS PROJECT

- .1 Preformed Control Joints: Ethafoam by Dow, or polyvinyl chloride, 25mm narrower than masonry unit width.
- .2 Cavity Vents: Vented PVC mortar joint insert, DA 1069 Cell Vent by Dur-O-Wal or equal by Goodco Limited, colour to match mortar [Moulded polyvinyl chloride grilles]

MASONRY

- .3 Mortar Collection Mesh Polymer core geomatrix mesh, Mortar Break, by Advanced Building Products, www.advancedflashing.com or approved equal.
- .4 Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that field conditions are acceptable and are ready to receive work.
- .2 Verify items provided by other sections of work are properly sized and located.
- .3 Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- .1 Direct and coordinate placement of metal anchors supplied to other sections.
- .2 Provide temporary bracing during installation of masonry work to CSA-A371. Maintain in place until building structure provides permanent bracing.
- .3 Establish lines, levels, and coursing; protect from disturbance.
- .4 Verify that items built-in under other sections are properly located and sized.
- .5 Clean masonry prior to erection.
- .6 Do not use wire brushes or implements which will mark or damage exposed surfaces.

3.3 COURSING

- .1 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .2 Lay out coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum cutting.
- .3 Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- .4 Veneer:
 - .1 Bond: Running.
 - .2 Mortar Joints: Raked.

3.4 PLACING AND BONDING

- .1 Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- .2 Lay hollow masonry units with face shell bedding on head and bed joints.
- .3 Remove excess mortar as work progresses.
- .4 Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- .5 Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- .6 Isolate masonry partitions from vertical structural framing members with a control joint.
- .7 Install mortar in accordance with CSA-A179.

MASONRY

- 3.5 WEEPS
- .1 Install cavity vents at top and bottom of each cavity space, above shelf angles, and at spacing of 600mm on centre, horizontally.
- 3.6 CAVITY BEHIND VENEER
- .1 Install mortar dropping collection mesh to manufacturer's written instructions.
 - .2 Build inner wythe ahead of outer wythe to receive air barrier.
- 3.7 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER
- .1 Install anchors and ties in accordance with CSA-A370 and CSA-A371.
 - .2 At exterior cavity walls provide cavity wall reinforcement across cavity and face veneer at minimum 600mm, off-set in diamond pattern.
 - .3 Increase quantity of wall ties around perimeter of openings, at wall terminations and corners, of openings and edges of masonry.
- 3.8 LINTELS
- .1 Install loose steel lintels, centred over openings.
 - .2 Maintain minimum 100mm bearing on each side of opening.
- 3.9 FLASHINGS
- .1 Provide flexible and sheet metal flashings not provided by other Sections and incorporate where indicated on Drawings and, in absence of any indication, in locations as follows:
 - .1 Top of foundation wall on exterior walls
 - .2 Over exterior lintels.
 - .3 Under Copings.
 - .4 Under sills.
 - .2 Turn flashing up minimum 200mm and bed into mortar joint of masonry.
 - .3 Lap end joints minimum 150mm and seal watertight.
 - .4 Turn flashing, fold, and seal at corners, bends, and interruptions.
- 3.10 ENGINEERED MASONRY
- .1 Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
 - .2 Reinforce masonry unit cores and cavities with reinforcement bars and grout in accordance with CSA-A179, CSA-A371 and CSA-S304.1.
- 3.11 CONTROL JOINTS
- .1 In the absence of notation provide control joints where wall height or thickness changes, at abutments of walls and at average 9m and maximum 11m intervals in continuous walls. Notify Architect before adding control joints to those indicated on the Drawings.
 - .2 Do not continue horizontal joint reinforcement through control joints.

MASONRY

- .3 Break vertical mortar bond with sheet building paper fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

3.12 BUILT-IN WORK

- .1 Build in items provided by other Sections, including steel door frames, anchor bolts, sleeves, inserts, loose steel lintels, access panels, special security construction, masonry flashings and other items as required. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.
- .2 Install built-in items plumb and level.

3.13 CUTTING AND FITTING

- .1 Cut neatly for electrical switches, outlet boxes and other recessed or built-in objects. Coordinate with other sections of work to provide correct size, shape, and location.
- .2 Make cuts straight, clean and free of uneven edges.
- .3 Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

- .1 Remove excess mortar and mortar smears.
- .2 Replace defective mortar. Match adjacent work.
- .3 Clean soiled surfaces with cleaning solution.
- .4 Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

- .1 Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

MASONRY

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.
2. Provide the Unit Prices as listed in the 'Schedule of Structural Unit Prices' in Division 1.

1.02 SCOPE OF WORK

1. Refer to the Contract Drawings for detailed requirements.
2. Supply all materials; provide all labour and equipment to erect the structural steel as shown or required by the drawings or specifications. The principal items include but are not limited to:
 1. Structural steel columns, girders, beams, girts, bracing.
 2. Galvanized railings/guards, gratings, lintels and bent plates.
 3. Angles, plates, stiffeners, strap anchors, welded stud anchors.
3. Supply:
 1. Anchor bolts - for installation under Division 03 – Concrete.
 2. Loose Structural Shapes Cast Into Concrete Work for installation under Division 03 – Concrete.
 3. Loose Lintels - for installation under Division 04 - Masonry.
4. Related Work Specified Elsewhere:
 1. Steel Floor & Roof Deck- Section 05 31 00.
 2. Cast-In-Place Concrete - Section 03 30 00.

1.03 APPLICABLE STANDARDS

1. All standards to be latest issue with amendments.
2. Unless otherwise stated, the applicable provisions of these reference standards are to be considered as part of this specification.
3. Ontario Building Code.
4. CSA Standard S16, 'Limit States Design of Steel Structures'.
5. CSA Standard W59, 'Welded Steel Construction (Metal Arc Welding)'.
6. CSA Standard W55.3, 'Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings'.

7. CSA Standard W47, 'Certification of Companies for Fusion Welding of Steel Structures'.
8. CSA Standard S136, 'Cold Formed Steel Structural Members'.

1.04 SHOP DRAWINGS

1. Examine all drawings forming a part of this contract and conform to the requirements of all such drawings.
2. The Consultant reserves the right to relocate members prior to and during the approval of erection diagrams for the purpose of clearing ducts, piping, walls, etc., and to finalize the location of mechanical roof top units, etc. at no additional cost to the Owner. Any cost involved in revisions to erection diagrams or shop drawings as a result of these changes shall be borne by this Contractor.
3. Submit shop drawings in accordance with the General Conditions for review prior to fabrication. Any fabrication executed before review of shop drawings shall be at the Contractor's risk. Fabrication shall be assumed to begin when material is cut to length whether this is by the fabricator or at the mill to the fabricator's orders.
4. Include with the drawing submission a certificate, signed and sealed by the registered professional engineer responsible for the detailed structural steel connections, stating that the connections have been designed, detailed, and fabricated in accordance with the applicable standards for the loads shown or required. **Drawings will not be accepted by the consultant for review without this certification.**
5. The Consultant's review of shop drawings will not relieve the Contractor from his responsibility for ensuring that his work is complete, accurate and in accordance with the drawings and specifications.
6. The use of reproduced copies of the Consultant's drawings for erection diagrams will not be allowed.
7. Submit shop drawings in accordance with the General Conditions except as noted below.
8. Submit one ADOBE PDF file, (Adobe Portable Document Format) for each erection diagram, complete with the General Contractor's shop drawing review stamp and with the required information completed, for review by consultant.
9. Provide one ADOBE PDF file, (Adobe Portable Document Format) for each shop fabrication/detail diagram requested by the consultant for review.

10. At the completion of the work, provide:
 1. A complete set of ADOBE PDF files, (Adobe Portable Document Format) for both erection and shop fabrication/detail diagrams to the Consultant showing 'as-built' conditions including final sizes and locations of openings and final locations of mechanical units.
 2. Two complete paper sets of the erection diagrams to the Consultant showing 'as-built' conditions including final sizes and locations of openings and final locations of mechanical units.

1.05 DESIGN CRITERIA

1. Certificates

1.
 1. Provide a certificate signed and sealed by the registered professional engineer responsible for the detailed structural steel connections, stating that the connections have been designed, detailed, and fabricated in accordance with the applicable standards for the loads shown or required.
 2. Certificates must bear the original seal and signature of the engineer and be dated. Photo-copies are not acceptable.
2. All loads, forces and reactions, shown on the drawings or noted in the specifications are service loads (unfactored), unless noted otherwise.
3. Typical connection details are shown on the drawings for guidance only. Design and submit for approval suitable bolted or welded connections. In general, bolted connections should be designed as 'bearing' connections with threads **included** in the shear plane. Short slotted connections will be permitted with hardened washers under both head and nut. **All** bolted connections are to be tensioned as for slip critical. Provide stiffeners, as required by the connection design, at all HSS / beam moment connections and HSS/bracing connections to transfer the loads and prevent distortion of the HSS.
4. The vertical shear capacity of all beam and girder connections shall not be less than the reaction calculated when the section acting as a simple beam is loaded uniformly to its moment capacity over the span shown or less than that value noted on the drawings, whichever is greater.
5. Note that the roof systems are sloped for drainage, which requires attention to detailing and fabrication.
6. For cantilevered beams continuous over columns, provide welded bearing stiffener each side of beam web. Stiffeners are to be in line with column web/flanges/walls. Bearing stiffener thickness is to be as determined by calculation or the thickness of the cantilevered beams web but in no case less than the 10 mm thick. Design suitable bearing stiffeners at all other locations of concentrated loads, particularly at columns bearing on transfer beams, and as required to suit the connection design.

7. For vertical braced frames, unless specifically noted and or detailed otherwise in the structural drawings, the working points for the connection of the brace is the:
 1. Intersection of the column and beam centerlines and
 2. Intersection of column centerline with underside of base plate.
8. For vertical or horizontal trusses, the working point for the connection of the diagonal web members is the intersection of the centerlines of the chord and perpendicular web member.
9. In general, design all connections of beams to supporting beams, columns or to cast-in wall plates, as double header angles or structural tees with zero moment applied at the face of the support. Double header angles are to be not less than 50% of the depth of the supported beam.
10. Refer to drawings for steel bracing locations. Design all steel bracing connections in accordance with S16-01 for the Seismic Force Resisting System as shown in "STRUCTURAL INFORMATION" on drawing S-101.

1.06 CO-ORDINATION

1. Co-ordinate the work of this Section with the Construction Manager's schedule in accordance with the General Conditions.
2. Co-ordinate the work of this Section with the work of all affected Divisions to provide proper clearances and assembly of the work, including mechanical loads, piping loads, and loose lintel requirements.
3. Co-ordinate the work of this Section with the work of Section 05 31 00, 'Steel Floor & Roof Deck' to provide a continuous erection procedure.
4. Co-ordinate the work of this Section to schedule access with the owner's testing and inspection agency. See 1.09 SPECIAL CONDITIONS.

1.07 SUBSTITUTIONS

1. Substitution of available beam and column section for those shown on the drawings may be permitted provided that the substituted members have equivalent or greater capacity and stiffness than those shown.
2. Proposed substitutions are subject to prior approval of the Consultant and must not interfere with Architectural clearances.

1.08 QUALITY ASSURANCE

1. Fabrication and erection of **all** components to be by companies holding current Canadian Welding Bureau 'C.W.B.' certification as Division 1 or Division 2. All welding is to be performed by welders holding current certification for the required welding position.

1.09 SPECIAL CONDITIONS

1. The site is adjacent to the existing college. The Contractors attention is drawn to the fact that the building is fully operational and must be kept operational. The presence of existing buildings, fire & vehicle routes, roadways and site works which may affect the work of this Section including hoisting, delivery and the availability of lay-down areas.
2. The Contractor's attention is drawn to the presence of an existing service tunnel adjacent to the area of the new link addition. The roof of the existing tunnel is not to be used as a thoroughfare for construction traffic, the storage of materials or a setup location of mobile crawler or wheeled cranes.
5. Architectural Exposed Structural Steel – 'AESS' is to be in accordance with the Canadian Institute of Steel Construction's Code of Standard Practice
 1. AESS 3 Exposed structure in public spaces, that would include but not limited to columns, struts attached to columns, horizontal curtain wall supports and stair stringers visible in the completed structure and can be viewed from a distance of less than 20 feet
 2. Shop Primer used for AESS is to prevent corrosion of the member for 180 days from the date of primer is applied.
7. Contractors attention is drawn to the fact that several site measurements must be taken prior to submission of shop drawings and fabrication of structural steel. Refer to structural and architectural drawings.
8. Contractors attention is drawn to the requirement for several connections back to the existing steel structure. These connections are required for the lateral stability of the completed structure.

PART 2: PRODUCTS

2.01 MATERIALS

1. Rolled Steel Sections, Shapes, plates and rods - in accordance with G40.21 - 350W.
2. Hollow Structural Sections (up to HSS 305x305 and HSS 406 round) in accordance with G40.21 - 350W, Class H. (Note that Grade C ASTM Standard is not equivalent to Class C.)
3. Hollow Structural Sections (larger than HSS 305x305 and HSS 406 round) – in accordance with ASTM A500, Grade C.
4. High Strength Bolts & Washers - in accordance with ASTM Standard A325 or A490. Galvanized bolts at galvanized steel.
5. Channels, angles and rods - in accordance with CSA Standard G40.21-300W

($f_y=44$ ksi), or better.

6. Shop Paint
 1. Except as noted below in accordance with CISC/CPMA 1-73A. No lead-based paints allowed.
 2. Architectural Exposed Structural Steel primer to be Devco Devguard 4190 or approved alternate.
7. Field Touch Up Primer
 1. Galvanized Steel – Catha-coat 302V-Gray,
 2. Primed Steel – to match original shop primer.
8. Anchor Bolts - in accordance with CSA Standard G40.21M-300W. (Galvanized bolts at exterior columns).
10. Galvanizing - in accordance with CSA-G164, zinc coating by hot dip process after fabrication, shot blasting and pickling to provide a uniform coating of not less than 2.0 ounces per sq. ft.
11. Base Plate and Column Corrosion Protection: W.R. Meadows “Patch Prime” Exposed Steel Primer or Bakor 810-07 Non Fibered Asphalt Roof and Foundation Coating or TREMproof 201/60 Fluid Applied Elastomeric Waterproofing, brush applied grade

2.02 FABRICATION

1. Fabrication of all structural steel in accordance with CSA-S16.
2. Carefully make and fit all details and connections to ensure that the finished work presents a neat and workmanlike appearance.
3. All shop and field connections are to be welded or high-strength bolted.
4. Splicing will not be allowed without the approval of the Consultant at the shop drawing review stage. Splicing will then only be allowed if the length of the fabricated member required is longer than that normally produced at the mill.
5. All members shall be true to length so that assembly may be done without fillers.
6. Provide holes for bolted connections, for connecting the work of other trades where such holes can be determined prior to fabrication and only at the request of the Engineer or the trade concerned. Such holes shall only be provided where they will not impair the satisfactory performance of the structure.
7. Provide welded strap or reinforcing bar anchors for beams and columns for anchorage of/to concrete or masonry as shown on the typical details.
8. Provide holes for blocking where blocking is required to receive 16 diameter bolts spaced at 600 on centre and staggered where possible.

9. Provide holes in webs or welded bar assemblies for masonry anchors as per typical details.
10. Surface Preparation:
 1. Except as noted in Items 2 and 3 below, thoroughly clean all steel by effective means of all loose mill scale, oil, rust or any other deleterious material which could affect the bond or performance of the paint (or primer) in accordance with SP3 of SSPC Specifications. Refer also to Architectural painting requirements.
 2. Architectural Exposed Structural Steel – 'AESS' immediately prior to shop painting, all steel to be shot or sandblasted to SSPC-SP6.
 3. Hot Dipped Galvanized Steel immediately prior to galvanizing, all steel to be shot blasted to SSPC-SP6.
11. Apply one coat of standard shop primer on dry surfaces for all members except as follows:
 1. Do not paint steel:
 - a. that is to receive spray applied fire proofing,
 - b. that is to receive intumescent fire proofing,
 - b. in direct contact with concrete,
 - c. where welded connections are to be made or
 - d. in other areas where paint will impair structural connections including encased elements.
 2. Exterior lintels, lintel plates, bar grating, handrails and guards to be galvanized.
12. Finish all joints and touch up to provide a smooth uniform surface, free of abrasions or chips to the satisfaction of the architect.
13. Supply suitable loose lintels as shown on the schedule for all openings in masonry walls for installation under Division 4.
14. Supply suitable galvanized shelf angles and lintel assemblies as shown on the drawings for all exterior walls.
15. Take care to minimize distortion due to welding and galvanizing procedures. Straighten members as required to maintain the fabrication tolerances of CSA - S16.
16. Hot Dip Galvanizing to CSA Standard G164, including preparation.
 1. Blast clean to SSPC SP6, after fabrication, prior to galvanizing.
 2. Provide seal welds in addition to structural welds as required by good practice.
 3. Hollow Structural Sections to be Hot Dip Galvanized are to have additional

drilled/punched vent holes as required by good practice. After galvanizing holes located on the underside of the member and not visible in the completed structure, may remain open. Otherwise fill hole and repair galvanized finish.

17. Supply suitable anchor bolts for base plates and bearing plates for installation under Section 03 30 00.
18. Base plate sizes shown on the drawings are finished sizes. Allow additional thickness as required for milling.
19. Fabricate beam openings as detailed.
20. Supply steel grating, 'matched' complete with banded edges and bolted fasteners.

2.03 QUALITY CONTROL

1. All materials and fabrication shall be subject to test by a testing and inspection company appointed by the Consultant.
2. Provide access to the work in the shop for the personnel of the inspection company.
3. Provide such samples of materials as may be required by the inspection company at no additional cost to the Owner.
4. Provide Mill Test Reports for review by the Consultant at no additional cost to the Owner
5. The cost of testing will be paid for from the Testing Allowance in accordance with the General Conditions.
6. Testing and inspection schedule:
 1. Visual Inspection
 - a. During erection of structural steel, two [2] field visits to inspect general fit-up, conformance with reviewed erection diagrams, conformance of with respect to CSA S16 erection tolerances for plumbness and horizontal alignment of columns and beams respectively, bolt torque, field welded moment connections.
 - b. During installation of roof and floor deck, one [1] field visits to confirm nominal core thickness of deck, side lap button punching, conformance to the installer's CWB approved welding procedures, spacing and size of welds, adherence to details shown on the reviewed shop drawings.
 2. Reports
 - a. Typed written reports are to be provided to the consultant within three days of the testing and or inspection.
 - b. Reports are to include a list of defects, date discovered, date

corrected.

PART 3: EXECUTION

3.01 EXAMINATION

1. Examine and obtain all necessary measurements of previously executed and existing work which may affect the work of this Section.
2. Make a line and level survey of the foundations and anchor bolts. Report any discovered discrepancies to the Architect so that instructions can be given for the necessary remedial action.

3.02 ERECTION

1. Accurately set all steel to the lines and elevations shown on the drawings. Temporarily connect all members with sufficient bolts to ensure the safety of the structure until permanent connections are made.
2. Assemble all members without twists or open joints. Take particular care that all parts are well pinned-up and drawn together before bolting or welding is started.
3. Assume full responsibility for the correct plumbing and alignment and for setting of all members.
4. If members do not fit properly in the field, repairs must be made by methods to the satisfaction of the Consultant. In no case shall cutting be done with a torch except where specific approval as to size and location of same is granted by the Consultant. Unfair holes shall be enlarged with a twist drill and large bolts used.
5. Set column base plates and beam bearing plates on steel shims or other suitable supports. DO NOT USE LEVELLING PLATES. Grouting under these plates will be by Section 03 30 00, 'Cast-In-Place Concrete'.
6. Erect the steel frame true and plumb. Place temporary bracing where necessary to support all loads to which the incomplete building may be subjected such as wind, equipment or construction procedures. Leave temporary bracing in place as long as necessary for the safety of the structure.
7. Erection tolerances in accordance with CSA -S16. Take particular care in the erection of exposed members.
8. Erection of structural steel in accordance with CSA-S16.
9. Handle member with either inorganic zinc epoxy or hot dip galvanized finishes with appropriate slings and protection to avoid damage to finish.
10. All bolts to be tensioned as for 'slip critical' connections.

3.03 FIELD PAINTING

1. Except as noted below, field paint, using the shop primer, all scars, blemishes, bolts and welds not previously shop painted or those areas damaged by erection procedures.
2. For members which are hot-dipped galvanized, touch up all scars, scratches, etc., with a compatible zinc rich paint.
3. For exterior exposed steel
 1. Field touch up scratches by scuff sanding primer with Aluminum Oxide 100 grit sandpaper and apply 2 coat of Catha-Coat 302V Inorganic Zinc primer.
 2. Field welds to be ground smooth and power brush cleaned to remove all spatters and apply 2 coats of Catha-Coat 302V Inorganic Zinc primer.
4. For columns, base plates, and anchor bolts placed below grade, apply base plate and column corrosion protection to within 12 millimeter below the exposed level.

3.04 FIELD QUALITY CONTROL

1. Provide access to the work at the site for the personnel of the inspection company.
2. Testing shall be carried out at the option of the Consultant and will be paid for from the Testing Allowance in accordance with Division 1, except that any retesting required due to defective work shall be borne by the Contractor.

3.05 CLEAN-UP

1. At the completion of the work of this Section, remove any excess materials, debris, and equipment from the site.

END OF SECTION

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.
2. Provide the Unit Prices as listed in the 'Schedule of Structural Unit Prices' in Division 1.

1.02 SCOPE OF WORK

1. Supply all materials; provide all labour and equipment to erect the steel deck as shown or required by the drawings or specifications. The principal items include but are not limited to steel floor deck steel, roof deck, closures, flashing plates and accessories.

1.03 RELATED WORK SPECIFIED ELSEWHERE

1. Structural Steel – Section 05 12 23.
2. Roofing, Flashing and Sheet Metal - Division 7.

1.04 APPLICABLE STANDARDS

1. All standards to be latest issue with amendments.
2. C.S.A. Standard S136, "Cold Formed Steel Structural Members".
3. C.S.A. Standard W47.1, "Certification of Companies for Fusion Welding of Steel Structures".
4. Ontario Building Code.
5. Manufacturing Standards, Canadian Sheet Steel Building Institute.

1.05 SHOP DRAWINGS

1. Examine all drawings forming a part of this Contract and conform to the requirements of all such drawings.
2. Prepare shop drawings to supplement the Consultant's drawings. Report any discrepancies in the Contract Drawings to the Consultant. Make allowances for clearance and provide details of framing around openings where these are not detailed on the drawings.
3. Shop drawings shall show the position, extent, type, and arrangement of the units, their relationship to other materials, depths, thicknesses, connections and

accessories.

4. The Consultant's review of shop drawings will not relieve the Contractor from his responsibility for ensuring that his work is complete, accurate and in accordance with the drawings and specifications.
5. Examine the Mechanical and Electrical Drawings to establish the number, size, and location of all openings through the deck.
6. The use of reproduced copies of the Consultant's drawings for erection diagrams will not be allowed.
7. Submit shop drawings in accordance with the General Conditions except as noted below.
8. Submit one ADOBE PDF file, (Adobe Portable Document Format) for each erection diagram, complete with the General Contractor's shop drawing review stamp and with the required information completed, for review by consultant.
9. Provide one ADOBE PDF file, (Adobe Portable Document Format) for each shop fabrication/detail diagram requested by the consultant for review.
10. At the completion of the work, provide
 1. A complete set of ADOBE PDF files, (Adobe Portable Document Format) for both erection and shop fabrication/detail diagram showing "as-built" conditions including final sizes and locations of openings and final locations of mechanical units.
 2. Two complete paper sets of the erection diagrams to the Consultant showing "as-built" conditions including final sizes and locations of openings and final locations of mechanical units.

1.06 CO-ORDINATION

1. Co-ordinate the work of this Section with the scheduling in accordance with the General Conditions.
2. Co-ordinate the work of this Section with the work of Section 05 12 23, "Structural Steel" to ensure a continuous erection, procedure.
3. Supply and erect steel deck at such a rate and in proper sequence so that the schedule is maintained.

1.07 DESIGN CRITERIA

1. The drawings show the minimum thicknesses and depths of the deck sections.
2. Design all floor and roof deck to support the sum of the live load and dead load

(LL + DL) shown on the drawings for each area in accordance with the requirements of C.S.A. Standard S136. Loading requirements, including snow drift patterns, are shown on the drawings.

3. Design Deflection of the roof deck shall not exceed 1/360th of the span under a live load of 1.92 kPa (40 psf). Do not use drift loads to calculate deflections.
4. Deflection of composite floor deck not to exceed 1/360th of the span under a live load of 4.80 kPa (100 psf).
5. Design and detail units to run over three or more supports except where the structural steel layout does not permit. NOTE. Where the roof structure has been detailed to slope for drainage, detail the units to avoid kinks at changes and or transitions in slopes.
6. Composite deck will **not** be shored.
7. Deck systems act as a structural diaphragm. Deck must close with perimeter boundary members to ensure integrity of diaphragms. Detail flashing plates at change of deck directions as required for diaphragm. Provide L40 x 40 x 3 closure angle welded to deck and boundary members where deck ends at high flute.
8. Design suitable reinforcing or framing details around openings (where these are not specifically detailed on the drawings) to suit the opening size and loading condition.

1.08 STORAGE & HANDLING

1. Exercise care in storing, handling, and placing the steel deck units to prevent damage likely to impair the adequacy or appearance of the material in the finished structure.
2. Replace or correct damaged material to the approval of the Consultant.

1.09 SPECIAL CONDITIONS

1. The site is adjacent to the existing college. The Contractors attention is drawn to the fact that the building is fully operational and must be kept operational. The presence of existing buildings, fire & vehicle routes, roadways and site works which may affect the work of this Section including hoisting, delivery and the availability of lay-down areas.
2. The Contractor's attention is drawn to the presence of an existing service tunnel adjacent to the area of the new link addition. The roof of the existing tunnel is not to be used as a thoroughfare for construction traffic, the storage of materials or a setup location of mobile crawler or wheeled cranes.

1.10 QUALITY ASSURANCE

1. All welding to be carried out by experienced 'deck' welders holding current C.W.B. certification for 'deck' welding and currently employed by a Division 1 or 2 company.

PART 2: PRODUCTS

2.01 MATERIALS

1. Steel Sheets: For the fabrication of deck sections, metal closures, straps and flashings in accordance with A.S.T.M. Standard A653 SS Grade 33.
2. Zinc Coating:
 1. Class ZF75, for acoustic roof deck and composite floor deck, ('wipe coat')
 2. Class Z275, applied before forming by a hot dipping process for other roof deck.
3. Metal Roof Deck:
 1. 38mm deep with flutes at 150 millimeters on centre with **minimum** nominal core thickness of 0.91 millimeters. See structural drawings for extent of 1.22 mm and 1.52 mm nominal core thickness 38 mm deck and Special Conditions. RD938 by Vicwest, or P-3615 by Canam, or approved alternate by Agway.
 2. 76mm deep with flutes at 150 millimeters on centre with minimum nominal core thickness of 0.91 millimeters RD306 by VicWest or P-2436 by Canam, or approved alternate by Agway.
4. Acoustic Roof Deck:
 1. 38mm deep with flutes at 150 millimeters on centre with minimum nominal core thickness of 0.91 millimeters RD938-A by VicWest or P-3615-A by Canam, or approved alternate by Agway.
 2. 76mm deep with flutes at 150 millimeters on centre with minimum nominal core thickness of 0.91 millimeters RD306-A by VicWest or P-2436-A by Canam, or approved alternate by Agway.
5. Composite Floor Deck:
 1. 38mm deep with flutes at 150 millimeters on centre with minimum nominal core thickness of 0.91 millimeters HB938 by VicWest or P-3615 composite by Canam, or approved alternate by Agway.
 2. 76mm deep minimum nominal core thickness of 0.91 millimeters HB306 with flutes centred at 152mm (6") on centre manufactured by Vicwest, P-2432 with flutes at 305mm (12") on centre manufactured by Canam or approved alternate.
6. Finishing Channels: 1.52mm (0.060") (minimum) thickness.

7. Flashing Sheets, Deck Flute Closures & Edge Screeds: 1.22mm (0.048") (minimum) thickness.
8. Deck Edge Supports: Steel angle 38x38x3.2 or 38x38x4.
9. Sound Absorbing Elements: Fibreglass AF110 mineral fibre insulation batts, shaped to fit all acoustic flutes. Density 18 kg/m³.

2.02 FABRICATION

1. Form all deck units to have interlocking male and female side laps. Embossed or rolled mechanical indentations for mechanical bonding for composite deck.
2. Provide sheet steel cover plates as noted on the drawings and to cover gaps where deck units abut or change direction.
3. Provide steel angle 40 x 40 x 3 deck supports to close between deck units and spandrel members, and deck edge supports (as required) to maintain the integrity of the diaphragms.
4. Supply sound absorbing elements to Division 7 for installation.

PART 3: EXECUTION

3.01 EXAMINATION

1. Examine and obtain all necessary measurements of previously executed work which may affect the work of this section.
2. Report any discovered discrepancies to the Consultant so that instructions can be given for any remedial action.

3.02 ERECTION

1. Erection of steel deck shall be performed by the erection forces of the manufacturer. Sub-letting of the erection of these materials will not be allowed without the prior written consent of the Consultant.
2. Place and align units in their final position on the supporting steel structure prior to making permanent connections.
3. Provide any temporary connection of the deck to the supporting structural steel to prevent displacement of the deck due to construction operations, wind forces, etc., which may result in a hazardous condition.
3. Provide permanent connection of steel deck to the supporting steel structure with 20mm diameter puddle welds as shown on the structural drawings. Refer to the S-100 series structural drawings and standard detail 5-A for the weld

requirements but provide welded connections not less than the following:

- a. End Welds: each flute for each sheet
 - b. Perimeter welds: 450mm (18") on centre
 - c. Intermediate supports: every flute for each sheet
 - d. Weld both low flutes on each side of deck laps
5. Ensure that welds penetrate through deck and flashing sheets where double thickness occurs.
 7. Exercise care to avoid burning through joist chords. Damaged joist chords will be repaired under the direction of the Engineer at no additional cost to the Owner.
 8. Clinch all male and female side laps mechanically as shown on the structural drawings. Refer to the S-100 series structural drawings and standard detail 5-A for clinching requirements but clinch all male and female laps mechanically at not less than at 300 o.c. (12") maximum.
 9. Cut and reinforce, where necessary, all holes through the deck where secondary structural framing is not specifically shown around the openings as designed under Sub-Section 1.07.8 of this Section. Exact location of openings will be established on site by the trades concerned.
 10. Install all flashing plates, closures, and finishing channels.
 11. If low flute of deck does not 'close' with perimeter angle, provide L40x40x3 welded to vertical leg of perimeter angle at 300 o.c. to provide welding base for deck.
 12. Clean the new deck of all debris, welding rods, oil and grease or other materials likely to have a harmful effect on the application of the roofing system or bond to concrete.

3.03 FIELD PAINTING

1. Field paint with a compatible zinc rich paint, all welds, burns, scratches or other defects of the zinc finish of the deck units for the roof system. VOC limit 250 g/L.

3.04 REPAIR AND MAKE GOOD

1. Just prior to installation of roofing, review all areas of roof deck for damage which affects the structural capacity or performance of the roofing system. Repair and make good all such damage to restore the deck.

3.05 CLEAN-UP

1. Remove any excess materials, debris from site.

END OF SECTION

STRUCTURAL METAL STUDS

1.PART 1 GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

- a. Provide structural metal stud framing system, including design, for the Work

1.2.2. Related Work:

- a. Gypsum Board and Sheathing: Section 09 25 00

1.3. DESCRIPTION OF SYSTEM

- 1.3.1. Heavy gauge cold formed sheet steel studs spanning from structure to structure and supporting drywall, equipment, accessories and finishes.

- 1.3.2. Lateral deflection of vertical stud members to not exceed L360.

1.4. QUALITY ASSURANCE

1.4.1. Requirements of Regulatory Agencies: Conform to the requirements of the following:

- a. The 2012 Building Code Compendium, Part 4, Structural Design.
b. CSA S16-1-M, Steel Structures for Buildings, Limit States Design.
c. CSA S136-M, Cold Formed Steel Structures, , Limit States Design.

1.4.2. Industry Standards:

- a. Steel Framing Systems manual published by example Bailey Metal Products Limited or Dietrich Metal Framing Canada or KLM Kitchener Metals.
b. CSSBI Light Weight Steel Framing Manual.
c. CSSBI Standard 30M, Steel Building Systems.
d. CSSBI Bulletin No. 10, Wind Load Design Criteria for Steel Building Systems.

1.4.3. Qualifications of Designer: Be a Registered Professional Engineer licensed in the Province of Ontario.

- 1.4.4. Tolerances: Erect stud framing plumb over entire building height and true to exterior line of building to within 5 mm each floor or suite and 10 mm overall.

1.4.5. Design: Conform to OBC and CSSBI Bulletin No. 10 to deflection criteria defined.

- a. Minimum depth of stud: 90mm.
b. Maximum deflection of horizontal member: 1/240.
c. Design Load wind: 1.0 kPa

STRUCTURAL METAL STUDS

- d. Design Dead Load: 1.0 kPa.
- 1.5 SUBMITTALS
- 1.5.1. Shop Drawings: Submit Shop Drawings, showing all elements of adjacent walls, floors and roof framing systems and calculations for systems showing design loads and deflections, bearing the stamp and seal of a Professional Engineer licensed in the Province of Ontario.
2. PART PRODUCTS
- 2.1. MATERIALS
- 2.1.1. Metal Studs:
 - a. Cold formed sheet steel studs conforming to CAN3 S136-M with Z25 galvanized.
 - b. Depth of metal studs as shown on drawings, thickness shall conform to design requirements.
 - c. With knock outs in web for horizontal services and bracing.
 - 2.1.2. Top and Bottom Runner Channels: 'C' channels, as per metal studs, thickness as required. designed.
 - 2.1.3. Furring Channels: 22.2 mm deep, 35 mm knurled face, minimum 0.53 core sheet thickness, Z275 galvanized.
 - 2.1.4. Sheathing Board: Dens glass Gold by Georgia-Pacific, or cement board at Stucco System 2 by Roc-Crete Industries or exterior sheathing board by CGC Inc.
 - 2.1.5. Screws: Self-drilling, self-tapping, galvanized steel length and gauges to be designed.
 - 2.1.8. Isolation Strip: 3 mm thick by 92 mm wide, foam strip.
3. PART EXECUTION
- 3.1. INSTALLATION
- 3.1.1. Top Runner Channel Expansion Track:
 - a. Determine necessary location of top runner channel to provide plumb of wall to within specified tolerances.
 - b. Secure continuous top runner channel in accordance with shop drawings.
 - 3.1.2. Wall Panels:
 - a. Assemble in accordance with shop drawings to tolerance of 1:1000.
 - b. Fabricate with top and bottom runner channels to provide 12 mm minimum/15 mm maximum clearance within top runner expansion joint.
 - c. Frame all openings fully with studs, include openings for doors, windows, HVAC vents, etc.
 - d. Provide reinforced box stud assemblies at all openings, designed to resist lateral structural loads.
 - e. Tack in place isolation strips to isolate studs from contact with concrete.

STRUCTURAL METAL STUDS

- f. Erect panels by tucking panel top into top runner, with seal in place, and locate bottom of panel accurately at floor.
- g. Secure panels in place by attaching bottom runner to floor slab as per shop drawings.
- h. Provide furring above and below location of electrical boxes set with face flush to inside of stud panel.
- i. Provide minimum two studs extending from floor to ceiling at each side of opening wider than stud centres.

END OF SECTION

STRUCTURAL METAL STUDS

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METAL FABRICATIONS

PART 1	GENERAL
1.1	GENERAL REQUIREMENTS
.1	Conform to Division 01, General Requirements.
1.2	SECTION INCLUDES
.1	Shop fabricated metal items for the Work.
1.3	RELATED SECTIONS
.1	Section 04 20 00: Installation of metal fabrications in masonry.
.2	Section 06 20 00: Installation of misc. items.
1.4	REFERENCES
.1	ASTM A53M-04a- Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
.2	ASTM A123M-02- Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
.3	ASTM A153M-04- Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
.4	ASTM A307-04- Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
.5	ASTM A325M-04a- Specification for High-Strength Bolts for Structural Steel Joints [Metric]
.6	ASTM A653M-04a- Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
.7	ASTM B117-03- Practice for Operating Salt Spray (Fog) Apparatus
.8	ASTM E119-05a- Test Methods for Fire Tests of Building Construction and Materials
.9	ASTM E736-00(06)- Test Methods for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
.10	ASTM F436M-04- Specification for Hardened Steel Washers [Metric]
.11	ASTM F738M-02- Specification for Stainless Steel Metric Bolts, Screws, and Studs
.12	ASTM F836M-02- Specification for Style 1 Stainless Steel Metric Nuts
.13	ASTM F844-04- Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
.14	CAN/CGSB-1.181-99- Ready-Mixed Organic Zinc-Rich Coating
.15	CAN/CGSB-85.10-99- Protective Coatings for Metals
.16	CSA G40.20-98- General Requirements for Rolled or Welded Structural Quality Steel
.17	CSA G40.21-98- Structural Quality Steel
.18	CAN/CSA-G164-M92- Hot Dip Galvanizing of Irregularly Shaped Articles
.19	CSA S136-01- Cold Formed Steel Structural Members
.20	CSA W47.1-03- Certification of Companies for Fusion Welding of Steel Structures
.21	CSA W47.2-M87- Certification of Companies for Fusion Welding of Aluminum
.22	CSA W48.1-M91- Carbon Steel Covered Electrodes for Shielded Metal Arc Welding
.23	CSA W59-M03- Welded Steel Construction (Metal Arc Welding)
.24	CSA W117.2-94- Safety in Welding, Cutting, and Allied Processes
.25	SSPC- Steel Structures Painting Council, ASteel Structures Painting Manual, Vol. 2"

METAL FABRICATIONS

1.5 SUBMITTALS

- .1 Product Data: Provide data on compatibilities, and limitations of product.
- .2 Maintenance Data: Provide data on maintenance of installed system.
- .3 Shop Drawings: Submit shop drawings for work of this Section in accordance with Section 01 33 00. In addition to minimum requirements indicate following:
 - .1 large scale details of members, materials and connections.
 - .2 jointing details.
 - .3 methods of setting, sealing, securing, anchorage.
 - .4 field connections.
- .4 Submit shop drawings for following work bearing the stamp of a Professional Engineer registered in the Province of Ontario:
 - .1 steel stairs.
 - .2 handrails, pipe handrails and balustrades.
- .5 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - .1 extruded and formed metals: minimum 300 mm (12") long.
 - .2 metal sheet: minimum 300 mm (12") square and of specified thickness.

1.6 QUALITY ASSURANCE

- .1 Welding: Provide welding in accordance with CSA W59-M performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau as specified herein.
- .2 Structural Design and Inspection:
 - .1 Employ a professional structural engineer carrying a minimum \$2,000,000.00 professional liability insurance and is registered in the province of Ontario to:
 - .1 design components of the work of this Section requiring structural performance.
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - .4 be responsible for production and review of shop drawings.
 - .5 inspect work of this Section during fabrication and erection.
 - .6 stamp and sign each shop drawing.
 - .7 provide site administration and inspection of this part of the Work.
 - .2 Design following:
 - .1 stairs including landings and supports.
 - .2 balustrades, handrails, railings.
- .3 Certification:
 - .1 Submit certification from registered professional structural Engineer registered in province of Ontario, who shall affix his/her seal and signature to certificate, stating structure is capable of supporting its own weight and specified live loads.
 - .2 Welders employed on this Project may be asked by Consultant at any time for their welding certificate.

METAL FABRICATIONS

- 1.7 DELIVERY, STORAGE AND HANDLING
- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond the designed limits.
 - .2 Handle and store metal materials at job site in such a manner to prevent damage to other materials, (to existing buildings) or property.
 - .3 Handle components with care, and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.
- PART 2 PRODUCTS
- 2.1 MATERIALS – STEEL
- .1 Structural Shapes, Plates, Etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.
 - .2 Hollow Structural Sections: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.
 - .3 Steel Pipe: ASTM A53, Type E or S, Grade A or B, Standard weight, Schedule 40.
 - .4 Stainless Steel:
 - .1 Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.
 - .2 Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A167 or ASTM A666, Type 304 and Type 316 alloy with exposed surfaces having No. 4 polished finish. Sizes as required to meet design requirements.
 - .1 Perforated: thickness indicated, with machine die cut round holes of 3 mm (1/8") dia. at 5.537 mm (0.218") oc in 60E staggered pattern and similar to sheet stock manufactured by Greening Donald Co. Ltd., or by Unalloy WRC- a division of Samuel Manu-Tech Inc. or by Gerard Daniel Worldwide.
 - .3 Stainless Steel Tubing: ASTM A554, Grade MT 304.
 - .4 Stainless Steel Exterior Tubing: ASTM A554, Grade MT 316.
 - .5 Stainless Steel Pipe: ASTM A312M, Grade TP 304.
 - .6 Stainless Steel Exterior Pipe: ASTM A312M, Grade TP 316.
 - .7 Castings: ASTM A743M, Grade CF 8 or Grade CF 20. Type 304.
 - .8 Castings: ASTM A743M, Grade CF 8M. Type 316.
 - .9 Exterior Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A666, Type 316.
 - .10 Exterior Stainless Steel Bars and Shapes: ASTM A276, Type 316.
 - .11 Refer to Drawings for stainless steel work.
 - .5 Structural aluminum: to CSA HA series - M, Type 6061-T6, clear anodized.
 - .6 Welding Materials: Conforming to CSA W48.1-M and CSA W59-M.
 - .7 High Strength Bolts: Supply bolts, nuts and washers conforming with ASTM A325M. Supply each type and size of bolt and nut of same manufacture and of same lot.
 - .1 Bolts: Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thick-ness of members joined and for type of connection.
 - .2 Nuts: Heavy hexagon semi-finished nuts.

METAL FABRICATIONS

- .3 Washers: For general use bolt, nut and stud application to provide increased bearing surfaces, spacing and to prevent galling. Flat and smooth hardened washers, quenched and tempered to suit applications and conforms to ASTM F844. Provide AISI Type 304 stainless steel washers at exterior locations.
- .4 Hardened Steel Washers: To suit applications and conforms to ASTM F436M.
- .5 Stainless Steel Bolts: To suit applications and conforms to ASTM F738M.
- .6 Stainless Steel Nuts: To suit applications and conforms to ASTM F836M.
- .7 Lock Washers: Helical spring type steel lock washers to suit applications and conforms to Federal specification FF-W-84. Provide AISI Type 304 stainless steel lock washers at exterior locations.
- .8 Exterior Vandal Resistant Fasteners: AISI Type 304 stainless steel, dual pin type vandal resistant fasteners to suit applications and acceptable to Consultant.
- .9 Security Fasteners: Button head Torx Plus R screw tamper resistant # 10, 25 mm (1") long 2 per glass stop minimum stainless-steel machine screws.
- .8 Common or Ordinary Bolts and Anchor Bolts: Unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm (1/4") beyond nut, without the use of washers. Supply anchor bolts of lengths noted but projecting not less than 13 mm beyond nut unless otherwise noted.
- .9 Galvanized Primer Paint: Zinc rich conforming to CAN/CGSB-1.181 for new galvanized metal.
- .10 High Performance Corrosion Protection for Perimeter Steel: 1 component, moisture cured, micaceous iron oxide/zinc filled primer, UL Classified in accordance with UL 263 (ASTM E119), corrosion protection in accordance with ASTM B117, meeting Class B Slip Certification in accordance with American Institute of Steel Construction (AISC) requirements for slip critical bolted connections, tested in accordance with ASTM E736 for its suitability for application of primer over steel to receive sprayed fireproofing, Series 394, PerimePrime by Tnemec Company Incorporated; www.tnemec.com.
- .11 Steel Pipe Handrails: Conforming to ASTM A53M, Type "S", Schedule 40, Grade A steel pipe of sizes shown.
- .12 Steel Pipe Bumpers: Conforming to ASTM A53M, Schedule 80 steel pipe of sizes shown.
- .13 Galvanizing: Hot dipped galvanizing with minimum zinc coating of 600 g/m² to CAN/CSA-G164-M.
- .14 Galvanized Sheet Steel: Supply 0.91 mm (20 ga) core thickness commercial quality to ASTM A653M, CS Type A, with Z275 zinc coating designation to ASTM A653M.
- .15 Perforated Sheet Steel: Commercial flattened sheet steel of thickness indicated, with machine die cut round holes of 3 mm dia. at 5.537 mm oc in 60E staggered pattern and similar to sheet stock manufactured by Greening Donald Co. Ltd., or by Unalloy WRC- a division of Samuel Manu-Tech Inc. or by Gerard Daniel Worldwide.
- .16 Expanded Steel Mesh: Flattened, expanded, carbon steel mesh of 10 msg gauge thickness, weighing minimum 112 lbs/100 sq ft, style 1.330" SWD x 3.200" LWD, 11mm - No.9 by Gerard Daniel Worldwide, Canadian Division, or Expanded Metal Corporation or Dramex International.

METAL FABRICATIONS

- .17 Welded Steel Wire Mesh: 50 mm x 50 mm x 0.135" diameter, welded carbon steel wire mesh conforming to ASTM A510 by Gerard Daniel Worldwide, Canadian Division
- .18 Aluminum Extrusions: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063- T5 or T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.
- .19 Aluminum Sheet: ASTM B221M, Minimum thickness 3 mm of type and characteristics to match finished extrusions; sheet which is not exposed shall be Utility Aluminum mill finished; for intricate forming with decorative finishes use AA 1100 and for siding and exposed panels use AA-3003 with specified finish.
- .20 Checkered Plate: Aluminum and steel plate types and sizes as shown.
- .21 Grout:
 - .1 Cementitious, non shrinking, non expanding grout: Sika Grout 212 by Sika Canada Inc., or Non Shrink Structural Grout - Dry Pack Grout by Euclid Chemical Company or Sealtight CG 86 Construction Grout by W.R. Meadows.
 - .2 Epoxy, non-shrinking, non expanding grout: Sika Anchor Fix.

2.2 FABRICATION

- .1 Fabricate each item of work of this Section in accordance with following general requirements:
 - .1 members square, straight, plumb and true.
 - .2 joints accurately and tightly fitted.
 - .3 intersecting members in true, flush planes.
 - .4 fasteners concealed.
- .2 Fabricate, fit and assemble work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.
- .3 Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plates and bracing, fitting, drilling, stopping, soldering, as required for a complete assembly.
- .4 Insulate dissimilar metals to prevent galvanic corrosion.
- .5 Weld connections unless otherwise indicated.
- .6 Shop Welding:
 - .1 Execute welding to avoid damage or distortion to the Work. Should there be, in the opinion of Consultant or Inspection Company, doubt as to adequacy of welds, they shall be tested for efficiency and any work not meeting Standards be removed and replaced with new work satisfactory to Consultant. Carry out welding in accordance with following standards:
 - .1 Fabricator shall be fully certified by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.
 - .2 CSA W48-M - for Electrodes (If rods are used, only coated rods are allowed).
 - .3 CSA W59-M - for design of connections and workmanship.
 - .4 CSA W117.2 - for safety.
- .7 Thoroughly clean welded joints and steel exposed for a sufficient space to properly perform welding operation. Neatly finish welds. Ensure welds exposed to view and finish painted are continuous and ground smooth.
- .8 Provide exposed metal fastenings and accessories of same material, texture, colour and finish as base metal to which they are applied or fastened.

METAL FABRICATIONS

- 2.3 FINISHES
- .1 Cleaning and Shop Painting:
 - .1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter.
 - .2 Shop prime steel with 1 coat of primer paint to dry film thickness of 0.025 mm (1 mil). Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C (45 deg F). Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.
 - .3 Shop prime non galvanized perimeter steel members and structural steel members to receive sprayed fire resistive materials with 1 coat of high performance corrosion protection primer to dry film thickness of 0.025 mm (1 mil). Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C (45 deg F). Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.
 - .4 Shop prime galvanized steel in accordance with CAN/CGSB-85.10.
 - .5 Clean but do not paint surfaces being welded in the field and surfaces in contact after assembly.
 - .2 Hot Dip Galvanizing:
 - .1 After fabrication, hot dip galvanize specific miscellaneous steel items noted on Drawings and/or called for herein. Plug relief vents air tight. After galvanizing, remove plugs, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with "Galvafruid" by W.R. Meadows in accordance with manufacturer's printed directions.
 - .2 Galvanize members exposed to elements when in final location; members embedded on exterior side of exterior walls; members imbedded in concrete; members specified in this Section or noted on Drawings.
 - .3 Hot-dip galvanize members, in accordance with CAN/CSA-G164-M and the requirements of following ASTM standards, with minimum coating weights or thicknesses as specified:
 - .1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123M; average weight of zinc coating per sq/ft of actual surface, for 4.8 mm (3/16") and less thickness members 2 ounces, for 6 mm (1/4") and heavier members 2.3 ounces.
 - .2 Iron and Steel Hardware: ASTM A153M; minimum weight of zinc coating, in ounces per sq ft of surface shall be in accordance with Table 1 of ASTM A153M, for the various classes of materials used on the Project.
 - .3 Steel Sheet: ASTM A653M; weight of zinc coating, per sq ft on both sides of sheet. Coating designation Z275 (G90), minimized spangle and chemically treated.
 - .3 Colour: To be selected by Consultant.
 - .4 Aluminum: Exposed aluminum surfaces shall have clear anodized coating (Architectural Class II). Pre-treat aluminum with caustic tech treatment prior to applying integral, clear, anodic oxide coating. Apply clear, anodic oxide coating in accordance with AAMA 611, 0.4 mils minimum coating thickness and also conforms to Aluminum Finish Designation AA-M12C22A31, Architectural Class II. Protect clear anodized coating with removable protective film.

METAL FABRICATIONS

- .5 Zinc-rich primer: Ready, mixed, zinc-rich primer conforming to CAN/CGSB-1.181. Acceptable Products and manufacturers shall be Sealtight Galvafrid Zinc-Rich Coating by W. R. Meadows of Canada Limited, or Zinc Clad No.7 Organiz Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or other Product and manufacturer acceptable to Consultant.
- .6 Bituminous Paint: To provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers. Acceptable Products and manufacturers shall be Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, or other Product and manufacturer acceptable to Consultant.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that field conditions are acceptable and are ready to receive work.
- .3 Verify dimensions, tolerances, and method of attachment with other work.

3.2 INSTALLATION

- .1 Verify dimensions at the Place of the Work to ensure work of this Section fits to that of other parts of the Work.
- .2 Erect the work of this Section plumb, square, true and level.
- .3 Securely anchor the work of this Section and rivet, weld or bolt to structural framing of the building. Where secured to concrete, provide bolts for setting in concrete. Provide expansion bolt supports to masonry.
- .4 Provide necessary fitting, setting and cutting required in connection with the fitting of work of this Section to other parts of the Work.
- .5 Field Painting: Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up with matching paint, shop primer damaged during transit and installation.
- .6 Erect stair work to line, plumb, square, true and level, with runs of stairs registering level with floor levels.

3.3 CLEANING

- .1 On completion of installation, carefully clean metal work.

3.4 ERECTION TOLERANCES

- .1 Maximum Variation From Plumb: 6 mm per story, non-cumulative.
- .2 Maximum Offset From True Alignment: 6 mm.
- .3 Maximum Out-of-Position: 6 mm.

END OF SECTION

METAL FABRICATIONS

ROUGH CARPENTRY

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Blocking in openings.
.2 Wood furring and grounds.
.3 Telephone and electrical panel back boards.
.4 Concealed wood blocking for support of accessories.
.5 Preservative treatment of wood.
- 1.3 RELATED SECTIONS
- .1 Section 04 20 00 Masonry openings to receive wood blocking.
- 1.4 REFERENCES
- .1 ANSI/NPA A208.1-1999 - Particleboard.
.2 APA (American Plywood Association) - Grades and Specifications.
.3 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
.4 CSA-B111-1974(R2003) - Wire Nails, Spikes and Staples.
.5 CSA-O121-08 - Douglas Fir Plywood
.6 CSA-O141-05 - Softwood Lumber.
.7 CSA-O151-04 - Canadian Softwood Plywood.
.8 CSA-O153-M1980 (R2003) - Poplar Plywood.
.9 CSA-O80 Series-08 - Wood Preservation.
.10 CSA-O437 Series-93 (R2006) - OSB and Waferboard.
.11 National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber, 2007 Edition.
- 1.5 SUBMITTALS
- .1 Product Data: Provide technical data on wood preservative materials.
.2 Installation Data: Provide application instructions.
- 1.6 QUALITY ASSURANCE
- .1 Lumber Products: Graded and stamped to NLGA requirements. Pressure treated and fire Treated.
.2 Plywood Products: Certified and graded to CANPLY requirements. Pressure treated and fire treated.
- PART 2 PRODUCTS
- 2.1 MATERIALS
- .1 Lumber: NLGA, CSA-O141, Spruce-Pine-Fir, kiln dried, FSC Certified Wood.
.2 Plywood: CSA 0121-M, Douglas Fir, FSC Certified Wood.
.3 Mat-Formed Panelboards: CSA-O437, OSB to CSA-0325.0-92, 1R24/2F16.

ROUGH CARPENTRY

2.2 ACCESSORIES

- .1 Fasteners and Anchors:
 - .1 Bolts, Nuts and Washers: CSA-S16.1-M and ASTM A325, standard structural grade, hexagonal nuts. Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - .2 Nails and Screws to CSA Wafer head, Type W rust resistant, bugle head, coarse thread, sharp point for wood and Type S-12 bugle head, self-tapping, rust-resistant, fine thread for heavy gauge steel.
 - .3 Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.
- .2 Moisture Barrier under all wood products bearing on concrete: Commercial compressible sill plate gasket material, continuous strip by width to match plate width.

PART 3 EXECUTION

3.1 FRAMING

- .1 Set members level and plumb, in correct position.
- .2 Place horizontal members, crown side up.
- .3 Construct curb members of single pieces.
- .4 Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

3.2 INSTALLATION

- .1 Provide specified moisture barrier under all wood products resting on concrete.
- .2 Provide 38mm x 89mm wood or 25mm thick plywood back blocking for all wall mounted cabinets and millwork and items such as handrails, grab bars and washroom accessories as well as wall mounted door stops
- .3 Provide Equipment back panels as called for in other Divisions of the Specifications.

END OF SECTION

FINISH CARPENTRY

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Finish carpentry items.
.2 Hardware and attachment accessories.
.3 Receive and install: Architectural woodwork, metal fabrications as specified, doors, door frames, finish hardware, ceiling access hatches, access doors for concealed mechanical equipment, door grilles, chalkboards, washroom and janitorial accessories, built-in equipment.
- 1.3 RELATED SECTIONS
- .1 Section 05 50 00 – Metal Fabrications.
.2 Section 06 10 00 - Wood Blocking and Curbing.
.3 Section 06 41 11 - Architectural Cabinetwork.
.4 Section 09 91 10 - Painting: Painting and finishing of finish carpentry items.
- 1.4 REFERENCES
- .1 ANSI A208.2-2002 - Medium Density Fibreboard (MDF) for Interior Applications.
.2 ANSI/BHMA A156.9-2003 - Cabinet Hardware.
.3 ANSI/NPA A208.1-1999 - Particleboard.
.4 ASTM E84-06 - Test Method for Surface Burning Characteristics of Building Materials.
.5 AWMAC (Architectural Woodwork Manufacturers Association of Canada) - Quality Standards, 8th Edition.
.6 CAN/CGSB-11.3-M87 - Hardboard.
.7 CAN/CGSB-11.5-M87 - Hardboard, Precoated, Factory Finished, for Exterior Cladding.
.8 CSA-O80 Series-08 - Wood Preservation.
.9 CSA-O121-08 - Douglas Fir Plywood
.10 CSA-O141-05 - Softwood Lumber.
.11 CSA-O151-04 - Canadian Softwood Plywood.
.12 CSA-O153-M1980 (R2003) - Poplar Plywood.
.13 CHPVA (Canadian Hardwood Plywood and Veneer Association) - Official Grading Rules for Canadian Hardwood Plywood.
.14 NEMA (National Electric Manufacturers Association) LD3-2000 - High Pressure Decorative Laminates.
.15 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2007 Edition.
.16 NHLA (National Hardwood Lumber Association).
- 1.5 SUBMITTALS
- .1 Product Data: Provide data on fire retardant treatment materials and application instructions.
.2 Shop Drawings:

FINISH CARPENTRY

- .1 Indicate materials, component profiles, fastening methods, jointing details, accessories.
 - .3 Installation Data: Provide application instructions.
- 1.6 QUALITY ASSURANCE
- .1 Perform work in accordance with AWMAC Premium quality.
 - .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- PART 2 PRODUCTS
- 2.1 LUMBER MATERIALS
- .1 Softwood Lumber: CSA-O141; NLGA Spruce-Pine-Fir, "Construction" Light Framing Grade, FSC Certified Wood.
 - .2 Hardwood Lumber: AWMAC Custom Grade (Standard Grade at concealed hardwood), Hard Eastern Maple, FSC Certified Wood.
- 2.2 SHEET MATERIALS
- .1 Softwood Plywood: Douglas Fir, G1S, sanded, waterproof.
 - .2 Hardwood Plywood: AWMAC Architectural Grade on exposed faces and AWMAC Good Grade on exposed faces as indicated on drawings, Maple face or faces (each exposed face).
 - .3 Medium Density Fibreboard (MDF): ANSI A208.2, composed of wood particles reduced to fibres, made with high waterproof resin binders; of grade to suit application; sanded faces.
 - .4 Pegboard: Pressed wood fibre with resin binder, tempered grade; 3 mm thick with 4 mm diameter holes at 25 mm on centre.
 - .5 Plastic Laminate Panels: Solid plastic laminate, conforming to CAN3-A172-M79, Grade SS. Multiple layer, resin impregnated solid phenolic. Bevelled and burnished edges to expose substrate. Sizes as indicated on drawings.
 - .6 6mm natural fine grain Bangor cork rolls c/w Schluter aluminum edges and trims, fully adhered to Gypsum Board partitions.
- 2.3 ADHESIVES
- Waterproof, suited to work for which they are used, conforming to CSA 0112 Series-M.
- 2.4 FASTENERS
- .1 Nails: "Common spiral nails", for unfinished work, and "spiral finishing nails" for finished work, conforming to CSA B111. Galvanized nails for exposed exterior use.
 - .2 Wood Screws: CSA B35.4, Wood Screws, non-ferrous, corrosion-resistant alloy finished. Stainless steel for exterior use.
- 2.5 ACCESSORIES
- .1 Not used.

FINISH CARPENTRY

2.6 FABRICATION

- .1 Fabricate to AWMAC Custom standards.
- .2 Shop assemble work for delivery to site, permitting passage through building openings.
- .3 Prep doors and frames for (but not limited to) heavyweight hinges, continuous hinges, concealed vertical rod and mortise lock case exit devices, cylindrical locksets, surface door closures and concealed overhead stops.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that field measurements are as indicated on shop drawings.
- .2 Verify adequacy of backing and support framing.
- .3 Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

- .1 Install work to AWMAC Custom Quality Standard.
- .2 Set and secure materials and components in place, plumb and level.
- .3 Woodwork: Cut and fit accurately, neatly and true to line. Cope inside corners of wood base, screw fasten at 400 oc min., countersink and fill.
- .4 Securement: Secure woodwork and other products in accordance with manufacturer's recommendations for best results, in accordance with AWMAC standards, the Drawings and reviewed shop drawings and to best practice to ensure all work in place for long life under hard use.
- .5 Secure salvaged Elm planks using mechanical fasteners and adhesive.
- .6 Installation of Products from Other Sections: Collect and review shop and installation drawings of all such work. Install all such work in accordance with reviewed installation drawings and manufacturers printed instructions and directions.
- .7 Metal Fabrications: Install metal fabrications supplied by other Sections.
- .8 Doors and Screens: Hang wood and steel doors and screens plumb and accurately within openings, free of hinge bound condition.
- .9 Special Doors: Install locking ceiling access doors to manufacturer's instructions. Install access doors for concealed mechanical and electrical equipment in accordance with those Divisions, reviewed shop drawings and reviewed instructions.
- .10 Hardware: Install all hardware except cabinet hardware, unless specified otherwise. Install in strict accordance with manufacturer's instructions and as dictated by hardware schedule.
- .11 Provide all anchorage devices and attachments as required and install plastic laminate panels by anchoring securely to floor and walls. Hinge doors and adjust hinges of doors to operate properly.
- .12 Washroom and Janitorial Accessories: Install in accordance with Section 10800, reviewed shop drawings and reviewed instructions.
- .13 Grommets: Install in locations directed by Owner.

3.3 ERECTION TOLERANCES

- .1 Maximum Variation from True Position: 1.5mm.

FINISH CARPENTRY

.2 Maximum Offset from True Alignment with Abutting Materials: 0.7mm.

END OF SECTION

ARCHITECTURAL WOODWORK

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

Provide all architectural woodwork requiring shop fabrication c/w hardware.

1.2.2. Related Work Specified Elsewhere:

- a. Installation of this work: Section 06 20 00

1.3. QUALITY ASSURANCE

- 1.3.1. This Section to be an AWMAC member in good standing for two (2) years.

- 1.3.2. Quality Standards for Architectural Woodwork by the Architectural Woodwork Manufacturers Association of Canada (AWMAC), Premium Grade.

- 1.3.3. Manufacture and install Architectural Woodwork to the specified AWMAC Architectural Woodwork Standards manual, Latest Edition. Subject Architectural Woodwork to an inspection at the plant and/or site by an appointed inspector, approved by the local AWMAC Chapter. GIS Inspection costs paid through cash allowance.

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit shop drawings for review.

1.4.2. Samples:

- a. Submit samples of range of clear finishes available for selection by Architect.
- b. Submit samples 1 bd. ft. in size of each type of finish on each type of wood to be used;
- c. Submit samples of all joinery, if requested;
- d. Submit samples of plastic laminate.
- e. Submit samples of wood species and stains.
- f. Submit samples of hardware.

- 1.4.3. Reference Data:

ARCHITECTURAL WOODWORK

Provide finish materials catalogue cuts and maintenance instructions including warnings on wrong maintenance practices for insertion in Operating Manuals and Reference Data specified in Section 01 33 00, Submittals.

1.5. WARRANTY

- 1.5.1. Provide Millwork Contractors Association two-year Certificate of Guarantee for all work of this Section.

2. PART PRODUCTS

2.1. MATERIALS

- 2.1.1. Materials: See drawings.

- a. Medium Density Fiberboard: Industrial Grade Medium Density Fibreboard (MDF) with a formaldehyde free binder to ANSI A201.2-1994 density 740 Kg/m³, product class MD: paint grade, good/solid grade. 19mm thickness unless noted otherwise on drawings.
- b. Plywood: Douglas Fir, G1S, sanded, waterproof, 19mm thick unless noted - FSC Certified Wood.
- c. Veneer Plywood: Walnut and Oak faced, A grade flat cut, thickness as noted and/or required for curving- FSC Certified Wood.
- d. Solid Wood: Walnut and Oak - FSC Certified Wood.
- e. Plastic Laminate: Conforming to CAN3-A172-M, Standard Grade, 2mm thick except 1.25mm thick post forming grade where required, 0.50mm thick backing sheet, sanded one side by same manufacturer, colour and finish choice by Architect from Arborite, Formica, Nevamar or Wilsonart complete range. Premium finish (speckled, crystal or quarry etc.) at countertops.
- f. Thermofused Melamine: Certified EPP (Environmentally Preferred Product) by CPP (Composite Panel Association) and to NEMA LD-3-95 Grade VGL consists of a decorative paper impregnated and saturated with melamine resin, thermally fused under heat and pressure to MDF substrate. Overlay bonded to both faces to prevent warping.
- g. Solid Surface: Corian, 13mm thick, Designer White or equal by Avonite or Wilsonart.
- h. Door and Drawer Edges: 3mm vinyl, to match adjacent laminate or melamine colour/pattern.
- i. Nails, screws and fasteners: To CSA B111, galvanized for exterior work, plain finish elsewhere.

ARCHITECTURAL WOODWORK

2.1.2. Cabinet Hardware:

- a. Heavy Duty Hinges: Self closing, concealed European style 170° open, all metal plated parts with six - way adjustability by Blum, Hettic or Grass.
- b. Pulls: Brushed Aluminum, 100mm D-style pull.
- c. Drawer Slides: Heavy duty ball bearing carrier, fully extendable, heavy duty.
- d. Pilaster Strips and shelf Brackets: Brushed metal, recessed.
- e. Locks: Cam style, keyed same within each room, keyed different room to room. Applies to all door and drawers.

2.1.3. Adhesives: Waterproof resin type except for plastic laminate which shall be recommended by plastic laminate manufacturer, all conforming to CSA 0112 Series – M and in conformance with The South Coast Rule #1168 VOC limits for adhesives (www.aqmd.gov).

2.2. FABRICATION

2.2.1. Provide backing sheet on all plastic laminate work. Plastic laminate surfaces shall be free of core ghosting. Adjacent sheets of plastic laminate on finished work shall be matched in colour with seam inconspicuous. Do not use more than one sheet when a sheet size is available that will cover required area. Precision camber outside corners between finished surfaces.

2.2.2. Make all joints tight, flush, level and plumb.

2.2.3. No exposed fasteners on exterior surfaces of melamine panels in finished (installed) condition. Assemble melamine millwork using doweled/wafered-and-glued construction unless otherwise specified.

2.2.4. Make provisions for electrical, gas and water services and outlets and provide concealment of service lines in the work except where service connections must be exposed.

2.2.5. Seal edges of cut-outs in countertops with two coats of varnish.

2.2.6. Install hardware. Install all pulls horizontally.

2.2.7. Ship all work fully assembled as far as practicable. Otherwise fabricate for site assembly and provide Section 06 20 00 with instructions to assemble on Site.

2.2.8. Protect all work with wrappings of cardboard or heavy kraft paper as is necessary to protect shipped work.

2.2.9. Replace, rework and/or refinish Work that does not meet specified AWMAC AWS Standards Latest Edition, at no additional cost to the Owner, and to the approval of AWMAC's independent Inspector.

ARCHITECTURAL WOODWORK

- 2.2.10. Prior to shipping, ensure relative humidity levels on site are within AWMAC recommendations.

3. PART EXECUTION

3.1. INSTALLATION

- 3.1.1. Install Work to AWMAC Standards.
- 3.1.2. Ensure relative humidity levels are within AWMAC Standards prior to installation.

END OF SECTION

DAMPPROOFING

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Brush or spray applied foundation Dampproofing.
- 1.3 RELATED SECTIONS
- .1 Section 07 21 00 - Board Insulation.
- 1.4 REFERENCES
- .1 ASTM D449-03(2008) - Asphalt Used in Dampproofing and Waterproofing.
- 1.5 SUBMITTALS
- .1 Product Data: Provide product data with temperature range for application of Dampproofing membrane.
- .2 Installation Data: Manufacturer's special installation requirements, indicating special procedures and perimeter conditions requiring special attention.
- 1.6 QUALITY ASSURANCE
- .1 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years approved by the manufacturer.
- .2 Construct mock-up for review by Architect. Mock-up may remain as part of the Work.
- PART 2 PRODUCTS
- 2.1 FOUNDATION COATING
- .1 Asphalt cutback, unfilled, for Dampproofing, brush or spray applied, conforming to CGSB 37-GP-6Ma. Dehydratine 4 as manufactured by W.R. Grace & Co., or Protecto Coat #160, as manufactured by Sternson Limited, or Reitzel Bros. RB-103. W.R. Meadows 501 Sealastic is acceptable.
- .2 Foundation mastic:
- .1 Compatible with foundation coating.
- 2.2 PROTECTION BOARD
- .1 Protection Board: 990-31 Polypropylene Protection Board as manufactured by Bakor or VIBRAFLEX by WR Meadows, a polypropylene extruded flexible twin-wall protection board with the following properties:
- .1 Thickness: 2mm
- .2 Weight: 0.45 kg/m²
- .3 Compressive Strength: 0.45 kg/cm²
- .2 Protection Board Adhesive: 230-21 Adhesive as manufactured by Bakor a synthetic rubber base compound having the following characteristics:

DAMPPROOFING

- .1 Compatible with waterproofing membrane and substrate,
- .2 Long term flexibility: Pass CGSB 71-GP-24M,
- .3 Chemical resistance: Alkalis, mild acid and salt solutions.

2.3 DRAINAGE LAYER

- .1 Terradrain 900 by Terrafix or MEL-DRAIN 7055 by WR Meadows for horizontal surfaces above grade and Terradrain 900 by Terrafix or MEL-DRAIN 5012 for vertical surfaces above grade, extruded polystyrene insulation as per Type A, Styrofoam Perimate Type 4 Exterior Insulation Drainage Layer as manufactured by Dow Chemical of Canada or Insuldrain by Owens Corning Canada Inc., in thickness shown for other vertical surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Prior to the installation, inspect areas to receive membrane system to ensure they are clean, dry, sound, smooth, continuous and suitable for installation to manufacturer's recommendations.

3.2 PREPARATION

- .1 Protect adjacent surfaces not designated to receive waterproofing.
- .2 Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's written instructions.
- .3 Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.
- .4 All surfaces to which dampproofing coating is to be applied must be firm and free from loose particles, surface pits, cracks, oil and other foreign matter. Loose particles shall be removed with a scraper or wire brush. Grease or oil shall be removed with an approved cleaner.
- .5 Excessive voids, honeycombing and poor joints shall be filled with mastic to provide a surface satisfactory for application of dampproofing.

3.3 INSTALLATION - DAMPPROOFING

- .1 Install membrane Dampproofing to manufacturer's instructions.
- .2 Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- .3 Required on exterior of filled side of the vertical faces of all walls which separate the interior of the building from earth where slabs occur below finished grade and as shown on drawings.
- .4 Asphalt dampproofing coating shall be brushed or sprayed on to cover foundation walls from 150mm below grade down over the footings to bearing level.
- .5 Material shall be applied in strict accordance with CGSB 37-GP-3M.
- .6 Minor holes and voids in surf aces, chases, corners, recesses, projections shall be completely covered with dampproofing.
- .7 The number of coats specified is the minimum and if all surfaces are not covered thereby, the Contractor shall apply more materials. Number of coats to comply with the requirements of the Ontario Building Code.
- .8 Caulk around items such as pipes, which go through the wall.

DAMPPROOFING

- .9 Seal membrane and flashings to adjoining surfaces.
- .10 Seal items protruding to or penetrating through membrane and install counter flashing membrane material.

3.4 INSTALLATION - PROTECTION BOARD

- .1 Place drainage board directly against membrane, butt joints, place to encourage drainage downward.
- .2 Adhere protection board to substrate with mastic. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

DAMPPROOFING

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AIR and VAPOUR BARRIERS

manufacturer and under dry conditions. Obtain Architect's approval before installing membrane at temperature below 4°C or under cool and windy conditions.

1.4.2. Protection of Finished Work:

Co-ordinate manufacturer's recommended limit for exposure of completed membrane system with Work of other Sections.

1.5. SUBMITTALS

1.5.1. Samples: Submit 300mm x 300mm samples of membrane upon request.

2. PART PRODUCTS

2.1. MATERIALS

2.1.1. Air Barrier: Blueskin SA vapour impermeable by Bakor Henry Inc. or equal by Dorken Systems Inc., Grace, WR Meadows, all to CGSB 71-GP-24M.

2.1.2. Vapour Retarder:

1. At walls (where indicated on drawings), decks: Translucent Polyethylene film conforming to CAN/CGSB-51.34-M86, 10mil thickness.
2. Under slabs on grade: Conform to ASTM E 1745, Classes A, B and C, Perminator, 15mil by W.R. Meadows Inc., or equal WVT rating of 0.011 grains/sq.ft./hr with perm rating of 0.027 Perms. Provide manufacturer's approved tape at joints.

2.1.3. Related Materials: Provide the membrane manufacturer's following:

1. Primers, Substrate Cleaners and Surface Conditioners;
2. Adhesives and Lap Cements,
3. Tapes;
4. Flashing and Transition membranes;
5. Mastic and Sealants,

3. PART EXECUTION

3.1. SUBSTRATE PREPARATION

3.1.1. Prior to the installation, inspect areas to receive membrane system to ensure they are clean, dry, sound, smooth, continuous and suitable for installation to manufacturer's recommendations..

3.2. PRIMING, SURFACE CONDITIONING

3.2.1. Prime all surfaces according to manufacturer's recommendations.

AIR and VAPOUR BARRIERS

3.2.2. Reprime surfaces not covered in the same working day.

3.3. AIR and VAPOUR BARRIER APPLICATION

3.3.1. Apply components of air and vapour barrier systems according to manufacturer's recommendations.

3.3.2. Apply a continuous and unbroken air barrier to outside face of exterior walls as indicated on the Drawings. Ensure continuity of air barrier at all control joints and penetrations.

3.3.3. Provide a continuous air barrier from damp course at top of foundation wall to roof membrane at flat roof. Provide continuous buffer between membrane roofing and air barrier to ensure no contact, as indicated on Drawings.

3.3.4. Carry air and vapour barriers into window and door openings and terminate in a neat straight line.

END OF SECTION

AIR and VAPOUR BARRIERS

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THERMAL INSULATION

- 1. PART GENERAL
 - 1.1. GENERAL REQUIREMENTS
 - 1.1.1. Conform to Division 01 - General Requirements.
 - 1.2. DESCRIPTION
 - 1.2.1. Work Included:
 - a. Provide insulation for the Work.
 - b. Spray foam insulation Section 07 19 00
 - 1.3. SUBMITTALS
 - 1.3.1. Samples:
 - a. Submit representative samples of each specified insulation material, insulation clips, adhesives, fasteners, tapes, flexible flashings and all other material if requested.
 - b. Submit data from manufacturer's or independent laboratory indicating compatibility and adhesive results of proposed materials if requested.
 - 1.4. PROTECTION
 - 1.4.1. Comply with manufacturer's printed recommendations respecting protection.
 - 1.4.2. Take suitable fire precautions were recommended by manufacturer for specific Products.
 - 1.4.3. Repair all damage resulting from performance of Work of this Section in manner acceptable to Architect.
 - 1.5. PRODUCT DELIVERY, STORAGE AND HANDLING
 - 1.5.1. Deliver materials in original unopened containers.
 - 1.5.2. Label containers with manufacturer's name, brand name, installation instructions, safety precautions and identification of various items.
 - 1.5.3. Store adhesive materials between 5°C and 27°C. If exposed to lower temperature, restore to acceptable temperature before using.
 - 1.5.4. Store materials in dry area and protect.
 - 1.5.5. WHMIS Safety bulletins on all hazardous Products are to be readily available to the Work crew at all times.

THERMAL INSULATION

2. PART PRODUCTS

2.1. MATERIALS

- 2.1.1. General: Refer to Drawings for thicknesses and minimum thermal values of insulation required.
- 2.1.2. Under Slab Rigid Insulation: High density thermal insulation:
 - a. Conforming to CAN/CGSB-51.20-M87.
 - b. Acceptable product:
 - 1. "HI-100" manufactured by Dow Chemical Canada.
 - 2. "Isofoil" manufactured by IsoFoam Group, 800 463 8886.
 - 3. C-200 Extruded Polystyrene by Owens Corning.
- 2.1.3. Rigid Foundation Insulation - Concealed: High density thermal insulation:
 - a. Conforming to CAN/ULC-S702-97.
 - b. Acceptable product:
 - 1. "Drainboard" manufactured by Rockwool. for foundation walls.
 - 2. "Foundation Board" manufactured by Dow for foundation walls.
 - 3. C-200 Extruded Polystyrene by Owens Corning.
- 2.1.3. Rigid Foundation Insulation - Exposed: Cement faced extruded polystyrene board:
 - a. Extruded polystyrene board to ASTM C 578-92 (CAN/ULC-S701) Type IV, rigid, closed cell, with integral high density skin, c/w integral 8mm thick latex-modified concrete facing.
 - 1. Panel size: 610mm x 1219mm x 59mm or 84mm thick.
 - b. Acceptable product:
 - 1. "WallGUARD Wall Panels" manufactured by T. Clear Corporation.
 - 2. "Tech-Crete" manufactured by National Concrete Accessories.
 - 3. Equal by Dow.
- 2.1.4. Semi-Rigid Fibre Insulation: At cavity walls
 - a. Mineral fibre insulation with minimum 50% recycled content, conforming to CAN/CGSB 51.10-92. Min. R 4.2 per inch.
 - b. Acceptable Products: "JM CladStone by Johns Manville, or "Sound Attenuation Batts" by Partek Insulation Inc., or "Cavityrock" by Rockwool, or Thermafiber Rainbarrier by Owens Corning.
- 2.1.5. Batt Insulation:
 - a. Mineral fibre with minimum 50% recycled content, conforming to CSA A101-M,
 - b. Acceptable Products: EcoTouch by Owens Corning, or TempControl Mineral Wool by Johns Manville or Safe'n'Sound or AFB by Rockwool. Minimum RSI 0.64per 25.4 mm. [Min. R 4.0 per inch.]

THERMAL INSULATION

- 2.1.6. Sound Batt Insulation:
 - a. Mineral fibre batts with minimum 50% recycled content.
 - b. Acceptable Products: EcoTouch QuietZone by Owens Corning, SAFB by Johns Manville, or Noise Stop by Rockwool."
- 2.1.7. Foamed-In-Place Insulation: Low expanding foam sealant with no ozone depleting blowing agent.
 - a. Insta Seal Eco Blend (Contractor Line) or Great stuff (Consumer Line) manufactured by Flexible Products Co.
 - b. Acceptable equal Products manufactured by Insta-Foam Products, Inc., and distributed by U.L.C. Foam and Plastics (Division of Ure-Al Corp. (Canada) Ltd.), or "Poly- Cell One" by W.R. Grace Canada Ltd., or "EnerFoam" or "Foamitt" by Abisko Manufacturing Inc. or similar acceptable type by CanAm Air Leakage Control Systems Incorporated.
- 2.1.8. Impale Fasteners for Rigid and Semi Rigid Insulation: (Above Grade Installation)
 - a. Impale type, perforated 50 x 50 mm galvanized steel, 2.6mm thick mild steel copper coated spindle, length to suit insulation, 25 mm dia. washers of self-locking nylon.
 - b. Acceptable Products: Tactoo Insul-Hangers by AGM Industries, Inc or Fero Industries or DuroDyne Fasteners.
- 2.1.9. Wedge Fasteners for Rigid Insulation: (Above Grade Installation)
 - a. High density plastic wedge or nylon spring clip.
 - b. Acceptable manufacturers:
 - 1. Blok-Lok
 - 2. Dur-o-lok
 - 3. DuroDyne Fasteners
- 2.1.10. Adhesive for Rigid Insulation: Acceptable product: "Bakor 230-21" by Bakor Inc or 450 by WR Meadows or 230-21 Adhesive by Henry.
- 2.1.11. Flexible Flashing:
 - a. Dampcourse,
 - b. Flexible Flashing Sheet,
 - c. Lap Cements, Primers, Tapes and Mastics for Dampcourse and Flexible Flashing: as recommended by the flashing material manufacturer.
 - d. Acceptable Products (to suit manufacturer's recommendations regarding environmental requirements):
 - 1. "Perm-A-Barrier System 4000 Wall Flashing" by W.R. Grace & Co.
 - 2. Blueskin SA, TG or AG by Bakor,
 - 3. SK by Henry.

THERMAL INSULATION

- 2.1.12. Metal Girts and Fasteners:
 - a. Girts: Galvanized commercial quality sheet steel, galvanizing as specified ASTM A526, 1.2mm thickness, size as indicated on Drawings.
 - b. Fasteners: Self-tapping, stainless steel screw fastener, #12 or greater, securement minimum 50mm depth into substrate, by Tapcon, Buildex or Wedge-Bolt.
- 2.1.13. Neoprene Gasket: Dense solid neoprene, 50 x 50mm x 3mil thickness.
- 2.1.14. Vapour Retarder:
Translucent Polyethylene film conforming to CAN/CGSB-51.34-M86, 10mil thickness.

3. PART EXECUTION

3.1. INSTALLATION - GENERAL

- 3.1.1. Mix and apply adhesives, and install insulation in strict accordance with manufacturer's printed recommendations, using minimum recommended quantities and recommended mix ratios. Finished Work shall be installed neatly, tightly bonded and level. Use adhesives within temperature ranges recommended by manufacturers. Remove excess adhesive.
- 3.1.2. Surfaces to receive insulation shall be dry and free of dew, frost, voids, loose material, oil, grease, asphalt, curing compounds and other matter detrimental to bond of the adhesive or fasteners.
- 3.1.3. Ensure substrate is level such that no voids or air pockets will occur behind insulation boards.
- 3.1.4. Carefully cut and fit insulation to fit all surfaces to which insulation bears contact. Cut backs of pieces as required to fit over projecting anchors, fastenings or similar protrusions. Fit boards neatly with tight joints around pipes, ducts, obstructions, openings, corners, and all structural members. Cavity wall insulation to fit snug around reinforcing rods.
- 3.1.5. Butt edges of each board snugly against adjacent board to form an unbroken thermal envelope. Ensure integrity and continuity of insulation at juncture with different types of materials and seal in an acceptable manner. Stagger joints in each row.
- 3.1.6. Unless otherwise specified, apply insulation in single layer of thickness indicated. Where double layer of insulation is accepted or indicated, stagger joints of succeeding layers so that joints are offset. Where adhesive is required, set in adhesive as specified for the one layer.
- 3.1.7. Do not install damaged insulation, or insulation with abraded surfaces.
- 3.1.8. Where firestopping and/or thermal insulation is indicated on the Drawings or required by Code to be installed to areas of building requiring a thermal barrier, and where the certified minimum depth of firestopping materials placed by Work of Section 07 27 00 does not fill the entire depth of this construction, augment firestopping materials with Type A insulation to ensure total insulation membrane coverage.

THERMAL INSULATION

3.1.9. Damp Course:

- a. Provide damp course integral to insulation and prepare for incorporation of damp course by other Sections where indicated on Drawings and, in absence of any indication, in locations as follows:
 1. Top of foundation wall on exterior walls
 2. Over exterior lintels.
 3. Under Copings.
 4. Under sills.
- b. Extend damp course and flashing as indicated on the Drawings carrying material to within 10mm of outside face of wall.
- c. Lap joints at least 100mm and cement with lap cement. Application of lap cement: to manufacturer's instructions.

3.2 CAVITY WALL INSULATION:

- 3.2.1. Do not install cavity wall insulation until air/vapour membrane has been inspected and accepted.
- 3.2.2. Place cavity wall insulation to surface of inner wythe, in parallel courses with tight butt joints. Stagger end joints in adjacent courses.
- 3.2.3. Fasten insulation at wood siding cavity wall to fit snugly between horizontal metal girts, with impale fasteners.
- 3.2.4. Fasten insulation at brick veneer masonry cavity wall with wedge fasteners.
- 3.2.5. Horizontal Metal Girts:
 - a. Fasten to substrate with mechanical fasteners at 400mm oc, with neoprene spacer gasket located at each fastener.
 - b. Fit snugly to insulation, to ensure greatest possible integrity and continuity of thermal blanket.
- 3.2.6. Impale Fasteners:
 - a. Fasten to substrate material by manufacturer's approved method and to recommendations of air/vapour barrier manufacturer at 300 mm oc in each direction.
 - b. Each fastener shall be capable of supporting a tensile force of 35 N and shall be supplemented as necessary with a mechanical fastener to sustain such force.
 - c. Impale insulation over fastener spindles to ensure intimate surface contact of insulation with substrate material. Install washer on spindle and flush to insulation surface. Clip excess hanger spindle.
- 3.2.7. Wedge Fasteners:

Install to manufacturer's recommendations to ensure intimate surface contact of insulation with substrate material.

THERMAL INSULATION

3.3. FOAMED-IN-PLACE INSULATION

- 3.3.1. Installation locations: All door and window frames, louvres and mechanical openings through exterior walls.
- 3.2.2. Install to manufacturer's printed instructions and as specified.
- 3.2.3. Ensure all shimming and final adjustments to frames has taken place, and welding of steel has been completed prior to commencing injection of insulation.
- 3.2.4. Ensure minimum surface and ambient temperature of minimum 5°C during and 3 hrs after application.
- 3.2.5. Inject insulation to completely fill voids between frames and wall opening, and to completely fill exterior hollow metal frames.
- 3.2.6. After insulation has set, re-check application and top off any low area. Trim off excess as directed by manufacturer.

END OF SECTION

SPRAY APPLIED FOAM INSULATION

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01 - General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

- a. Spray applied foam insulation and air barrier at wall.

1.2.2. Related Work Specified Elsewhere:

- a. Air Vapour Barriers: Section 07 19 00

1.3. QUALITY ASSURANCE

- 1.3.1. Application of insulation/air barrier system only by applicators certified by CUFCA/NECA (Canadian Urethane Foam Contractors Association/National Energy Conservation Association) or certified by the manufacturer of the system being installed for the installation of their system and have third party independent certification in accordance with the training requirements outlined in CAN/ULC S705.2-98.

1.4. SUBMITTALS

- 1.4.1. Submit manufacturer's product data sheets.

1.5. PERFORMANCE REQUIREMENTS

- 1.5.1. Long Term Thermal Resistance tested to CAN/ULC S770-09 and achieving RSI 0.91 per 25mm @ 50mm at a minimum core density of 28.34 kg/m³.

2. PART PRODUCTS

2.1. MATERIALS

2.1.1. Spray Insulation.

- a. Sprayed polyurethane foam material to CAN/ULC S705.1-01.
- b. Burning characteristics: maximum values in accordance with CAN/ULC-S102-03.
 - 1. Flame spread.
 - 2. Smoke developed: 500.

SPRAY APPLIED FOAM INSULATION

- c. Water vapour permeance: Maximum 60 ng/Pa.m² .s. (1 perm) when tested to ASTM E96/E96M-05.
 - d. Acceptable Products:
 - 1. BASF Building Systems 'Walltite CM10'.
 - 2. Demilec Inc. 'Heatlok Soya/Polarfoam SOYA'.
 - 3. Dow Chemical 'Styrofoam Brand SPF CA Insulation'.
 - 4. Genyk 'Boreal Elite' (CCMC #14140-L).
- 2.1.2. Air Barrier Membrane: at substrate transitions and as indicated, at control joints, over parapet wall at roof air barrier locations down onto roof air barrier and between junctions of dissimilar material prior to the application of the insulation. Install in widths of min 300 mm with 150 mm cover to each side of joints or onto dissimilar products.
- a. Primers: As required by CAN/ULC S705.2-98, Annex A and to suit environmental conditions at time of application.
 - b. Self-Adhesive membrane: Composite preformed modified membrane system consisting of SBS modified asphalt for low temperature flexibility and polyethylene scrim reinforcing with physical properties as follows:
 - 1. Thickness: 1 mm (40 mils).
 - 2. Application temperature: minimum +5 °C.
 - 3. Elongation: 200% minimum in accordance with ASTM D412-06ae2-modified.
 - 4. Low temperature flexibility: to -30 °C to CGSB 37-GP-56M-1985.
 - 5. Air leakage: 0.005 L/m².s under a pressure differential of 75 Pa in accordance with ASTM E283-04.
 - 6. Water vapour transmission: 2.8 ng/Pa.s.m² in accordance with ASTM E96/E96M-05.
 - c. Acceptable Products: As approved in writing by sprayed foam insulation manufacturer:
 - 1. Primer: as recommended by manufacturer of air barrier sheet membrane.
 - 2. Membrane: as recommended by manufacturer of air barrier sheet membrane.
 - 3. Termination mastic: Rubberized asphalt-based mastic with 200 g/l max. VOC content, as recommended by manufacturer of air barrier sheet membrane.
 - d. Compatibility: Obtain confirmation from sprayed foam insulation manufacturer that materials used are compatible.

SPRAY APPLIED FOAM INSULATION

3. PART EXECUTION

3.1. EXAMINATION

- 3.1.1. Verify that surfaces and conditions are ready to accept the work of this section. Application of work of this section deems acceptability of existing conditions. Report in writing defects in substrate which may adversely affect the performance of the foam insulation/air barrier.

3.2 PREPARATION:

- 3.2.1. Surfaces to receive foam insulation/air barrier shall be free of frost, loose or foreign matter which might impair adhesion of materials.
- 3.2.2. Prepare adjacent surfaces to receive transition membrane by removing contaminants which will affect adhesion of membrane.

3.3. FOAMED-IN-PLACE INSULATION

- 3.3.1. Apply materials over clean and dry surfaces.
- 3.2.2. Install membranes in accordance with membrane manufacturer's recommendations for this application, overlapping joints of sheet membrane with minimum 150 mm (6") laps. Seal laps and termination joints with edge of membrane sealer.
- 3.2.3. Install transition air barrier membrane prior to application of the urethane foam.
- 3.2.4. Apply materials in accordance with manufacturer's written instructions and in accordance with CAN/ULC S705.2-98.
- 3.2.5. Fill joints with foam sealant making allowances for post expansion of foam.
- 3.2.6. Ensure joints are free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed or detailed.
- 3.2.7. Apply foam insulation/air barrier within +6.4 mm (1/4") and -0 mm (0") of indicated thicknesses.
- 3.2.8. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- 3.2.9. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used will not damage their work.

END OF SECTION

UNDER FLOOR VAPOUR BARRIER SYSTEM

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Surface preparation.
.2 Application of an underslab vapor retarder.
.3 Air seal materials to connect and seal openings, joints, and junctions between other air seal materials and assemblies.
- 1.3 RELATED SECTIONS
- .1 Section 03 30 00 – Cast-in-place Concrete.
.2 Section 07 16 00 – Dampproofing.
- 1.4 REFERENCES
- .1 ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
.2 ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
.3 ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
.4 ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
.5 ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
.6 ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- 1.5 SUBMITTALS
- .1 Comply with Section 01 33 00 - Submittal Procedures.
.1 Product Data: Provide technical data on wood preservative materials.
.2 Installation Data: Provide application instructions.
- 1.6 QUALITY ASSURANCE
- .1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapour retarder.
.2 Obtain vapour retarder materials from a single manufacturer regularly engaged in manufacturing the product.
.3 Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
.4 Environmental Requirements:
.1 Apply membrane system at ambient temperatures satisfactory to the manufacturer and under dry conditions only. Obtain Architect's approval before installing membrane at temperature below 4°C or under cool and windy conditions.
.5 Protection of Finished Work.
.1 Co-ordinate manufacture's recommended limit for exposure of completed membrane system with work of other Sections.

UNDER FLOOR VAPOUR BARRIER SYSTEM

- 1.7 PRECONSTRUCTION MEETING
 - .1 Pre-Construction Meeting: Convene one week prior to installation of underslab vapour retarder. Attendees to be as follows: - Architect, General Contractor, Vapour Retarder Installer, and Vapour Retarder Manufacturer to discuss the application in detail.

- 1.8 DELIVERY, STORAGE, AND HANDLING
 - .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
 - .2 Store materials in a clean, dry area in accordance with manufacturer's instructions.
 - .3 Protect materials during handling and application to prevent damage or contamination.
 - .4 Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

- 1.9 ENVIRONMENTAL REQUIREMENTS
 - .1 Product not intended for uses subject to abuse or permanent exposure to the elements.
 - .2 Do not apply on frozen ground.

- PART 2 PRODUCTS
 - 2.1 ACCEPTABLE MANUFACTURER
 - .1 W. R. Meadows Inc.

 - 2.2 MATERIALS
 - .1 Plastic Vapour Retarder
 - .1 Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins, and when tested according to all requirements of ASTM E1745, shall meet the following minimum performance requirements:
 - .1 Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
 - .1 As received: 0.0063 perms.
 - .2 After Wetting and Drying: 0.0052 perms.
 - .3 Resistance to Plastic Flow and Temperature: 0.0057 perms.
 - .4 Effect Low Temperature and Flexibility: 0.0052 perms.
 - .5 Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0052 perms.
 - .2 Puncture Resistance (ASTM D1709): >3,200 grams.
 - .3 Tensile Strength ASTM E154, Section 9: 72 Lb. Force/inch.
 - .2 Proprietary-Based Specification:
 - .1 PERMINATOR 15 mil by W. R. MEADOWS.

UNDER FLOOR VAPOUR BARRIER SYSTEM

2.3 ACCESSORIES

- .1 Seam Tape
 - .1 High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4" (100 mm).
 - .1 Perminator Tape by W.R. Meadows.
- .2 Pipe Collars
 - .1 Construct pipe collars from vapour retarder material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

- .1 Prepare surfaces in accordance with manufacturer's instructions.
- .2 Level, tamp, or roll earth or granular material beneath the slab base.
- .3 Remove loose or foreign matter which might impair adhesion of materials.
- .4 Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturers written instructions.

3.2 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.3 INSTALLATION

- .1 Apply components of air barrier system according to manufacturer's recommendations.
- .2 Install the vapor retarder membrane in accordance with manufacturer's instructions and ASTM E 1643-98.
- .3 Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
- .4 Lap vapor retarder over footings and seal to foundation walls.
- .5 Overlap joints 6" (152 mm) and seal with manufacturer's tape.
- .6 Seal all penetrations (including pipes) with manufacturer's pipe boot.
- .7 No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
- .8 Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 6"(152 mm) and taping all four sides with tape.
- .9 Inspection: Inspect membrane for punctures, misaligned seams and fish-mouths, apply additional layer of membrane over affected area, extending minimum of 150mm beyond damaged area in all directions.

3.4 PROTECTION OF FINISHED WORK

- .1 Do not permit adjacent work to damage work of this section.

END OF SECTION

UNDER FLOOR VAPOUR BARRIER SYSTEM

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ALUMINUM COMPOSITE PANELS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to Division 01, General Requirements.

1.2 DESCRIPTION

- .1 Work Included
 - .1 Work of this Section includes design, fabrication, supply and installation of aluminum composite panels and subgirts.

1.3 QUALITY ASSURANCE

- .1 Fabricator shall meet the standards of the Premium MCM Fabricator Certification program and be certified by Metal Construction Association (MCA) as a Premium MCM Fabricator.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Design, fabricate and erect a pressure equalized wall panel system to meet the following requirements.
 - .1 Rain Penetration: prevent rain penetration through wall system. Design system based on "Rain Screen Principle". Incorporate means of draining to the exterior.
 - .2 Wind Load: Design wall system to resist wind loads, positive and negative, expected in this geographical region without causing rattling, vibration or excessive deflection of panels, overstressing of fasteners, clips and other detrimental effects on system. The panel system shall be designed to withstand local positive and negative wind load pressures at a maximum deflection of L/60 measured at the centers of panels, and L/180 measured at perimeters.
 - .3 Structural and Thermal Movement: Accommodate movement of supporting structural framing and movement caused by the thermal expansion and contraction of system component parts without causing bowing, buckling, delamination, oil canning, failure of joint seals, excessive stress on fasteners or any other detrimental effects.
- .2 Panel flatness tolerance: Fabricate panels not exceeding the following tolerances:
 - .1 .080" (2mm) in a concave/convex direction, measured perpendicular to normal plane.
 - .2 Rises and falls across panel, (local bumps and depressions) will be rejected.
- .3 Panel removal: System/procedure to allow removal of individual panels within wall system.
- .4 Maximum deviation from vertical and horizontal alignment of erected panels: ¼" in 20'-0" (6mm in 6m).

ALUMINUM COMPOSITE PANELS

- .5 Testing: Provide wall assembly that has been tested and certified to conform to the following criteria:
 - .1 Air Leakage: Not more than 0.006 (cfm)/sf of wall area 0.11m³/h/m², when tested at 6.24 psf (300 Pa) in accordance with ASTM E283.
 - .2 Water Penetration: No water infiltration under static pressure when tested in accordance with ASTM E331 at a pressure level of 14.61 psf (700 kPa) minimum, after 15 minutes.
 - .3 Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure of 65 psf (3.12 kPa) and have been certified to be without permanent deformation of failures of structural members.

- 1.5 SUBMITTALS**
 - .1 Submit shop drawings indicating elevations, profiles, dimensions and thickness of panels and joint details. Indicate attachment clips, system extrusions, fastening, anchor and installation details. Confirmation that the clip layout is based on structural and wind loading.
 - .2 Provide available colours and indicate any extended manufacturing/delivery timelines.
 - .3 Submit samples.

- 1.6 MAINTENANCE DATA**
 - .1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual.

- 1.7 MOCK-UP**
 - .1 Erect mock-up panel approximately 3.0m Long x 3.0m high in location as directed by Architect.
 - .2 Mock-up panel shall include all components of the wall system (eg. back up framing/block, air and vapour barriers, insulation, sheathing, clips, rails, girts and cladding) and may be incorporated into work once approved.

- 1.8 PRODUCT DELIVERY, HANDLING AND STORAGE**
 - .1 Protect panel face with a plastic film adhered to panel in accordance with panel manufacturer's recommendation.
 - .2 Store components and materials in accordance with panel manufacturer's recommendations.

ALUMINUM COMPOSITE PANELS

1.9 WARRANTY

- .1 Provide a manufacturer's written warranty: Finish panel manufacturer's written warranty covering failure of factory-applied exterior finish on composite metal panels within the warranty period; warrant finish per ASTM D 4214 for chalk not in excess of 8 NBS units and fade not in excess of 5 NBS units. Warranty period for finish; 20 years after the date of substantial completion.
- .2 Warranty against defects or deficiencies shall be for a period of one year from date of substantial completion.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Panel System: Basis of design is Sobotec Dry Joint SL-2000 with ½" (12.5mm) wide panel joints using proprietary aluminum extrusions.
- .2 Aluminum Composite Material (ACM):
 - .1 Acceptable material and manufacturer: Alucobond supplied by Sobotec Ltd., 67 Burford Rd., Hamilton, Ontario, L8E 3C6 Tel: (905) 578-1278 or equal that is compatible as confirmed by the Panel System provider.
 - .2 Composition: Two sheets of aluminum sandwiching a core of extruded thermoplastic, formed in a continuous process without the use of glues or adhesives between dissimilar materials. Bond integrity testing to adhere to ASTM D1781-76.
 - .3 Aluminum face sheets: aluminum alloy 3003, thickness: 0.020" (0.51mm).
 - .4 Panel thickness: 4mm (.157").
 - .5 Panel weight: 1.12 lbs/sq.ft. (5.5 kg/sq.m).
 - .6 Tolerances: Panel bow: Maximum 0.8% of panel dimension (width or length).
 - .7 Panel finishes: Kynar, two/three coat, coil-coated baked enamel finish containing Kynar 500 polyvinylidene fluoride (PVDF) resin. Colours: as selected from Stock, The Classic Collection range.
- .3 Panel and Wall Accessories:
 - .1 Provide proprietary aluminum extrusions to manufacturer's standard profiles for a complete installation.
 - .2 Fasteners: As recommended by the panel manufacturer, concealed and non-corrosive.
 - .3 Extrusions and extrusion clips for attaching panels to the sub-structure: purpose made aluminum. Extrusions shall be full length around panel perimeter for panel reinforcement and alignment.
 - .4 Thermal clips: Basis of Design = SLT-Clip by Sobotec.
 - .5 Subgirts: Manufactured from G-90 galvanized and shall be designed to accommodate expansion and contraction, dynamic movements and design load requirements.

ALUMINUM COMPOSITE PANELS

- .6 Joint filler strip: same material and colour as panels. Use of caulking at joints is not acceptable.

Part 3 EXECUTION

3.1. PREPARATION

- .1 Before proceeding, examine work of other sections upon which this section depends.
- .2 Install air barrier, clips and then subgirts.
- .3 Erect panels and joint filler strip in accordance with system manufacturer's details and instructions and so as to meet specified design criteria and performance.
- .4 Panel bow: Maximum 0.8% of panel dimension (width or length).
- .5 Install panels plumb, true, level and in alignment to established lines and elevations.
- .6 Panel lines, breaks and angles to be sharp and true; panel surfaces to be free from warp or buckle.

3.3. CLEAN-UP

- .1 Remove protective film from panels.
- .2 Repair and touch-up with colour matching high grade enamel minor surface damage.
- .3 Replace damaged panels and components which cannot be satisfactorily repaired.

END OF SECTION

METAL TRIM

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

- a. Provide metal trim and support system for the Work.

1.2.2. Related Work Specified Elsewhere:

- a. Exterior sheathing boards: Section 06 10 00
b. Sealants: Section 07 92 00

1.3. QUALITY ASSURANCE

1.3.1. Requirements of Regulatory Agencies:

Conform to the requirements of the following:

- a. ASTM D 958 - Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics.
- b. AAMA 2605-05 - Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- c. AAMA 2604 - Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels
- d. AAMA 2603 - Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- e. ASTM E2768-11 – Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials (30 min Tunnel Test). Results: Zero Flame Spread, Smoke Developed Index of 5. Meets criteria for Class A fire rating.
- f. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- g. CAN/ULC S114 – Standard method of test for determination of non-combustibility in building materials.

1.4. SUBMITTALS

- 1.4.1. Samples: Submit samples of metal and metal finish colour range representing the manufacturer's full range of available colours and patterns. Confirm with Architect whether physical samples are required to be delivered to their office. Identify any colours that require extended manufacturing/delivery timelines.

METAL TRIM

1.4.2 Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

1.5. WARRANTY

1.5.1. Warrant the Work of this Section for 2 years and provide written warranty, addressed to the Owner, warranting that finish paint process to metal will withstand fading or discolouration for a period of 5 years from date of Substantial Performance of the Work.

2. PART PRODUCTS

2.1. MATERIALS

2.1.1. Sheet Metal for Exposed Components:

- a. Sheet Steel: ASTM A446 and CSSBI Publications No. 18-26, 0.71mm (24 gauge) core thickness where exposed to view, 0.56mm (26 gauge) core thickness where concealed.
- b. Finishes to Exposed Sheet Steel:
 1. Series 5000 precoating by Dominion Foundaries and Steel Limited or the Steel Company of Canada Limited or Gentek or Boncor.

2.1.6. Sealants:

Selection, standard and use in conformance with Section 07 90 00, use Type 6 for inside seals in metal to metal joints. Colour to match finish paint colour.

2.2. FABRICATION

2.2.1. Prepare surfaces, pre-treat and coat components in accordance with AAMA 2604 and 2605 Quality Standards and applicable European standards for the coating material specified.

2.2.2. Wrap and package coated components using methods suitable for transit and covered site storage without damage.

3. PART EXECUTION

3.1. INSTALLATION

3.1.1. Install in accordance with manufacturer's installation instructions.

3.1.3. Locate joints over supports.

3.1.4. Install expansion control joints where indicated.

3.1.5. Use concealed fasteners unless otherwise approved by Architect.

3.1.6. Install soffits, and accessories in accordance with best practice, with all joint members

METAL TRIM

plumb and true.

3.2. FIELD QUALITY CONTROL

- 3.2.1. After installation, check entire surface for obvious flaws or defects.
- 3.2.2. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.3. CLEANING

- 3.3.1. After application of soffits, clean as necessary to remove all fingerprints and soiled areas.
- 3.3.2. Upon completion, clean entire area, removing all scrap, packaging, and unused materials related to this work.

3.4. PROTECTION

- 3.4.1. Protect installed products until completion of project.
- 3.4.2. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

METAL TRIM

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COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- 1 General
 - 1.1 SECTION INCLUDES
 - .1 Built-up membrane roofing, cold-applied method.
 - 1.2 RELATED SECTIONS
 - .1 Section 05 31 00 - Steel Decking: Structural metal roof deck.
 - .2 Section 06 10 00 - Rough Carpentry: [Structural wood deck,] cants, blocking and curbs.
 - 1.3 REFERENCES
 - .1 [ASTM C931/931M-01: Standard Specification for Exterior Gypsum Soffit Board.]
 - .2 ASTM D4601-98: Standard Specification for Asphalt-Coated Glass Fibre Base Sheet Used In Roofing.
 - .3 CSA A123.4-M1979: Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.
 - .4 CGSB 37-GP-9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .5 CGSB 37-GP-52M: Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric.
 - .6 CAN/CGSB-51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use In Building Construction.
 - .7 CAN/ULC-S704-2001: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
 - .8 CAN/ULC-S706-02: Standard for Wood Fibre Thermal Insulation for Buildings.
 - 1.4 PERFORMANCE REQUIREMENTS
 - .1 Roofing System: three ply cold-applied built-up roofing system with thermal barrier underlay board, rigid board insulation, composite ply roofing membranes, and calcite aggregate surfacing; BURmastic by Tremco Canada.
 - .2 Provide Products that are compatible with one another under field conditions, as demonstrated by roofing manufacturer.
 - .3 Provide watertight roofing system capable of resisting specified uplift pressures, thermally induced movement and exposure to weather without failing during the specified warranty period.
 - .4 Factory Mutual: comply with FMG Fire / Windstorm Classification FM 1A-90.
 - 1.5 SUBMITTALS
 - .1 Submit Product data as specified.
 - .2 Product Data: for each major component, including membrane, thermal barrier underlay board, vapour retarder, rigid board insulation, pavers and adhesives. Highlight critical criteria for proper installation.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .3 Shop Drawings: Include plans, sections, details in accordance with performance requirements, and for attachment to other portions of the Work.
- .4 Shop Drawings for Sloped Insulation: Indicate degree of slope and layout of sloping insulation on roof surfaces. Ensure positive drainage to roof drains.

1.6 CERTIFICATES

- .1 Manufacturer Certificates: Signed by roofing manufacturer verifying that installer is approved, authorized or licensed by manufacturer to install specified Products.
- .2 Installer Certificates: Signed by installer verifying that they have the specified qualifications described below.

1.7 TEST REPORTS

- .1 Product Test Reports: based on the evaluation of comprehensive tests conducted by an independent testing agency of the specified roofing Products.
- .2 Manufacturer Field Inspection Reports: manufacturer's written acceptance of roofing installation based on regular inspections.

1.8 QUALITY ASSURANCE

- .1 Manufacturer: qualified manufacturer having roofing systems listed by UL and approved for use by Factory Mutual.
- .2 Installer: Brock Universities Pre-Qualified Roofing Contractors as listed:
 - 1. Atlas-Apex Roofing Inc. 65 Disco Road, Etobicoke, ON M9W 1M2
 - 2. Bothwell Accurate Co. Inc. 6675 Rexwood Rd., Mississauga, ON L4V 1V1
 - 3. Flynn Canada 890 Arvin Ave., Stoney Creek, ON L8E 5Y8
 - 4. Nortex Roofing Ltd. 40 Bethridge Rd., Etobicoke, ON M9W 1N1
 - 5. Roque Roofing Inc. 3 Clark Ave., Hamilton, ON L8L 5J7
 - 6. Schreiber Brothers Ltd. 50 Brockley Dr., Hamilton, ON L8E 3P1
 - 7. Semple Gooder Roofing Corp. 1365 Martin Grove Rd., Toronto, ON M9W 4X7
 - 8. Spinton Roofing Ltd. 1384 Rymal Rd. E., Hamilton, ON L8W 3N1
 - 9. T Hamilton & Son Roofing Inc. 20 Thornmount Dr., Scarborough, ON M1B 3J4
 - 10. Triumph Roofing & Sheet Metal Inc. 1 Connie St., Toronto, ON M6L 2H8
- .3 Conform to CRCA Roofing Specifications and roofing membrane manufacturer's instructions.

1.9 PRE-INSTALLATION MEETINGS

- .1 Conduct pre-installation meeting.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .2 Meeting: prior to commencement of deck installation, review and document methods and procedures related to roof deck and roofing system construction , including the following:
 - .1 Participants: authorized representatives of the Contractor, Construction Manager, Owner, Consultant, roofing Subcontractor, roofing manufacturer, and installers of roof accessories and roof-mounted equipment.
 - .2 Review methods and procedures related to roofing installation, including manufacturer's written installation instructions.
 - .3 Review construction schedule and confirm availability of Products, Subcontractor personnel, equipment and facilities.
 - .4 Review deck installation criteria and finishes for conformance with roofing system criteria, including issues of flatness and fastening.
 - .5 Review structural loading conditions and limitations of roof deck both during and after roofing application.
 - .6 Review flashing details, special roofing details, roof drainage, roof penetrations, equipment curbs, and other conditions affecting roofing installation.
 - .7 Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
 - .8 Review safety requirements, including temporary fall-arrest measures.
 - .9 Review field quality control procedures.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store Products undamaged in original containers with manufacturer's labels and seals intact.
- .2 Store Products in designated areas elevated off the ground and protected from ultra-violet radiation, inclement weather and construction activities.
- .3 Store solvent-based liquids away from excessive heat and open flame.
- .4 Store adhesives and sealants at temperature above 5 degrees Celsius.
- .5 Store membrane rolls on end, dry, and protected from moisture and damage. Cover rolls, insulation and other moisture-sensitive Products with tarpaulins.
- .6 Store Products on roof deck in a manner to prevent overloading the structure and properly secured to prevent movement due to wind or other forces. Prevent permanent deformation of deck.

1.11 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply any roofing materials during inclement weather.
- .2 Comply with manufacturer's recommendations for minimum and maximum temperatures and humidity during application.
- .3 Do not install Products when temperatures are below -10 degrees C.
- .4 Consider effects of wind chill on adhesives, and ensure they will not prematurely set before proper adhesion takes place.
- .5 Keep water-based Products from freezing. Do not apply water-based Products if temperatures are below 5 degrees C.

1.12 WARRANTY

- .1 Submit extended warranties in accordance with the General Conditions of the Contract.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .2 Installer's Extended Warranty: standard OIRCA 2 year warranty, commencing from the date of Substantial Performance of the Work.
- .3 Manufacturer's Extended Warranty: a written guarantee that the manufacturer will replace, at no cost to the Owner, any portion of the roofing membrane which experiences actual leaks resulting from defects in the manufacture of the membrane for a period of 20 years, commencing from the date of Substantial Performance of the Work.

1.13 MAINTENANCE

- .1 Arrange for roofing manufacturer to conduct periodic visual inspections and maintenance of roof surface during the second, fifth, tenth and fifteenth years after Substantial Performance of the Work.
- .2 Record noted deficiencies and arrange for their proper repair under warranty.

1.14 SAFETY

- .1 For purposes of the installation, the roofing installer and not the manufacturer shall act as the Constructor (as that role is defined in the health and safety legislation of Ontario, Yukon, Prince Edward Island and Nova Scotia) or Prime Contractor (as that role is defined in the health and safety legislation of British Columbia, Alberta and Manitoba) or Principal Contractor (as that role is defined in the health and safety legislation of Newfoundland, Quebec and North West Territories) or Contractor (as that role is defined in the health and safety legislation of New Brunswick and Saskatchewan) and as such is fully responsible for directing and controlling all roofing installation work and the safety of the work on the jobsite.
- .2 As Constructor / Prime Contractor / Principal Contractor/Contractor the roofing installer and not the manufacturer shall be fully and solely responsible for ensuring that all applicable occupational health and safety laws, regulations, rules and orders are complied with in the course of the installation. Entry of manufacturer personnel to ensure quality installation in accordance with the manufacturer's specifications and to perform warranty inspections shall not be for purposes of monitoring the safety of the work at the job site.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of cold-applied built-up asphalt roofing systems having Products considered acceptable for use:
 - .1 Tremco Canada.

2.2 MATERIALS

- .1 Primer: non-fibred, asbestos free, water-based, low-VOC formulation; to CGSB 37-GP-9Ma; eg. Tremco Improved TREMprime WB.
- .2 Thermal Barrier Underlay Board: 13 mm thick glass mat faced gypsum panel with water-resistant core, and meeting the following criteria:
 - .1 Combustibility: Noncombustible to ASTM E136.
 - .2 Surface Burning Characteristics: to ASTM E84, maximum flame spread of 0, smoke developed of 0.
 - .3 Manufacturer and Product Name: Securock by CGC.
- .3 Roof Vapour Retarder: AVC Primer and AVC Membrane self adhered Vapour Retarder.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .4 Roof Insulation: Polyisocyanurate rigid board; to CAN/ULC-S704, Type 3, Class 2, closed cell type:
 - .1 Long Term Thermal Resistance (CAN/ULC-S770): minimum RSI 1.01 per 25 mm of thickness.
 - .2 Compressive Strength (ASTM D1621): 140 kPa.
 - .3 Dimensional Stability (ASTM D2126): < 2 percent linear change.
 - .4 Water Absorption (ASTM C209): < 1 percent by volume.
 - .5 Edges: square.
 - .6 Faces: non-asphaltic, fibre-reinforced felt facers both sides.
 - .7 Combustibility: meets CAN/ULC-S107-M87 and CAN/ULC-S126-M86.
 - .8 Thickness: minimum two layers required, total thickness as indicated on Drawings.
 - .9 Manufacturer and Product Name: Trisotech Roof Insulation by Tremco Canada.
- .5 Overlay Board: 13 mm (0.5") thick asphalt coated fibreboard.
- .6 Roofing Membrane: 3 Plies 1.4 mm thick polyester-glass-polyester tri-laminate reinforced asphalt-coated sheet; BURmastic Composite Ply by Tremco Canada.
- .7 Aggregate Ballast: Snow white calcite by Coloured Aggregates, free of fines, long splinters, dust or foreign

2.3 ACCESSORIES

- .1 Adhesive for Underlay Board, Vapour Retarder, Roof Insulation Boards and Overlay Boards: Low-Rise Foam; meeting ULC and tested by Factory Mutual; Low-Rise Foam Adhesive by Tremco Canada.
- .2 Adhesive for Aggregate Ballast and Roofing Membranes Felts, and Aggregate Ballast: Asbestos-free, cold-process asphalt adhesive; Tremco BURmastic Adhesive.
- .3 Adhesive for Flashing Membranes: Single-component bitumen modified polyurethane; Tremlar V by Tremco Canada.
- .4 Mechanical Fasteners: Flat-head, countersunk, self-tapping screws; size, type and length in accordance with FMG; corrosion resistant coating in accordance with FM 4470, with locking plastic or metal plates.
- .5 Flexible Flashing Membrane: 1.14 mm thick, reinforced EPDM/SBR elastomeric sheeting; TRA by Tremco Canada.
- .8 Stack Flashings: Prefabricated aluminum sleeves; sizes to suit applications.
- .9 Roof Drains: Thaler as specified
- .10 Metal Flashing: Pre-Painted Sheet Metal as specified.
- .11 Cant Strips: purpose made asphalt impregnated wood fibreboard, 75 x 75 mm size.
- .12 Stripping Membrane: Vinyl-coated fibreglass mesh; Burmesh by Tremco Canada.
- .13 Stripping Adhesive: One-part rubberized elastomer; Polyroof by Tremco Canada.
- .14 Pitch Pan: premanufactured type; 0.61 mm thick galvanized steel sheet, minimum 100 mm high.
- .15 Sealant: Dymonic by Tremco.
- .16 Termination Bar: 3 mm thick aluminum bar, 25 mm wide profile, pre-drilled for mechanical attachment.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .17 Prefabricated Control or Expansion Joint Flashing: sheet butyl reinforced with closed cell urethane foam backing, seamed into metal flashing flanges, including sheet butyl counter flashing each side.

3 Execution

3.1 EXAMINATION

- .1 Inspect existing conditions to ensure they are suitable for roofing work to begin. Do not proceed until unacceptable conditions are corrected.
- .2 Ensure substrate is solid, clean, dry and free of any contaminants prior to commencing any roofing work.
- .3 Ensure Products are dry prior to installation. Replace damaged Products.

3.2 PREPARATION

- .1 Prime metal and concrete surfaces designated to be covered with asphaltic Products.
- .2 Apply primer at an average rate of 4.3 m²/litre. Allow to cure.
- .3 Ensure primer does not enter building through cracks and other openings.

3.3 THERMAL BARRIER UNDERLAY BOARD

- .1 Adhere thermal barrier underlay board to metal deck with approved adhesive at manufacturer's recommended rate. Stagger boards 150 mm.
- .2 Install thermal barrier underlay boards with long axis perpendicular to ribs, with end joints fully supported.
- .3 Firmly butt each board to surrounding boards. Do not jam or deform boards.
- .4 Cut and fit boards where roof deck intersects vertical surfaces.
- .5 Provide filler boards every 450 mm in both directions.
- .6 Tape joints of thermal barrier underlay board with 50 mm wide tape.

3.4 VAPOUR RETARDER

- .1 Adhere roof vapour retarder over primed thermal barrier underlay board
- .2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps.
- .3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.
- .4 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.

3.5 INSULATION AND OVERLAY BOARD

- .1 Install insulation boards to maintain continuity of thermal envelope, as specified Minimize joints.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .2 Adhere base layer of roof insulation to vapour retarder with approved foam adhesive at manufacturer's recommended rate.
- .3 Adhere top layer of roof insulation to base layer of roof insulation with approved adhesive at manufacturer's recommended rate.
- .4 Adhere tapered roof insulation where indicated and in accordance with approved Shop Drawings.
- .5 Fit insulation tight to roof penetrations.
- .6 Firmly butt insulation boards. Do not jam or deform boards.
- .7 Minimize lipping between adjacent boards.
- .8 Stagger joints minimum 300 mm.
- .9 Adhere single layer of overlay board over roof insulation with approved adhesive at manufacturer's recommended rate.
- .10 Stagger overlay board seams with insulation board seams.

3.6 CANT STRIPS

- .1 Install cant strips at intersections of roofing and vertical surfaces.
- .2 Embed in a continuous bed of approved adhesive applied to overlay boards.
- .3 Lay true to line, level and with flush, butt joints and accurately mitred corners.

3.7 ROOF MEMBRANE

- .1 Install three plies of roof membrane in shingle fashion, starting at roof low point. Apply membrane perpendicular to overlay board joints. Conform to manufacturer's recommended method.
- .2 Overlap starter strips 660 mm with first ply, then overlap each succeeding ply 625 mm.
- .3 Place ply sheets to ensure water will flow over or parallel to, but not against, exposed edges.
- .4 Shingle in direction to shed water. Extend ply membranes over and terminate beyond cants and cut evenly.
- .5 Embed plies in approved adhesive, at a minimum rate of 1.2 L/m², and solidly coating each ply for full width.
- .6 Ensure complete and continuous seal and contact between adhesive and ply membranes, including ends, edges and laps without wrinkles, fish mouths or blisters.
- .7 Do not step or walk on felts during or immediately after application until adhesive has set.
- .8 Install each ply so that it shall be firmly and uniformly set, without voids, into adhesive. Thoroughly and effectively broom or roll each membrane application to ensure full adhesion.
- .9 Lap ply membrane ends 150 mm. Stagger end laps 1.0 metres minimum.
- .10 Overlap previous day's work 600 mm, as required.
- .11 Terminate all ply layers to outer edge of roof perimeter.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

3.8 ELASTOMERIC FLASHINGS

- .1 Provide membrane flashings in accordance with manufacturer's written installation guidelines.
- .2 Install flashings to ensure the roof is watertight at the end of each Working Day.
- .3 Extend flashing membrane minimum 150 mm over roof membrane.
- .4 Extend flashing membranes minimum 200 mm up vertical surfaces.
- .5 Secure flashings at 200 mm OC. Secure vertical flashings through termination bar.
- .6 Overcoat lap edges with end lap stripping adhesive and membrane.
- .7 Tie-in leading edge of elastomeric sheet flashing with stripping ply membrane embedded between alternate courses of stripping ply adhesive.
- .8 Canted Eave:
 - .1 Extend reinforced elastomeric sheeting over outside face of cant and extend minimum 25 mm below blocking. Mechanically fasten with 38 mm common roofing nails, 200 mm OC.
 - .2 Extend reinforced elastomeric sheeting down over cant strip and embed in flashing adhesive from top of cant to at least 150 mm beyond toe of cant onto roof.
 - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .9 Canted Eave with Fascia
 - .1 Extend reinforced elastomeric sheeting over outside face of cant and fascia and secure to underside of fascia. Mechanically fasten with 38 mm common roofing nails, 200 mm OC.
 - .2 Extend reinforced elastomeric sheeting down over cant strip and embed in flashing adhesive onto roof surface a minimum of 150 mm.
 - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .10 Low Parapet Wall Flashing
 - .1 Seal exposed joint between the wall and roof deck for airtight seal.
 - .2 Adhere elastomeric sheeting completely to flashing surface, cant, and roofing with flashing adhesive.
 - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
 - .4 Extend elastomeric sheeting up and over parapet at least 38 mm and face nail with 38 mm common roofing nails, 200 mm OC.
- .11 Gravel Stop
 - .1 Prior to setting and nailing horizontal flanges of edge flashings, uniformly trowel a 1.5 mm thick layer of cold flashing adhesive to roofing surface designated to receive metal flange.
 - .2 Install metal gravel stop with formed drip edge, incorporating lock-type joints to allow expansion and contraction. Set flange in cold flashing adhesive.
 - .3 Nail interior portion of flange to wood blocking 75 mm OC, staggered.
 - .4 Prime metal flange with asphaltic primer.
 - .5 Fully adhere a sufficiently wide strip of elastomeric sheeting to flashing with flashing adhesive. Ensure complete bond and continuity without wrinkles or voids lap sheeting

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- ends 100 mm and adhere with flashing adhesive. Elastomeric sheeting to cover gravel stop completely and overlapping onto adjacent roof minimum 150 mm.
- .6 Seal edge of flashing membrane at metal upturn as specified.
- .12 Flashing At Edges and Gutters
- .1 Fabricate and install new one-piece edge gutter with downspouts. Slope gutter to downspouts.
 - .2 Prior to setting and nailing horizontal flanges of gutter, uniformly trowel a 1.5 mm thick layer of cold flashing adhesive to roofing surface designated to receive metal flange.
 - .3 Nail flange to wood blocking 75 mm OC, staggered.
 - .4 Prime metal flange with asphaltic primer.
 - .5 Adhere sufficiently wide strip of elastomeric sheeting completely to flashing surface with flashing adhesive. Ensure complete bond and continuity without wrinkles or voids lap sheeting ends 100 mm and adhere with flashing adhesive. Elastomeric sheeting to cover gravel stop completely and overlap onto adjacent roof a minimum of 150 mm.
 - .6 Seal edge of flashing membrane at metal upturn as specified.
- .13 Wall Flashing
- .1 Seal exposed joint between the wall and roof deck for airtight seal.
 - .2 Adhere elastomeric sheeting completely to flashing surface, cant and roofing with flashing adhesive.
 - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
 - .4 Elastomeric sheeting width: sufficient to extend at least 150 mm beyond toe of cant onto roof surface and 200 mm above the roof surface.
 - .5 Secure top of elastomeric sheeting to vertical plane with termination bar. Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.
- .14 Building Expansion Joints
- .1 Fill joint with loose insulation.
 - .2 Provide plywood to top of wood blocking, secured one side only; as specified.
 - .3 Apply foam rubber or 25 mm thick mineral fibre insulation to top of plywood.
 - .4 Install elastomeric sheeting centred over expansion joint.
 - .5 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
 - .6 Elastomeric Sheetting Width: Sufficient to extend onto adjacent roofing minimum 150 mm.
 - .7 Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .15 Expansion Joint at Wall
- .1 Extend vapour retarder from deck level up wall sufficiently and secure to wall.
 - .2 Fill joint with loose insulation.
 - .3 Install blocking, sheathing and compressible insulation as detailed on Drawings and as specified.
 - .4 Adhere elastomeric sheeting completely to flashing surface, cant and roofing with flashing adhesive.
 - .5 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
 - .6 Elastomeric Sheetting Width: sufficient to extend at least 150 mm beyond toe of cant onto roof surface and 200 mm above the roof surface.
 - .7 Secure top of elastomeric sheeting to vertical plane with a termination bar. Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .16 Area Divider
 - .1 Install elastomeric sheeting centered over area divider extending onto roof membrane a minimum of 150 mm beyond toe of cant on either side.
 - .2 Fully adhere sheeting with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
 - .3 Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .17 Control Joint
 - .1 Install elastomeric sheeting centered over joint.
 - .2 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
 - .3 Flashing Width: Sufficient to extend onto adjacent roofing minimum 150 mm.
 - .4 Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .18 Curb Flashing
 - .1 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
 - .2 Elastomeric Sheeting Width: Sufficient to extend from top of curb down onto adjacent roofing minimum 150 mm. Mechanically fasten sheeting on top face of curb.
 - .3 Lap sheeting ends 100 mm and adhere with flashing adhesive.
 - .4 If membrane does not completely cover sleeper, secure top edge with a termination bar. Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.
- .19 Projection Flashing
 - .1 Apply flashing adhesive to prepared area and Provide aluminum base over pipe and set into the flashing adhesive.
 - .2 Select proper step of rubber cap and cut off above index ring.
 - .3 Install cap onto base collar and press edge to ensure proper seal.
 - .4 Provide clamp around pipe and rubber cap. Prime flange.
 - .5 Install elastomeric sheeting with stripping ply adhesive and membrane.
 - .6 Cover flange completely. Extend flashing minimum 100 mm onto adjacent roofing. Remove wrinkles and voids. Lap flashing ply ends 100 mm.
- .20 Lead Plumbing Vents
 - .1 Provide lead plumbing vent flashing.
 - .2 Flange: minimum 100 mm wide; extend completely around periphery of vent flashing. Set flange into flashing adhesive. Neatly dress flange with wood blocking.
 - .3 Prime lead flange with asphaltic primer.
 - .4 Pipe Greater Than 50 Mm OD: Bend lead inside pipe minimum 25 mm; replace cracked lead.
 - .5 Pipe 50 mm OD or Less: Cut lead at vent top. Provide integral lead cap.
- .21 Cartwheel and Collar: Provide cartwheel and collar flashing around projection using elastomeric sheeting and flashing adhesive.
- .22 Coping
 - .1 Test mortar bond of coping units. Remove loose mortar from bell joint and clean surfaces.
 - .2 Pack flashing adhesive into bell joint and extend up onto bell approximately 75 mm and down onto shank of adjoining unit a similar distance.
 - .3 Cut proper lengths of 150 mm wide reinforcement membrane and dry trowel membrane into flashing adhesive; tight and wrinkle-free.
 - .4 Overcoat reinforcing membrane with flashing adhesive.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

.23 Pitch Pans

- .1 Uniformly apply a 3 mm thick layer of flashing adhesive to surfaces designated to receive metal flange.
- .2 Install pre-manufactured pitch pan into adhesive. Prime flange prior to installation.
- .3 Ensure minimum 50 mm clearance between projection and side wall.
- .4 Fully adhere elastomeric sheeting to flashing surface with flashing adhesive. Cover flange completely. Extend flashing at least 100 mm onto adjacent roofing. Ensure complete bond and continuity without wrinkles and voids. Lap sheeting ends minimum 100 mm.
- .5 Fill pitch pan 25 mm from top with pitch pan base filler.
- .6 Fill remainder with rubberized elastomer mastic. Crown top of mastic to ensure water run-off.

.24 Equipment Stands (Pipe)

- .1 Provide 200 mm high sleeve flashing with 100 mm wide flange. Flange to extend completely around flashing periphery. Solder joints. Double solder vertical joints.
- .2 Nail flange to wood blocking minimum 75 mm OC; staggered.
- .3 Prime flange with asphaltic primer.
- .4 Install elastomeric sheeting to stand and roofing with continuous 1.5 mm thick application of flashing adhesive.
- .5 Sandwich top edge of sheeting between two layers flashing tape.
- .6 Secure top of sheeting with stainless steel drawband. Seal top of drawband and sheeting-to-pipe interface. Provide watershed and tool neatly.
- .7 Fabricate umbrella and install drawband; cover sleeve flashing minimum 75 mm. Install immediately above sleeve flashing. Tighten drawband.
- .8 Wipe clean top of umbrella and projection with metal cleaner. Prime surface with metal primer.
- .9 Seal projection-to-sheet metal interface. Provide watershed and tool neatly.

.25 Piping Through Roof Boxes

- .1 Install wood blocking as specified.
- .2 Provide two-piece pipe box. Fabricate bottom portion with 100 mm flange. Notch top section to fit over piping. Provide openings 200 mm above the roof surface.
- .3 Set flange in mastic, nail flange to wood blocking at 75 mm OC. Prime flange.
- .4 Fill box interior with mineral fibre insulation.
- .5 Fasten top and closure detail to bottom.
- .6 Clean surfaces of box and piping with metal cleaner and then prime. Seal joint between box and piping.
- .7 Install elastomeric sheeting with flashing adhesive and membrane.

.26 Roof Drain

- .1 Install drain assembly in accordance with manufacturer's written installation guidelines.
- .2 Plug and seal drain to prevent water entry until service connection is completed.
- .3 Provide 600 x 600 mm size elastomeric sheeting reinforcement, centered over drain; and fully adhered with flashing adhesive. Remove wrinkles and entrapped air.
- .4 Apply mastic to exposed edge of membrane inside the drain opening.
- .5 Reclamp flashing collar to drain in bed of flashing adhesive.
- .6 Trim excess sheeting within drain.

.27 Roof Drain Insert

- .1 Cut 225 mm OD opening through membrane and insulation; coinciding with existing drain opening.
- .2 Install roof drain insert into existing drain pipe in accordance with drain insert manufacturer's written installation guidelines.
- .3 Adhere drain flange to membrane with flashing adhesive.

COLD-APPLIED - BUILT-UP ASPHALT ROOFING

- .4 Provide 900 x 900 mm size elastomeric sheeting reinforcement, centered over drain; and fully adhere sheeting with flashing adhesive. Remove wrinkles and entrapped air.
- .5 Trim excess sheeting within drain.
- .6 Seal leading edge of sheet with reinforcing membrane embedded between alternate continuous courses of flashing adhesive.

3.9 SURFACING

- .1 Flood coat roof surface with cold-process adhesive, applied at a rate of 2.4 L/m².
- .3 Immediately broadcast white calcite aggregate ballast into cold-adhesive at a rate of 20 kg/m², covering flood coat completely.
- .4 Rake out aggregate to a neat, even surface.

3.10 FIELD QUALITY CONTROL

- .1 Contractor Inspection: Prior to application aggregate surfacing, inspect completed membrane and flashing for punctures, tears, and discontinuously sealed seams.
- .2 Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions, and seal seams.
- .3 Manufacturer's Field Service: arrange for manufacturer's technical representative to regularly inspect the roofing application (minimum twice per week) and confirm that the roofing system installation is in strict accordance with manufacturer's recommendations.

3.11 CLEANING

- .1 Clean drains, gutters and downspouts of debris, ensuring free drainage.
- .2 Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.

3.12 PROTECTION

- .1 Adequately protect Products and work from damage by weather, traffic and other causes.
- .2 At the end of each Working Day, seal exposed edges of roofing membrane to be watertight.
- .3 Protect adjacent Work from damage. Repair damage.

END OF SECTION

CEMENTITIOUS FIREPROOFING

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Cementitious fireproofing, spray applied.
- 1.3 RELATED SECTIONS
- .1 Section 07 84 00 - Firestopping.
.2 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board fireproofing.
- 1.4 REFERENCES
- .1 ASTM E72-05 - Method for Conducting Strength Tests of Panels for Building Construction.
.2 CAN/ULC-S101-07 - Methods of Fire Endurance Tests of Building Construction and Materials.
.3 CAN/ULC-S102-07 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.4 ULC (Underwriters Laboratories of Canada) - List of Equipment and Materials for:
.1 Building Materials.
.2 Fire Resistance.
.3 Firestop Systems and Components.
- 1.5 PERFORMANCE REQUIREMENTS
- .1 Cementitious Fireproofing System: Provide a fire rated assembly rating of two (2) hours for typical floor assembly to ULC requirements.
- 1.6 ADMINISTRATIVE REQUIREMENTS
- .1 Sequencing: Sequence work in conjunction with placement of ceiling hanger tabs, mechanical component hangers and electrical components.
- 1.7 SUBMITTALS
- .1 Manufacturer to review site and confirm that product is compatible with existing fireproofing product. Provide product data indicating product characteristics, performance and limitation criteria.
.2 Test Reports: Indicating the following:
.1 Bond Strength of Fireproofing: ASTM E72, tested to provide minimum bond strength twenty times weight of fireproofing materials.
.2 Fire test reports of fireproofing application to substrate materials similar to project conditions.
.3 Reports from reputable independent testing agencies, of product proposed for use, which indicate conformance to the following:
.1 Fire Endurance: CAN/ULC-S101.
.2 Surface Burning Characteristics: CAN/ULC-S102.

CEMENTITIOUS FIREPROOFING

- .3 Installation Data: Manufacturer's special installation requirements, including special procedures and perimeter conditions requiring special attention.
 - .4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements and are compatible with existing fireproofing products.
 - .5 Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed.
- 1.8 QUALITY ASSURANCE
- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
 - .2 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- 1.9 REGULATORY REQUIREMENTS
- .1 Conform to applicable code for fire resistance ratings.
 - .2 Provide certificate of compliance for fireproofing materials to authority having jurisdiction indicating approval for use on this project.
- 1.10 ENVIRONMENTAL REQUIREMENTS
- .1 Section 01 35 26: Environmental conditions affecting products on site.
 - .2 Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 5 degrees C.
 - .3 Provide ventilation in areas to receive fireproofing during and 24 hours after application, to dry material.
 - .4 Provide temporary enclosure to prevent spray from contaminating air.
- 1.11 WARRANTY
- .1 Section 01 78 10: Warranties.
 - .2 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.
 - .3 Warranty: Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair failures.
- PART 2 PRODUCTS
- 2.1 MANUFACTURERS
- .1 A/D Fire Protection Systems Inc.,
 - .2 Grayhawk Industries,
 - .3 Sika Canada Inc.,
 - .4 W.R. Grace & Co.
- 2.2 MATERIALS
- .1 Fireproofing: Monokote MK-6 Fireproofing.
 - .2 Primer: Of type recommended by fireproofing manufacturer.

CEMENTITIOUS FIREPROOFING

- PART 3 EXECUTION
- 3.1 EXAMINATION
- .1 Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing, are in place.
 - .2 Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.
 - .3 Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.
- 3.2 PREPARATION
- .1 Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
 - .2 Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting.
- 3.3 PROTECTION
- .1 Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
 - .2 Close off and seal duct work in areas where fireproofing is being applied.
- 3.4 APPLICATION
- .1 Install metal lath over structural members as required.
 - .2 Apply primer, fireproofing to manufacturer instructions.
 - .3 Apply fireproofing in sufficient thickness to achieve **fire resistance rating of one (1) hour** with as many passes necessary to cover with monolithic blanket of uniform density and texture.
- 3.5 FIELD QUALITY CONTROL
- .1 Inspect the installed fireproofing after application and curing for integrity of fire protection, prior to concealment of Work.
 - .2 Existing conditions, application and work is to be reviewed by Manufacturer to ensure existing site fireproofing conditions are maintained and product is applied correctly.
 - .3 Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.
- 3.6 CLEANING
- .1 Remove excess material, overspray, droppings, and debris.
 - .2 Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

CEMENTITIOUS FIREPROOFING

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FIRESTOPPING

- PART 1 GENERAL
- 1.1 GENERAL INSTRUCTIONS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Work Included: Provide firestopping and smoke seals including but not limited to following:
- .1 firestopping and smoke seals in accordance with Code requirements, at openings and around penetrations, at un-penetrated openings, at projecting and recessed items and at openings and joints within fire separations and assemblies having fire resistance rating, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts etc.).
 - .2 firestopping and smoke seals in accordance with Code requirements, at openings and spaces at perimeter edge conditions, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts etc.).
 - .3 firestopping and smoke seals in spaces around mechanical and electrical penetrations, at tops of fire walls, between slab edges and other gaps and penetrations at fire separations.
 - .4 seals to form draft tight barriers to retard passage of flame and smoke and where specifically designated, passage of liquids while passing hose stream test.
 - .5 seal shall provide and maintain a fire-resistance rating as determined by OBC for adjacent floor, wall or other fire separation assembly to requirements of and as acceptable to authorities having jurisdiction and to Consultant.
 - .6 firestopping and smoke seals in and around fire separations, including spaces around mechanical and electrical penetrations, at tops of fire walls, between slab edges and other gaps and penetrations at fire separations.
 - .7 Divisions 21, 22, 23 and 26 respectively shall be responsible for firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside electrical bus ducts). Firestopping and smoke seals around outside of such mechanical and electrical assemblies where they penetrate fire-rated separations shall be part of work of this Section.
 - .8 systems and specified Products are only a guide and may not address all firestopping conditions pertaining to situations which may be present in the Work. Provide firestopping and smoke seal required for the Work. These Products and systems are not presented to restrict other tested and approved listed assemblies of other manufacturers designing assemblies conforming to Code and resolving firestopping required for the Work.
- 1.3 RELATED SECTIONS
- .1 Following description of work is included for reference only and shall not presumed to be complete:
- .1 Section 03 30 00: Poured concrete slabs and walls.
 - .2 Section 04 20 00: Masonry partitions including mortaring in of fire dampers.

FIRESTOPPING

- .3 Section 05 31 13: Provision of metal decking.
- .4 Section 07 92 00: Sealants and caulking.
- .5 Section 09 21 16: Gypsum board partitions.
- .6 Division 21, 22 and 23: Firestopping and smoke seals inside mechanical assemblies.
- .7 Division 26: Firestopping and smoke seals inside electrical assemblies.

1.4 REFERENCES

- .1 NFPA 101-00 - Life Safety Code
- .2 CAN/ULC S101-M89 - Standard Methods of Fire Endurance Tests of Building Construction and Materials
- .3 CAN/ULC S102-M88 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .4 ULC-S115-95 - Standard Method of Fire Tests of Firestop Systems
- .5 ULC Guide No. 40U19 - Firestop Systems
- .6 ULC Guide No. 40U19.13 - Firestop Systems Components
- .7 UL - Underwriters Laboratories of Northbrook, IL (UL tests conforming to ULC-S115 given cUL listing published by UL in their Products Certified for Canada (cUL) Directory

1.5 DEFINITIONS

- .1 General: Firestop systems intended for installation in fire separations shall have assigned fire ratings when tested in accordance with ULC-S115. Firestop systems intended for use in fire resistive wall and/or floor assemblies shall be evaluated in accordance with CAN/ULC-S101-M (Refer to ULC Guide No. 40 U18). Type of firestop systems:
 - .1 Head of Wall Joint Firestop Systems: (HW): Systems intended for installation in vertical separations between wall and floor or roof structures. These systems shall not incorporate penetrating items such as pipes or cables.
 - .2 Joint Firestop Systems (JF): Systems intended for installation in openings such as construction joints, gaps and spaces in floors or walls or at floor and wall intersections in accordance with approved systems. These systems shall not incorporate penetrating items such as pipes or cables.
 - .3 Perimeter Joint Firestop Systems (PJ): Perimeter joint firestop system rating are governed by lowest of fire resistance ratings of individual components (i.e. the wall, floor or joint system). These systems consist of floor with fire endurance rating, exterior wall with or without fire endurance rating and perimeter joint system. These perimeter joint firestop systems shall not incorporate penetrating items such as pipes or cables.
 - .4 Service Penetration Firestop Systems (SP): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with approved systems. Penetrating pipes, cable trays and similar items shall be in exact accordance with approved systems.
 - .5 Service Penetration for Combustible Systems (SPC): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with approved systems. Penetrating pipes shall be in exact accordance with approved systems. These systems are tested with a minimum differential pressure of 50 Pa between exposed and unexposed surfaces of assembly to meet Code requirements for Combustible Pipes for Use in Drain, Waste and Vent Piping.

FIRESTOPPING

- .2 Ratings: Rating of firestop system applies to its use in specific assembly of materials, penetration and floor or walls in which it is tested.
 - .1 F Rating: When system remains in opening during fire test for rating period without permitting passage of flame through openings or occurrence of flaming on any element of unexposed side of assembly.
 - .2 FT Rating: (Fire passage, plus temperature rise of 163 deg C (325) above ambient of penetrating item on cold side of assembly): When system remains in opening during fire test in accordance with F Rating requirement and additionally, transmission of heat through firestop system during rating period shall not have been such as to raise temperature of any thermocouple on unexposed surface of system more than 163 deg C (325 deg F) above initial temperature.
 - .3 FH Rating: (Fire passage and hose stream test, which simulates shock and falling building content such as ceiling, lighting fixtures and similar items): When system remains in opening during fire and hose test in accordance with F Rating requirement and additionally, during hose stream test firestop system shall not develop any opening that would permit a projection of water from stream beyond unexposed side.
 - .4 FTH Rating: When system remains in opening during fire test and hose stream test within limitations described for F, FT and FH ratings.
 - .5 L Rating: Based on volume of air flowing, per unit of time through opening around test sample under specified pressure difference applied across surface of system. L Ratings are intended to determine acceptability of firestop systems with reference to control of air movement through assembly. Rating is expressed in litres per second (l/s) per linear metre of opening for joint systems.

1.6 SUBMITTALS

- .1 Submit manufacturers specifications and technical data for each material including compositions, limitations, documentation conforming ULC and/or cUL firestop system proposed for this Project and manufacturers' installation instructions.
- .2 Submit complete and detailed shop drawings for each condition encountered on site. Indicate following:
 - .1 ULC and/or cUL assembly number certification and material safety data sheets.
 - .2 required temperature rise and flame rating.
 - .3 hose stream rating (where applicable).
 - .4 thickness.
 - .5 proposed installation methods.
 - .6 material of firestopping and smoke seals, primers, reinforcements, support and securement methods, damming materials, reinforcements and anchorages /fastenings.
 - .7 size of opening.
 - .8 adjacent materials.
 - .9 number of penetrations.
- .3 Designate on shop drawings both fixed and moving penetrants, relative positions, number of penetrations, expansion and control joints in rated slabs and walls, firestopping details at receptacles and similar poke-through devices and surrounding permanent materials. Identify re-entry locations.
- .4 Submit fireproofing manufacturer's written verification that manufacturers have identified where firestopping is required, have selected correct firestop system

FIRESTOPPING

and applicators have been trained by system manufacturers. Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

- .5 Samples: Submit various types of firestopping and smoke seal material.
- .6 Submit manufacturer's verification that installed firestopping and smoke seal materials comply with specified requirements.
- .7 Submit copies of ULC, Warnock Hersey and/or cUL Listing cards for review.

1.7 QUALITY ASSURANCE

- .1 Qualifications: Provide work of this Section executed by competent installers experienced trained, licensed and approved, by material or system manufacturer for application of materials and systems being used having minimum 5 years experience in application of Products, systems and assemblies specified. Firestopping systems shall conform to requirements of ULC-S115 tested assemblies that provide fire rating as shown.
- .2 Firestopping systems shall not affect structural integrity of load bearing walls and assemblies. Coordinate with Consultant prior to penetrating any load bearing assembly. For unusual firestop application for which no tested system is available, manufacturers shall submit their proposal to local authorities having jurisdiction for their review and approval prior to installation.
- .3 Conform to both temperature and flame ratings of standards listed hereinafter and other requirements of authorities having jurisdiction.
- .4 Consult with Product manufacturer's technical representative about following items:
 - .1 Fire separation required.
 - .2 Curing characteristics of materials specified.
 - .3 Joint characteristics as built.
- .5 Pre-Installation Meetings: Prior to commencement of sealing, arrange for Product manufacturer's knowledgeable representative to meet and discuss installation procedures and unique conditions at the Place of the Work, inspect substrate surfaces and recommend solutions to accommodate adverse conditions, periodically visit and verify installations before being concealed and report unsatisfactory conditions to Contractor, attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

1.8 WARRANTY

- .1 Warrant work of this Section against defects and deficiencies for period of five (5) years 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 additional expense to Owner. Defects include but are not limited to cracking, breakdown of bond, failure to stay in place or bleeding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 A/D Fire Protection Systems Inc.; www.adfire.com

FIRESTOPPING

- .2 Canadian General Electric Company Limited; www.gesilicones.com
- .3 Electrical Products Division/3M; www.3m.com
- .4 Grace Construction Products; www.graceconstruction.com
- .5 Instant Firestop Inc.
- .6 Hilti (Canada) Limited; www.ca.hilti.com
- .7 Johns Manville, Fire Protection Systems; www.jm.com
- .8 M.W. McGill and Associates Ltd.
- .9 Nelson Firestop Products.
- .10 ThermoFire Systems Inc.
- .11 Thomas & Betts Ltd.
- .12 Tremco (Canada) Limited. www.tremcosealants.com

2.2 MATERIALS

- .1 Supply materials and systems capable of providing effective barrier against passage of fire, smoke, gasses and where specifically indicated passage of liquids. Use only firestop systems that have been ULC and/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 Ensure firestopping system provides fire-resistance rating, flame and temperature not less than fire resistance rating of surrounding floor, wall or assembly, in accordance with requirements of OBC.
- .3 Firestop System Rating: Where applicable, comply with F rating based on number of hours system can resist flames and gases; T rating based on maximum temperature rise of 163 deg C (325 deg F) above ambient for any thermocouple in addition to flame, gas and stream performance and H rating based on capacity to withstand hose stream after burn. Design combined and/or built-up site systems in accordance with approved restrictions and technical evaluations acceptable to Consultant and authorities having jurisdiction.
- .4 Systems shall provide fire and temperature rating in accordance with those outlined in OBC and provide effective barrier against passage of flame, smoke and gasses.
- .5 Firestopping seals except for wall joints in visible areas must be of easily identifiable colour, such as red or yellow to be clearly distinguished from other building materials.
- .6 Service penetration components and assemblies, including back-up materials and supports shall be certified in accordance with ULC-S115 or CAN/ULC-S101-M and be ULC listed by a certified authority recognized by building Code officials in locality in which Building is situated.
- .7 Ensure suitability of Products for application and compatibility of materials with surfaces to which it will be applied.
- .8 Site system assembly shall be in accordance with ULC-S115 labeled and listed system design limitations, unless proposed assembly is approved by authorities having jurisdiction and meets Consultant's approval. Design combined and/or built-up site systems in accordance with approved restrictions and technical evaluations acceptable to Consultant and authorities having jurisdiction. Engineering judgements from firestopping manufacturers reviewed by Consultant and authorities having jurisdiction may be used for conditions where a ULC and/or cUL firestopping system is not available.
- .9 Sealants and putty for overhead and vertical joints shall be non-sagging; seals for floors, self-levelling. Flexible fire stop sealant shall provide movement capability in fire rated joint applications. Sealants shall be compatible with base materials

FIRESTOPPING

- such as without limitations masonry, concrete, metal, gypsum board and other similar items.
- .10 Products shall have a compressive strength capable of providing self support at a penetrating item and shall maintain their integrity as tested in a ULC vertical application.
- .11 Products shall be compatible with abutting dissimilar architectural coatings and finishes at floors, walls, ceilings, waterproofing membranes and the like. Check with Room Finish Schedule and manufacturer of selected materials being installed.
- .12 Integral Pipe Sleeves/Firestopping Components: Other Sections within Division 21, 22 and 23 may specify fire-rated pipe sleeves, >zero' clearance pipe/sleeve assemblies and integral firestopped penetration devices and accessories listed by authorized testing and certification authorities. These systems may eliminate need for separate firestopping applications at certain designated locations and it shall be responsibility of this Section to determine any and all locations where such devices will be utilized on Project.
- .13 Do not provide Products containing asbestos.
- .14 Firestopping System 1 (JF Systems):
- .1 This Firestopping System is primarily an expansion, control and perimeter seal without smoke resistance, and shall be non-combustible, semi-rigid, felt fire protection, 65 kg/m³ minimum density, depth, length and required width. Certified assembly of 1 of listed manufacturers and acceptable to Consultant. Provide sealant of spray firestopping over mineral wool.
- .2 Blanket type firestopping shall be listed and labelled in accordance with ULC Guide No. 40-U19 or 40-U19.13, with reference to 'JF System Listings'.
- .3 Where required by listing, impaling clips shall be heavy gauge galvanized wire or 25 mm wide x 0.607 mm (24 ga) galvanized steel, Z formed with horizontal bottom and dimensions conforming to location of firestopping and width of void to be filled. Ensure compression of joint do not damage clips.
- .15 Firestopping System 2: Same materials as in System 1, but without use of impaling clips and with smoke and fluid seal with hose stream resistance. Certified assembly of 1 of listed manufacturers and acceptable to Consultant.
- .16 Firestopping System 3: Fire, gas, fluid and hose stream resistant elastomeric sealant with movement capabilities, ULC labeled assembly of 1 of listed manufacturers and acceptable to Consultant. Materials shall have elastic characteristics where used at openings subject to movement. Intumescent pads may form part of this system, at Contractor's option.
- .17 Firestopping System 4: Firestopping, gas, fluid and hose stream resistant seals at openings intended for ease of re-entry such as cables shall be an elastomeric seal or proprietary assembly of following types; a cementitious or rigid seal at such locations is not permitted. Certified assembly of 1 of listed manufacturers and acceptable to Consultant.
- .18 Firestopping System 4-A: Where openings are considered large such as at cable trays and bus ducts. Certified assembly of 1 of listed manufacturers and acceptable to Consultant.
- .19 Firestopping System 5 (Cavity Wall Compartment Closer and Firestopping): Strips of "RXL Safe" semi-rigid mineral fibre insulation by Roxul Inc. 75 mm wide by depth of cavity plus 13 mm with galvanized skewers for securement at 300 mm oc., or compressed 25% to fill depth of cavity.
- .20 Primers: To manufacturer's recommendations for specific material, substrate and end use.

FIRESTOPPING

- .21 Damming and Backup Materials, Supports and Anchoring Devices: Non-combustible, to manufacturer's recommendations in accordance with tested assembly being installed and as acceptable to authorities having jurisdiction. Sheet steel covers over temporarily unused sleeves in tenant and similar spaces shall be minimum 0.912 mm (20 ga) thick galvanized sheet steel formed to a tight fit over opening with specified firestopping materials installed beneath. Combustible materials are acceptable only if they are approved under ULC or cUL systems, otherwise they should be removed after permanent firestop materials have cured.
- .22 Pipe and Duct Insulation and Wrappings Compatible with Firestopping Systems: "Nelson WRP" by Nelson Electric Ltd. for use with Nelson Electric Ltd. firestops and "Instant Type PI" by Instant Firestop Inc. for use with Instant Firestop Inc. firestops; or "TREMstop WS" by Tremco Canada Limited.
- .23 Intumescent Pads: AFSP 1077" by Grace Construction Products or "FSP Pads" by Nelson Electric, or "Instant Putty 200" by Instant Firestop Inc., or "Type PLW Firestop Pillow" by Electrovert Ltd.
- .24 Re-Entry Pillows: Permanently pliable, AFSPIL Pillows" by Grace Construction Products or "Type PLW Firestop Pillow" by Electrovert; or "PLW" by Nelson Electric; or "TREMstop PS" by Tremco Canada Limited.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Fully protect walls, windows, floors and other surfaces around areas to be firestopped from marring or damage. Mask where necessary to avoid spillage on to adjoining surfaces. Mask areas adjacent to openings, where necessary to prevent contamination or marring of adjacent surface materials. Remove masking after seal has been completed and an initial set has been achieved. Remove stains on adjacent surfaces as required.
- .2 Provide primer or surface conditioner if required by Product manufacturer. Prime surfaces in accordance with manufacturer's directions.
- .3 Verify openings, dimensions and surfaces conform to fire and smoke seal assembly.
- .4 Comply with manufacturer's recommended requirements for temperature, relative humidity, moisture content and presence of any sealer or release agents on substrate during application and curing of materials. Ensure surfaces are dry and frost free.
- .5 Remove combustible material and loose material detrimental to bond from edges of penetration. Clean, prime or otherwise prepare substrate material to manufacturer's recommendation.
- .6 Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless ULC certified assembly permits such insulation to remain within assembly, or where mechanical trades have installed special fire rated insulated sleeves. Ensure continuity of thermal and vapour barriers where such are removed, altered or replaced, to satisfaction of Division 21, 22, 23 and Consultant.
- .7 Alternatively, ensure pipe and duct insulation and wrappings occurring within openings to receive firestopping and smoke seals under this Section are installed prior to work of this Section and insulation and wrappings within fire seals are ULC listed components of system to be installed under this Section, unless ULC certified assembly permits such other insulation and wrappings to remain within assembly. Coordinate work of this Section with Division 21, 22 and 23.

FIRESTOPPING

- .8 Do not apply firestop material to surfaces previously painted or treated with sealer, curing compound, water repellent to other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .9 Provide temporary forming, packing and bracing materials necessary to contain firestopping. Upon completion, remove forming and damming materials not required to remain as part of system.
- .10 Install damming and firestopping materials as per manufacturer's instructions.
- .11 Examine sizes of penetrating service and sleeve or opening sizes with exact annular space calculations, anticipated movement and all conditions necessary to establish correct type, thickness and installation of back-up materials and seals.
- .12 Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease, moisture, frost and other foreign matter which may otherwise impair effective bonding.

3.2 INSTALLATION

- .1 Mix and apply firestopping and smoke seals in accordance with manufacturer's instructions and tested designs to provide required fire (temperature and flame) rated seal, to prevent passage of smoke and where specifically designated, passage of fluids.
- .2 Provide temporary forming and packing as required. Apply materials with sufficient pressure to properly fill and consolidate mass to seal openings.
- .3 Tool or trowel exposed surfaces. Allow materials to cure by not covering up materials until full curing has taken place.
- .4 Where a designated system described hereinafter does not meet Code requirements for particular service condition, substitute with next higher system meeting required rating.
- .5 Notify Consultant when completed installations are ready for inspection and prior to concealing or enclosing firestopping and smoke seals.
- .6 System 1:
 - .1 Install fire rated joint firestopping by compressing material minimum of 25% to ensure complete sealing and to follow irregularities of concrete slabs at perimeter of building where junction occurs with back of cladding system. Apply firestopping sealant of spray over compressed mineral wool.
 - .2 Butt succeeding sections of firestopping material tightly up against preceding. Leave no voids.
 - .3 Provide firestopping between exterior wall cladding and concrete floor slab. Secure and support to suit design requirements.
 - .4 Use this System for joint seals through fire-resistance rated floor slabs, ceilings and roofs unless otherwise stipulated.
- .7 System 2:
 - .1 At fire-rated masonry walls and gypsum board partitions which extend nominally to within 19 mm of underside of deck above, insert fire rated joint assembly firestopping material in 25% compression in accordance with ULC test requirements and manufacturer's instructions. Provide adequate depth of material to fill gap flush with face of wall, except as otherwise specified. Apply firestopping sealant of spray over compressed mineral wool.
 - .2 Insert at intersection of fire-resistance rated masonry and gypsum board partitions.

FIRESTOPPING

- .3 Insert at both sides of control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .4 Where wall/slab junction is exposed in finished work, keep fibre back 9 mm from face of block and apply fire-resistant sealant to gap, tooling to a concave joint.
- .5 At perimeter slab locations where this system would otherwise be exposed in finished work and where smoke seal is required, provide cover spray material of thickness as recommended by manufacturer of System 3 material set flush with top of slab and tooled smooth. Minimum cover spray thickness 3 mm. Where anticipated movement in joint width is inevitable, select sealant with elastic capabilities.
- .8 System 3:
 - .1 This System establishes fire rated firestopping for service penetrations throughout the Project. Seal gaps and holes in fire-rated walls and slabs and composite construction through which conduit, wire, cables, ductwork, piping and all other protrusions pass as a result of work using fire-resistant penetration sealant. Include opening which have been formed, sleeved and cored.
 - .2 Apply at unpenetrated openings and sleeves installed for future use through fire-resistance rated assemblies.
 - .3 Apply this System between spaces having different air pressures. (See Mechanical Drawings for pressurized areas and locations of moving penetrants.)
 - .4 Apply at "wet" rooms supported by suspended slabs at locations over Electrical and Equipment Rooms or similar areas containing power devices in which future re-entry is not required.
 - .5 Apply at Mechanical Rooms and similar rooms having systems containing liquids, including piping runs, unless such rooms are located over slab-on-grade.
 - .6 Install System 3 materials at elevator shafts, duct shafts and other similar locations over occupied spaces.
 - .7 Install 6 mm to 9 mm bead of firestop caulking at interface of retaining angles around fire dampers, where angles meet fire-rated assembly and between retaining angles and fire damper, both sides of penetration. At floor locations, sealant bead at top of assembly is adequate.
 - .8 Where necessary, remove insulation from insulated pipe and duct where such services penetrate a fire separation unless certified assembly permits such insulation to remain within assembly. Apply wrapping materials as listed herein.
 - .9 Install System 3 materials at open wall joints, including expansion joints between fire rated enclosures and assemblies.
- .9 Systems 4 and 4A: Install at following locations:
 - .1 At Electrical, Electrical Switchgear, Electrical Transformer Rooms and at Telephone Equipment Rooms requiring re-entry for additional services.
 - .2 Install at communications and computer cable penetration points throughout.
- .10 Accessories: At hollow fire-rated walls, apply intumescent pads to back surfaces and cable entry points of electrical boxes, panels and other service penetration points, ensuring close coordination with electrical, mechanical and drywall trades. Where greater dimension of panel exceeds 500 mm, gypsum board trades construct fire-rated enclosure around recessed panels.
- .11 System 5: Maintain maximum cavity wall compartments to lesser of following 2 criteria by bridging gap between cavity back-up material and back face of brick

FIRESTOPPING

with full-depth strips of compartment closer and firestopping material, securing in position with mechanical fasteners and sealing against firm, primary cavity materials:

- .1 10 m²,
- .2 Paragraph 3.1.11 of OBC.

3.3 INSPECTION AND TESTING

- .1 Perform a series of 5 fog tests to random locations as designated by Consultant. Should any penetration, joint or void, under jurisdiction of this Section, emit visible fog, make repairs and replace deficiencies and re-perform fog test at no additional cost to Owner.
- .2 Fog units (machines) shall have a formulation output range of (1.5 gal/hr). Formulation particle size 0.5 - 25 µm. Fogging agent shall be non-toxic, non-staining and shall provide a heavy fog at 30 ppm with a permissible airborne level concentration of 50 ppm.
- .3 Fog at a rate of 4 s/100 cu ft. Maintain fog density until inspection is complete.
- .4 Where work or materials fail to meet requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.

3.4 CLEANING

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of Consultant. Remove and or correct staining and discolouring of adjacent surfaces as directed.
- .2 Remove temporary dams after initial set of firestopping and smoke seal materials where such materials are left exposed in finished areas and flame spread rating of such materials exceed a value of 25, in accordance with CAN/ULC-S102-M.

3.5 PENETRATION SIZING

- .1 Following shall regulate sizing of service penetrations to be firestopped, other than for fire damped openings:
 - .1 Single, circular penetration shall be sleeved by work of Divisions 21, 22, 23 and 26.
 - .2 Multiple penetrations of circular elements are defined as more than 1 circular penetration having a maximum space of 100 mm between closest faces of such penetrating elements. Forming of such multiple penetrations is responsibility of respective trades whose service penetrates rated assembly and such formed opening shall be square or rectangular frame around group of penetrations in which maximum clearance between outer penetration element and face of opening shall be 25 mm (1").
 - .3 Create single and multiple rectangular penetrations in same manner as specified above, but edge clearance may be increased to a maximum of 50 mm.
 - .4 Exception; at fire dampers, clearances are governed by testing authorities' requirements.
 - .5 For purposes of this specification, a moving penetrant is defined as a penetrating device having an anticipated movement of greater than 9 mm when measured at right angles to face of rated assembly.

FIRESTOPPING

3.6 CABLE TRAY PENETRATIONS

- .1 Seal cable tray penetrations with re-enterable matrices having a minimum compressive strength of 250 psi having a minimum FTH Rating of 1/2 hr for 500 MCM cables and 2 hr for 300 MCM cables.
- .2 Listings shall be for cable tray tests carried out having minimum 30% actual and/or 100% visual cable density.

END OF SECTION

FIRESTOPPING

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JOINT SEALING

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Conform to Division 01, General Requirements.

1.2 SECTION INCLUDES

- .1 Preparing substrate surfaces.
- .2 Sealant and joint backing.
- .3 Work Included: Provide joints sealants including but not limited to following:
 - .1 Exterior:
 - .1 Control and expansion joints in cast in place concrete.
 - .2 Joints between architectural precast concrete units.
 - .3 Control and expansion joints in unit masonry.
 - .4 Joints in dimension stone cladding.
 - .5 Joints in glass unit masonry assemblies.
 - .6 Joints in exterior insulation and finish systems.
 - .7 Joints between metal panels.
 - .8 Perimeter joints between materials listed above and frames of doors and windows.
 - .9 Control and expansion joints in soffits and overhead surfaces.
 - .10 Control and expansion joints in brick pavers.
 - .11 Control, expansion, and isolation joints in cast in place concrete slabs.
 - .12 Joints between architectural precast concrete paving units.
 - .13 Joints in stone paving units, including steps.
 - .14 Tile control and expansion joints.
 - .15 Joints between different materials listed above.
 - .16 Other joints as indicated.
 - .2 Interior:
 - .1 Control and expansion joints on exposed interior surfaces of exterior walls.
 - .2 Perimeter joints of exterior openings where indicated.
 - .3 Tile control and expansion joints.
 - .4 Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - .5 Joints on underside of precast beams and planks.
 - .6 Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - .7 Joints between plumbing fixtures and adjoining walls, floors and counters.
 - .8 Other joints as indicated.

1.3 RELATED SECTIONS

- .1 Section 04 20 00: Masonry control and expansion joint fillers and gaskets.
- .2 Section 07 84 00: Firestopping and smoke seals.
- .3 Section 09 21 16: Sealing of joints around sound attenuating gypsum board partitions.

JOINT SEALING

1.4 REFERENCES

- .1 ASTM C719-93(05)-Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
- .2 ASTM C834-05-Standard Specification for Latex Sealants
- .3 ASTM C920-05-Standard Specification for Elastomeric Joint Sealants
- .4 ASTM C1021-01-Standard Practice for Laboratories Engaged in Testing of Building Sealants
- .5 ASTM C1193-05a-Standard Guide for Use of Joint Sealants
- .6 ASTM C1248-06-Standard Test Method for Staining of Porous Substrate by Joint Sealants
- .7 ASTM E548-94e1-Standard Guide for General Criteria Used for Evaluation and Assessment of Analytical Chemistry Laboratories
- .8 CAN/CGSB-19.13-M87-Sealing Compound, One-Component, Elastomeric, Chemical Curing
- .9 CAN/CGSB-19.17-M90-Sealing Compound, One-Component Acrylic Emulsion Base
- .10 CAN/CGSB-19.24-M90-Multicomponent, Chemical-Curing Sealing Compound

1.5 SYSTEM DESCRIPTION

- .1 Performance Requirements: Provide exterior and interior elastomeric joint sealants establishing and maintaining water tight, water resistant and air tight continuous joint seals without staining or deteriorating joint substrates at all dissimilar materials.

1.6 SUBMITTALS

- .1 Product Data: Submit Product information from sealant manufacturer prior to commencement of work of this Section verifying:
 - .1 selected sealant materials are from those specified.
 - .2 composition and physical characteristics.
 - .3 surface preparation requirements.
 - .4 priming and application procedures.
 - .5 suitability of sealants for purposes intended and joint design.
 - .6 test report on adhesion, compatibility and staining effect on samples of materials used on Project.
 - .7 sealants compatibility with other materials and Products with which they come in contact including but not limited to sealants provided under other Sections, insulation adhesives, bitumens, brick, stone, concrete, masonry, metals and metal finishes, ceramic tile, plastic laminates, paints.
 - .8 suitability of sealants for temperature and humidity conditions at time of application.
- .2 Colour: Submit colours for acceptance in accordance with following general colour hierarchy i.e. Between 2 dissimilar materials, colour the sealant to match the material with the higher relative position on the colour hierarchy scale (highest is at ".1"):
 - .1 Concrete.
 - .2 Masonry.
 - .3 Metal extrusions.
 - .4 Metal (formed).

JOINT SEALING

1.7 QUALITY ASSURANCE

- .1 Manufacturer's Supervision: Consult with manufacturer's technical representative about following items:
 - .1 weather conditions under which work will be done.
 - .2 anticipated frequency of joint movement.
 - .3 shape factor of the joint.
 - .4 Durometer hardness, slump and curing characteristics of materials specified.
 - .5 joint characteristics as built.
 - .6 installation procedures to be adopted.
 - .7 mixing procedures to be adopted.
 - .8 conditions under which the Work will be done, in order that any alternative recommendations may be made should adverse conditions exist.
- .2 Qualifications: Provide work of this Section executed by competent installers who have a membership in good standing in the Sealant and Waterproofing Association and with minimum of five (5) years experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
- .3 Mock ups: Conform to requirements of Section 01 40 00. At site, in area(s) designated by Consultant, erect sample panels 1 m long for each type(s) of sealant joint design, showing location, size, shape and depth of joint complete with backup materials, primer, caulking and sealant, bond, colour and quality of installation work. If requested conduct field test for joints designated. Do not sealant work until samples have been approved. Approved samples shall become standard of comparison for sealant and caulking work on site and shall become part of work.

1.8 PROJECT CONDITIONS

- .1 Environmental Requirements: Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C Maintain minimum temperature of application during application and for 8 hours after application. Consult manufacturer for specific instructions before proceeding and obtain Consultant's approval.
- .2 Do not proceed with installation joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated and until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 WARRANTY

- .1 Warrant work of this Section for period of five (5) years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; cracking, crumbling, melting, shrinkage, sag, failure of adhesion, cohesion or reversion, air and moisture leakage, marbling or streaking due to improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials.

JOINT SEALING

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 ChemRex Inc.; www.chemrex.com
 - .2 CPD Construction Products; www.cpd.com
 - .3 Dow Corning; www.dowcorning.com
 - .4 GE Silicones Canada, Inc.; www.gesilicones.com
 - .5 Sika Canada Inc.; www.sikacanada.com
 - .6 Sonneborn; www.chemrex.com
 - .7 Tremco Canada; www.tremcosealants.com
 - .8 W.R. Meadows of Canada; www.wrmeadows.com

2.2 MATERIALS

- .1 Primer: As recommended by sealant manufacturer for type of surface being primed and conditions of service. VOC limit of 250g/L
- .2 Sealant: VOC limits of 250g/L.
- .3 Provide Products with capability, when tested for adhesion and cohesion under maximum cyclic movement in accordance with ASTM C719, to withstand required percentage change in joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.
- .4 Where elastomeric sealants shall be non-staining to porous substrates, provide Products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.
- .5 Type A Sealant: Provide 1 of following:
 - .1 Nonsag type, multi-component polyurethane sealant conforming to CAN/CGSB-19.24-M, Type 2, Class B. Supply in standard colours as selected. Supply 1 of following:
 - .2 Dymeric by Tremco Canada.
 - .3 Sikaflex -2c NS by Sika Canada Inc.
 - .4 Sonoplastic NP 2 by ChemRex Inc.
 - .5 Nonsag type, 1 component polyurethane sealant conforming to CAN/CGSB-19.13 M, Class MCG 2 25 B N. Supply in standard colours as selected. Supply 1 of following:
 - .6 Sikaflex -1a by Sika Canada Inc.
 - .7 DyMonic and/or AVulkem 116 by Tremco Canada.
 - .8 Sonoplastic NP 1 by ChemRex Inc.
- .6 Type B Sealant: Nonsag type, 1 component, mildew resistant silicone containing non toxic fungicidal agents. Supply in standard colours as selected. Supply 1 of following:
 - .1 Dow Corning 786 by Dow Corning Canada Inc.
 - .2 Tremsil 200 by Tremco Canada.
 - .3 Sanitary SCS1700 by GE Silicones Canada, Inc.
 - .4 Sonoplastic 150 by ChemRex Inc.
 - .5 Type C Sealant: Provide 1 of following:
 - .6 Nonsag type, 1 component, acrylic latex sealant conforming to ASTM C834 or CAN/CGSB-19.17-M. Supply in standard colours as selected. Supply 1 of following:
 - .7 Tremflex 834 by Tremco Canada.
 - .8 Sonolac by Sonneborn.

JOINT SEALING

- .7 Nonsag type, multi-component polyurethane sealant conforming to CAN/CGSB-19.24-M, Type 2, Class B. Supply in standard colours as selected. Supply 1 of following:
 - .1 DYmeric by Tremco Canada.
 - .2 Sikaflex -2c NS@ by Sika Canada Inc.
 - .3 Sonoplastic NP2 by ChemRex Inc.
 - .4 Nonsag type, 1 component polyurethane sealant conforming to CAN/CGSB-19.13 M, Class MCG 2 25 B N. Supply in standard colours as selected. Supply 1 of following:
 - .5 Sikaflex -1a by Sika Canada Inc.
 - .6 DyMonic and/or Vulkem 116 by Tremco Canada.
 - .7 Sonoplastic NP1 by ChemRex Inc.
- .8 Type D Sealant: Provide 1 of following:
 - .1 Pour grade, 1 component polyurethane sealant conforming to CAN/CGSB-19.13 M, Class MC 1 40 B N. Supply in standard colours as selected. Supply 1 of following:
 - .2 SL 1 by Sonneborn.
 - .3 Vulkem 45 by Tremco Canada.
 - .4 Pour grade, multi component, polyurethane sealant conforming to CAN/CGSB-19.24 M, Type 1, Class B. Supply 1 of following:
 - .5 Sikaflex -2c SL by Sika Canada Inc.
 - .6 THC-900/901 or Vulkem 245 by Tremco Canada.
 - .7 Sonoplastic NP2 by ChemRex Inc.
- .9 Type E Sealant: Self levelling type, epoxy modified joint sealant, cold-applied, 2 component, pour grade, grey colour. Supply 1 of following:
 - .1 Loadflex by Sternson, Division of Sika Canada Inc.
 - .2 Bondflex by W.R. Meadows of Canada.
 - .3 CPD Joint-Flex P.E.@ by CPD Construction Products.
 - .4 EP 280 Control Joint Sealant by ChemRex Inc.
- .10 Silicone Sealants for Exterior Joints: Perimeters of exterior openings, where frames meet exterior facade of building such as precast, masonry and similar surfaces:
 - .1 1 component 50% movement, medium modulus, neutral cure, non-sag silicone sealant:
 - .1 795 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 2 by Tremco Canada.
 - .3 Silpruf by GE Silicones Canada, Inc.
 - OR
 - .2 1 component 50% movement, medium modulus, neutral cure, silicone sealant:
 - .1 791 Silicone Weatherproofing Sealant by Dow Corning.
 - .2 Spectrum 3 by Tremco Canada.
 - .3 Ultrapruf by GE Silicones Canada, Inc.
 - .4 123 Silicone Seal by Dow Corning.
 - .5 Silspan by GE Silicones Canada, Inc.
- .11 Silicone Sealants for Exterior Expansion and Control Joints:
 - .1 Cast-In-Place Concrete Walls, Architectural Precast Panels, Unit Masonry Wall and Exterior Insulation Finish System (EIFS): 1 component 100% movement, low modulus, neutral cure, non-sag silicone sealant:
 - .1 790 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 1 by Tremco Canada.
 - .3 GE-NB by GE Silicones Canada, Inc.

JOINT SEALING

- .12 Composite Metal Panels and Joints Between [EIFS and] Adjacent Materials: 1 component, 50% movement, medium modulus, neutral cure, non-sag silicone sealant
 - .1 795 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 2 by Tremco Canada.
 - .3 Silpruf by GE Silicones Canada, Inc.
- .13 Marble, Granite or Limestone: Non-staining, 1 component, 50% movement, medium modulus, dirt resistant finish, neutral cure silicone sealant:
 - .1 756 SMS Silicone Building Sealant by Dow Corning.
- .14 Coping Joints and Coping to Façade Joints:
 - .1 1 component 50% movement, medium modulus, neutral cure, non-sag silicone sealant :
 - .1 795 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 3 by Tremco Canada.
 - .3 Silpruf by GE Silicones Canada, Inc.

OR

 - .2 50% movement, medium modulus, neutral cure, silicone sealant:
 - .1 791 Silicone Weatherproofing Sealant by Dow Corning.
 - .2 Spectrum 3 by Tremco Canada.
 - .3 Ultrapruf by GE Silicones Canada, Inc.
- .15 Silicone Sealants for Exterior Joints in Horizontal Surfaces:
 - .1 Pre-cast and Cast In Place Concrete: 1 component □ 100% movement, low modulus, neutral cure, non-sag silicone sealant:
 - .1 790 Silicone Building Sealant@ by Dow Corning.
 - .2 Spectrem 1 by Tremco Canada.
 - .3 GE-NB by GE Silicones Canada, Inc.
 - .2 Low modulus silicone sealant:
 - .1 Parking Structure Sealant NS (non-sag), FC (fast cure) or SL (self levelling) by Dow Corning.
 - .2 Tremco Parking Structure SL by Tremco Canada.
 - .3 Unit Paver, Granite Pavers, Brick Masonry Pavers: 1 component □ 100% movement, low modulus, neutral cure, non-sag silicone sealant
 - .1 790 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 1 by Tremco Canada.
 - .3 GE-NB by GE Silicones Canada, Inc.
- .16 Silicone Sealants for Interior Perimeters of Exterior Openings: 1 component □ 50% movement, medium modulus, neutral cure, silicone sealant
 - .1 791 Silicone Weatherproofing Sealant by Dow Corning
 - .2 Spectrem 3 by Tremco Canada.
 - .3 Ultrapruf by GE Silicones Canada, Inc..
- .17 Silicone Sealants for Interior Expansion or Control Joints: Cast in place concrete walls and architectural precast panels, 1 component , 100% movement, low modulus, neutral cure, non-sag silicone sealant:
 - .1 790 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 1 by Tremco Canada.
 - .3 GE-NB by GE Silicones Canada, Inc.
- .18 Silicone Sealants for Interior Unit Masonry Walls: 1 component □ 50% movement, medium modulus, neutral cure, non-sag silicone sealant
 - .1 795 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 2 by Tremco Canada.
 - .3 Silpruf by GE Silicones Canada, Inc.
- .19 Silicone Sealants for Expansion and Control Joints In Interior Floor Surfaces: 1 component, 100% movement, low modulus, neutral cure, non-sag silicone sealant

JOINT SEALING

- .1 790 Silicone Building Sealant by Dow Corning.
- .20 Silicone Sealants for Interior Joints of Underside of Precast Beams or Planks: 1 component, 100% movement, low modulus, neutral cure, non-sag silicone sealant.
 - .1 790 Silicone Building Sealant by Dow Corning.
 - .2 Spectrem 1 by Tremco Canada.
 - .3 GE-NB by GE Silicones Canada, Inc.
- .21 Joint Backing: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam, compatible with joint substrates and are approved by sealant manufacturer based on field experience and laboratory test. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Backing shall be compatible with sealant, primer and substrate.
- .22 Bond Breaker Tape: As recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self adhesive tape where applicable.
- .23 Joint Primer: Non-staining, suitable for substrate surfaces, compatible with joint forming materials and as recommended by sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.
- .24 Masking Tape: Provide non staining, non-absorbent tapes and sheets which effectively mask sealant without leaving an adhesive residue compatible with joint sealants and surfaces adjacent to joints.
- .25 Cleaning Material: Non corrosive, non-staining, solvent type, xylol, methyl ethyl ketone (MEK), toluol, isopropyl alcohol (IPA) or as recommended by sealant manufacturer and acceptable to material or finish manufacturers for surfaces adjacent to sealed areas free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Examine joints for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Ensure joints are suitable to accept and receive sealants.
- .2 Verify that joint surfaces are clean, sound, free of defects and that dimensions are within sealant manufacturer=s size requirements.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work implies acceptance of surfaces and conditions.
- .4 Do not apply sealant to masonry until mortar has cured.
- .5 Before any sealing work is commenced, test materials for indications of staining or poor adhesion.

3.2 PREPARATION

- .1 Remove existing caulking and/or sealant from joints as required. Ensure joint interfaces are clean.
- .2 Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such

JOINT SEALING

- contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- .3 Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.
 - .4 Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or blast cleaning, mechanical abrading or combination of these methods as required to obtain clean and sound surfaces.
 - .5 Remove laitance by grinding or mechanical abrading.
 - .6 Remove oils by sandblast cleaning.
 - .7 Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.
 - .8 Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.
 - .9 Wipe non-porous surfaces such as metal and glass to be sealed, except pre coated metals, with cellulose sponges or clean rags soaked with ethyl alcohol, ketone solvent, xylol or toluol and wipe dry with clean cloth. Where joints are to be sealed with silicone based sealants clean joint with methyl ethyl ketone (MEK) or xylol. Do not allow solvent to air-dry without wiping. Clean pre coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant. Check ferrous metal surfaces are painted before applying sealant.
 - .10 Examine joint sizes and where depth of joint exceed required depth of sealant correct to achieve proper following width/depth ratio:
 - .1 Maintain 2:1 width/depth ratio: minimum joint size shall be 6 mm (1/4") x 6 mm (1/4"), maximum depth of sealant to be 13 mm (1/2").
 - .11 Install joint backing material to achieve correct, uniform joint profile and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - .12 Do not leave gap between ends of sealant backing; do not stretch, twist, puncture, or tear sealant backings; remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 - .13 Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape to prevent 3-sided adhesion.
 - .14 Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.
 - .15 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.
 - .16 Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.
 - .17 Do not exceed shelf life and pot life of materials and installation times, as stated by manufacturer.
 - .18 Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.
 - .19 Use materials as received from manufacturer, without additions, deletions and adulterations of materials.
 - .20 Mix multiple component sealants and bulks sealants using mechanical mixer capable of mixing without mixing air into material, in accordance with manufacturer's directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.

JOINT SEALING

- .21 Seal joints in surfaces to be painted before surfaces are painted. Where surfaces to be sealed are prime painted in shop before sealing check to make sure prime paint is compatible with primer and sealant. If they are incompatible, inform Consultant and change primer and sealant to compatible types approved by Consultant.
- .22 Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.
- .23 Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant as recommended by sealant manufacturer.

3.3 APPLICATION

- .1 Apply in accordance with manufacturer's directions and recommendations unless more stringent requirements apply.
- .2 Apply sealant by proven techniques using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer.
- .3 Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill all voids in joint regardless of variation in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead is not acceptable.
- .4 Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.
- .5 Compound may be tooled, provided such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.
- .6 Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.
- .7 Ensure joint surfaces are straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life Products.
- .8 Do not use solvent curing sealants indoors.
- .9 Use 1 of sealants specified for each type in following locations. Ensure sealant chosen (from several specified under each type under "MATERIALS") for each location is recommended by manufacturer for use for conditions encountered:
 - .1 Type A: Joints between metal frames and adjacent masonry and/or concrete construction in exterior walls, exterior and interior sides; control and expansion joints in exterior and interior surfaces of poured-in-place concrete walls, precast architectural wall panels and unit masonry walls; sealing of joints between underside of pre stressed precast concrete floor slabs and masonry; and all other locations where sealant is required or noted on Drawings except in locations designated for Type B, C, D, E, F and G and except where sealant is specified in other Sections.
 - .2 Type B: Joints between urinals and walls, around washrooms accessories, at corners of walls, between splash backs and walls, in shower, damp or wet areas, at ceramic tiles where mildew resistant sealant is required.
 - .3 Type C: Joints between interior metal and/or wood frames and adjacent construction in interior partitions.
 - .4 Type D (traffic bearing): Joints with movement in horizontal surfaces between concrete slabs, pavers and precast concrete panels.

JOINT SEALING

- .5 Type E (load bearing): Static joints in horizontal surfaces where self-levelling sealants are required.
 - .6 Type F: Provide in areas requiring use of pick proof sealants so occupants cannot pick through the sealants.
 - .7 Type G: Provide at traffic bearing joints including concrete and ceramic tile control, expansion and joints to adjacent materials, at non traffic bearing joints between metal and concrete, ceramic tile, masonry, gypsum board, plaster or adjacent materials; masonry control and expansion joints and between masonry and concrete; joints in concrete including precast or between concrete and adjacent materials; joints between plumbing fixtures and adjacent materials; metal to metal joints.
 - .10 Joint designation in preceding paragraphs and fact that Drawings do not show all locations to be sealed does not limit responsibility of this Section to seal all locations except those indicated in other Sections of work, required to create and ensure continuous enclosure.
 - .11 Firestopping and Smoke Seal: Sealants part of firestopping systems and smoke seals provided within fire rated assemblies shall be part of work of Section 07 84 00 and shall be carried out under supervision of this Section.
- 3.4 FIELD QUALITY CONTROL
- .1 Inspect joints for complete fill, for absence of voids and for joint configuration complying with specified requirements. Record results in a manner acceptable to Consultant.
 - .2 Tests may include sampling of installed Product where adhesion, cohesion or reversion failure is suspected.
 - .3 Where work or materials fail to meet requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.
 - .4 Confirm in writing by manufacturer=s representative to be on site throughout construction period work to inspect application of sealant and surface preparation.
- 3.5 CLEANING
- .1 Immediately clean adjacent surfaces which have been soiled and leave work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.
- 3.6 PROTECTION
- .1 Provide approved, non staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.
 - .2 Maintain protection securely in place until completion of Work. Remove protection when so directed by Consultant.
 - .3 Repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

EXPANSION CONTROL

PART 1 GENERAL

1.1 GENERAL INSTRUCTION

- .1 Conform to Division 01, General Requirements.

1.2 SECTION INCLUDES

- .1 Architectural joint systems for building interiors and exteriors.
- .2 Related Sections include the following:
 - .1 Sheet metal wall joint systems Section 07 26 01
 - .2 Liquid-applied joint sealants Section 07 92 00

1.3 DEFINITIONS

- .1 Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- .2 Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- .3 Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.
- .4 Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.4 SUBMITTALS

- .1 Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:
 - .1 Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- .2 Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval, and obtain approval before materials are fabricated and delivered to the site. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seal for UV exposure.
- .3 Samples For each type of joint system indicated. include manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.
- .4 Certificates – Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Approved by manufacturer.
- .2 Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.
- .3 Loading Characteristics: Standard loading refers to covers that are capable of withstanding up to 500 lb. point loads. Heavy duty refers to covers that are capable of withstanding up to 2000 lb. point loads.

EXPANSION CONTROL

- .4 Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.
- .5 Manufacturer to provide 5 year warranty for all joint covers.

1.6 COORDINATION

- .1 Coordinate installation of exterior wall joint systems with roof expansion assemblies to ensure that wall transitions are watertight.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.
 - .1 Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 - .2 Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
 - .3 Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- .2 Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.
 - .1 Finish: No.4, directional satin.
- .3 Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.
- .4 Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C28000 Muntz Metal for plates.
- .5 Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- .6 Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
- .7 Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
- .8 Moisture Barrier: 7-ply laminate reinforced Polyethylene.
- .9 Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS, GENERAL

- .1 General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
- .2 Design architectural joint systems for the following size and movement characteristics:
 - .1 Nominal Joint Width: 50 mm.
 - .2 Maximum Joint Width:
 - .3 Minimum Joint Width:
 - .4 Lateral Shear Movement Capability:

EXPANSION CONTROL

2.3 ARCHITECTURAL JOINT SYSTEMS

- .1 Basis of Design is Construction Specialties, Inc., 6696 Route 405 Highway, Muncy, PA. Other manufacturers may be accepted if the manufacturer can demonstrate product compliance with the requirements of the contract documents.
- .2 Wall-to-Wall Joint Systems:
 - .1 Model FWF-200
 - .2 Type: Flat seal.
 - .1 Exposed Metal: Aluminum, mill finish.
 - .2 Seal Material: Santoprene, Colour from manufacturer's standard range.
 - .3 Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than applicable fire separation as noted on the drawings.
- .3 Floor-to-Floor Joint Systems: - NOT USED THIS PROJECT
 - .1 Model GFT including new-to-existing condition
 - .2 Type: Elastomeric seal.
 - .1 Exposed Metal: Aluminum, Class II, clear anodic finish
 - .2 Seal Material: CS Thermoplastic Rubber (TPR), Colour: As selected by Architect from manufacturer's standard range. Gaskets to be dual durometer and have a flat profile that is free of ridges/reveals that collect dirt.
 - .3 Attachment Method: Mechanical anchors.
 - .4 Load Capacity: Standard duty.
 - .5 Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction as noted on the drawings.
- .4 Floor-to-Wall Joint Systems: - NOT USED THIS PROJECT
 - .1 Model GFTW
 - .2 Type: Elastomeric seal.
 - .1 Exposed Metal: Aluminum. Class II, clear anodic finish.
 - .2 Seal Material: CS Thermoplastic Rubber (TPR). Colour: As selected by Architect from manufacturer's standard range. Gaskets to be dual durometer and have a flat profile that is free of ridges/reveals that collect dirt.
 - .3 Attachment Method: Mechanical anchors.
 - .4 Load Capacity: Standard duty.
 - .5 Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction as noted on the drawings.
- .5 Ceiling-to-Ceiling Joist Systems: - NOT USED THIS PROJECT
 - .1 Model FCF.
 - .2 Type: Flat seal.
 - .1 Exposed Metal: Aluminum, mill finish.
 - .2 Seal Material: Santoprene, Colour: As selected by Architect from manufacturer's standard range.
- .6 Wall-to-Ceiling Joist Systems: - NOT USED THIS PROJECT
 - .1 Model FCFC.
 - .2 Type: Flat seal.
 - .1 Exposed Metal: Aluminum, mill finish.
 - .2 Seal Material: Santoprene, Colour: As selected by Architect from manufacturer's standard range.
- .7 Exterior Wall Joint Systems:
 - .1 Model VF.
 - .2 Type: Pre-compressed joint filler.
 - .1 Seal Material: Silicone, Colour: Grey.

EXPANSION CONTROL

- .2 Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction as noted on the drawings.

2.4 FINISHES

- .1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- .2 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .3 Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
 - .1 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Prepare substrates according to architectural joint system manufacturer's written instructions.
- .2 Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.
- .3 Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- .4 Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- .1 Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.
- .2 Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - .1 Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - .2 Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.
 - .3 Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - .4 Locate in continuous contact with adjacent surfaces.
 - .5 Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
 - .6 Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.
 - .7 Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3") from each end and not more than 610 mm (2'-0") o.c.
- .3 Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

EXPANSION CONTROL

- .1 Provide in continuous lengths for straight sections.
- .2 Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
- .3 Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- .4 Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.
- .5 Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.
- .6 Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
 - .1 Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- .7 Water Barrier: Provide water barrier at exterior joints and where called for on Drawings. Provide drainage fittings where indicated.

3.4 PROTECTION

- .1 Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- .2 Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

EXPANSION CONTROL

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DOORS AND FRAMES

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Work Included: Provide steel doors and frames including but not limited to following:
- .1 hollow metal doors, swing flush type.
 - .2 fire rated with or without temperature rise rated doors.
 - .3 hollow metal door frames
 - .4 hollow metal transom panels.
 - .5 hollow metal frames and mullions for borrowed lights and glazed screens.
 - .6 Glazing stops.
 - .7 Preparation of hollow metal doors and frames for security system CSA approved wiring and/or conduit for electronic hardware. Include junction boxes and conduit for electronic hardware Include system consisting of 15 conductors of 22 gauge wire complete with a modular quick connect wiring harness.
 - .1 Refer to Door Schedule for openings that require electrified hardware.
- 1.3 RELATED SECTIONS
- .1 Section 04 20 00 - Installation of steel door frames in masonry.
 - .2 Section 07 92 00 - Caulking and/or sealing door frames.
 - .3 Section 06 20 00 - Installation of hardware.
 - .4 Section 08 71 00 - Supply of hardware.
 - .5 Section 08 80 50 - Provision of glazing.
 - .6 Section 09 91 10 - Finish painting.
 - .7 Division 26 - Electrical, conduit, wire runs and 115 VAC hook-up for electronic hardware.
- 1.4 REFERENCES
- .1 ANSI A115-05 - Hardware Preparations for Steel Doors and Frames
 - .2 ANSI A115-IG 94 - Installation Guide for Doors and Hardware
 - .3 ANSI A224. 1-94 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
 - .4 ANSI A250. 4-01 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware reinforcing.
 - .5 ASTM A568M-06a - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold - Rolled, General Requirements for
 - .6 ASTM A653M-06 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .7 ASTM A924(M)-07 - Specification for General Requirements for Steel Sheet, Metallic-Coated by Hot-Dip Process
 - .8 ASTM C177-04 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

DOORS AND FRAMES

- .9 ASTM C518-04 - Standard Test Method for Steady-State Thermal Transmission Properties by means of the Heat Flow Meter Apparatus
 - .10 ASTM C578-06 - Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - .11 ASTM C665-06 - Specification for Mineral Fiber Insulation
 - .12 ASTM C1289-06 - Specification for faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - .13 ASTM D1622-03 - Standard Test Method for Apparent Density of Rigid Cellular Plastics
 - .14 ASTM E90-04 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - .15 ASTM E413-04 - Classification for Rating Sound Insulation
 - .16 CGSB 41-GP-19M - Rigid Vinyl Extrusions for Windows and Doors
 - .17 CAN/CGSB-82.5-M88 - Insulated Steel Doors
 - .18 CSA W59-03 - Welded Steel Construction (Metal Arc Welding)
 - .19 CAN4-S104-M80 - Standard Method for Fire Tests of Door Assemblies
 - .20 CAN4-S105-M85 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104
 - .21 CAN4-S106-M80 - Standard Method for Fire Test of Window and Glass Block Assemblies
 - .22 CAN/ULC-S702-97 - Standard for Mineral Fibre Thermal Insulation for Buildings
 - .23 CAN4-S106-M80(92) - Standard Method for Fire Tests of Window and Glass Block Assemblies
 - .24 CSDMA, - Recommended Specifications for Commercial Steel Door and Frame Products, 2006
 - .25 NAAMM - National Association of Architectural Metal Manufacturers
 - .26 HMMA - Hollow Metal Manufacturer's Association.
 - .27 NAAMM-HMMA-840-99 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames
 - .28 NFPA 80-2007 - Standard for Fire Doors and Other Opening Protectives
 - .29 NFPA 252-99 - Standard for Fire Tests of Door Assemblies
 - .30 NFPA 257-00 - Standard for Fire Tests of Window Assemblies and Glass Block Assemblies
 - .31 UL List of Equipment and Materials, Volume 2
 - .32 WH Certification Listings
- 1.5 SYSTEM DESCRIPTION
- .1 Design Requirements: Ensure Product is manufactured by a firm experienced in design and production of standard and custom commercial steel door and frame assemblies, integration of builders' or electronic hardware and glazing assemblies and other items affecting work.
 - .2 Testing and Performance Requirements:
 - .1 Physical Endurance Performance Test for Steel Doors.
 - .2 Test specimen shall be a 915mm x (2134mm x 45mm thick nominal size door, representative of construction and material provided.
 - .3 Specimen shall be tested in accordance with ANSI A250.4, Cycle and Twist Test procedures.
 - .3 Cycle Test Acceptance Criteria:
 - .1 Steel stiffened core, continuously welded edge seam doors specified with 16 gauge and heavier face sheets shall be tested to 4,000,000 cycles
 - .2 Doors specified with 18 gauge and heavier face sheets shall be tested to 1,000,000 cycles.

DOORS AND FRAMES

- .3 Twist Test Acceptance Criteria: Maximum deflection under 300 pound (136.08 kg) load.
- .4 Steel stiffened core, continuously welded edge seam doors specified with 16 gauge and heavier face sheets shall not exceed 15.88mm deflection and maximum permanent deflection shall not exceed 1.57mm.
- .5 Doors specified with 18 gauge and heavier face sheets shall not exceed 31.75mm deflection and maximum permanent deflection shall not exceed 3.18mm.
- .6 Provide Test Reports or Certificates of Companies including description of test specimen, procedures used in testing and indicate compliance with specified acceptance criteria.
- .7 Labelled Fire-Rated or Temperature Rise Rated Doors and Frame Product:
- .8 Fire and temperature rise rated steel doors and frame products shall be provided for those openings as determined and scheduled by Consultant.
- .9 Products shall bear the label of a recognized testing agency having factory inspection service, and shall be constructed as listed or classified for labeling
- .10 Doors provided for openings requiring fire rating only, or fire and temperature rise rating shall be tested in accordance with CAN4-S104
- .11 Frames, transom and sidelight assemblies provided for openings requiring fire-rating, shall be tested in accordance with CAN4-S104.
- .12 Labelling shall be in accordance with ANSI/NFPA 80, the listing organization's policies and Follow-Up Service Procedures/Manuals.
- .13 Fire rated door or frame component, not qualifying for labelling due to design, hardware or any other reason, shall be noted in the submittal documents, or prior to manufacture of product if hardware, glazing or other options affecting fire-rating are not available at time of submittal shop drawing preparation.
- .14 Ensure core materials for exterior doors attain thermal resistance of RSI 2.17 (R 12.3) when tested in accordance with ASTM C177 or ASTM C518.
- .15 Provide thermally broken assemblies as indicated on Drawings and noted on Door Schedule tested in accordance with requirements of CAN/CGSB-82.5-M.
- .16 Product quality shall meet standards set by (CSDMA) Canadian Steel Door and Frame Manufacturers Association.

1.6 SUBMITTALS

- .1 Shop Drawings: Submit shop drawings under Section 01 33 00.
- .2 Installation Data: Provide application instructions.

1.7 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this Section by a manufacturer who is a member of CSDFMA.
- .2 Manufacturer's Qualification: Upon request, manufacturer shall provide evidence of having fabricated type of work under this Section, for projects of similar size and scope, for a continuous period of not less than five (5) years prior to award of contract, has personal and plant equipment capable of fabricating steel door and frame product of the types specified and has a written quality control and system in place.

DOORS AND FRAMES

- .3 Qualifications:
 - .1 Product supplier shall have Architectural Hardware Consultant or person of equivalent experience, available at reasonable times to consult with Consultant, Contractor and/or Owner.
 - .2 Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .4 Quality Criteria:
 - .1 All door and frame product shall meet the appropriate requirements of Section 4.2 Testing and Performance, of these specifications. Fabricate assemblies on strict accordance with approved submittal drawings.
 - .2 Steel door and frame product not in compliance with this specification may be grounds to reject entire shipment, supplier and/or manufacturer. Rejected product shall be replaced at no cost to Owner, including two (2) additional exterior doors. Extensions of time or additions to Contract Price will not be considered due to rejection of product.
- 1.8 DELIVERY, STORAGE AND HANDLING
 - .1 Deliver materials in sequence to meet construction schedule, arrange for strategic, off-the-ground, undercover storage locations. Deliver in sealed cartons and containers, with manufacturer's name and product description marked thereon.
 - .2 Be responsible for supply of products under this Section to site in timely manner, so as not to delay progress of other trades.
 - .3 Protect doors and frames during shipping and storage.
 - .4 Inspect all materials thoroughly upon receipt and report all discrepancies, deficiencies and/or damages immediately in writing to the supplier. Note all damage on carrier's Bill of Lading.
 - .5 Make Good immediately any damage done. Clean scratches and touch up with rust-inhibitive primer. Replace damaged work which cannot be repaired, restored or cleaned.
 - .6 Store in a dry, secure location, on planks or dunnage. Doors and frame product shall be stored in a vertical position, spaced with blocking. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation. Site storage and protection of materials shall be in accordance with NAAMM-HMMA 840. Coordinate this requirement with Section 06 90 00 for installing doors.
- 1.9 WARRANTY
 - .1 Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; dock levellers, bumpers, seals and shelters not remaining in perfect operating condition during warranty period and that any defects in design, materials or workmanship arising within this period shall be repaired and/or replaced to approval of, and without additional cost to Owner.

DOORS AND FRAMES

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 Ali-Porte Inc.; www.aliporte.com
 - .2 Artek Door Limited; www.artekdoor.com
 - .3 Daybar Industries Limited; www.daybar.com
 - .4 Metal Door Ltd.; www.metaldoorltd.com
 - .5 Fleming Door Products Limited; www.flemingdoor.com
 - .6 Doors, frames and screens are to match profiles shown on Drawings.

2.2 MATERIALS

- .1 Sheet Steel: Commercial grade steel to ASTM A568M, Class 1, hot-dip galvanized to ASTM A653M, ZF 120 (A40), known commercially as "Galvanneal". Steel sheet thicknesses specified are base metal thicknesses prior to galvanizing.
- .2 Galvanized steel conforming to ASTM A653, Commercial Steel (CS), Type B, coating designation Z275(G90), for steel door faces sheets and frame product profiles.
- .3 Equivalent minimum base steel thicknesses for gauges shall be in accordance with Appendix 1 of CSDMA "Recommended Specifications for Commercial Steel Door and Frame Products".
- .4 Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves and other defects.
- .5 Door Cores:
 - .1 Honeycomb: Structural small cell 25 mm maximum, kraft paper "honeycomb"; weight; 36 kg per ream (min), density; 16.5 kg/m³ minimum, sanded to required thickness.
 - .2 Glass Fibre: Mineral wool insulation, density 24 kg/m³ minimum consisting of durable fibrous material processed from rock, slag or glass, bound with deterioration resistant binders, CAN/ULC-S702, Type 1.
 - .3 Steel Stiffened: Internally reinforced with 0.91 mm (20ga) interlocking steel stiffeners, at 150 mm on center, securely welded to each face sheet at 150 mm on center maximum. Voids between stiffeners shall be filled and sound deadened with mineral wool insulation, density 24 kg/m³ minimum consisting of durable fibrous material processed from rock, slag or glass, bound with deterioration resistant binders, CAN/ULC-S702, Type 1 or ASTM C665.
 - .4 Polyisocyanurate For Exterior Door: Rigid, modified polyisocyanurate, closed cell board with a density of 32 kg/m³ and minimum R-value of RSI 1.9 (R11).
 - .5 Temperature Rated Rise (TRR) Core: Core composition to provide fire protection rating and to limit temperature rise on unexposed side of door to 250 deg C at 30 or 60 minutes, as determined by OBC requirements. Test core as part of complete door assembly in accordance with CAN4-S104-M or NFPA 252, covering the Standard Method of Door Assemblies and shall be listed by nationally recognized testing agency having factory inspection service.
- .6 Adhesives:
 - .1 Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive UL/WH approved.

DOORS AND FRAMES

- .2 Interlocking Edge Seams: Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, sealant/adhesive or UL/WH approved.
- .3 Honeycomb Cores and Steel Components: Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .4 Polyisocyanurate Cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
- .5 Lock-Seam Doors: Fire resistant, resin reinforced polychloroprene (RRPC), fire resistant, high viscosity sealant/adhesive.
- .7 Primer: Rust inhibitive touch-up only.
- .8 Door Silencers (Bumpers): Single stud rubber/neoprene type.
- .9 Exterior Top Caps: Rigid polyvinyl-chloride (PVC) extrusion conforming to CGSB 41-GP-19Ma.
- .10 Frame Thermal Breaks: Rigid polyvinyl-chloride (PVC) extrusion conforming to CGSB 41-GP-19Ma.
- .11 Fasteners for Stops: Cadmium plated steel, counter sunk flat or oval head sheet metal Phillips screws.
- .12 Frame Anchors:
 - .1 Frame anchor products shall be provided with anchorage appropriate to floor, wall and frame construction.
 - .2 Floor Anchors:
 - .1 Where frame product is installed prior to construction of adjacent wall, each jamb shall be provided with 1.52 mm (16 ga) steel floor anchors. Each anchor shall be provided with 2 (two) holes for mounting to floor and shall be securely welded to inside of jamb profile.
 - .3 Wall Anchors:
 - .1 Each wall anchor shall be located immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
 - .2 Provide 2 anchors for rebate opening heights up to and including 1500 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof, except as indicated below. For frames in previously placed concrete, masonry or structural steel provide anchors located not more than 150 mm from top and bottom of each jamb and intermediate anchors at 660 mm on center maximum.
 - .3 Frame products installed in steel stud and drywall partitions shall be provided with 20 gauge steel snap-in or "Z" stud type anchors. Supply frame anchors to gypsum board installers with directions for installing steel door frames in solid gypsum board partitions.
 - .4 Frame products for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 16 gauge minimum or 0.156 in. diameter wire. Straps shall be not less than 50mm x 254mm in size, corrugated and/or perforated.
 - .5 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4mm diameter, located not more than 150mm from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike

DOORS AND FRAMES

- jamb. Each preparation shall be provided with 16 gauge anchor bolt guides.
- .6 Anchor bolts and expansion shell anchors for the above preparations shall be provided by subcontractor responsible for installation.
 - .7 On sidelights or windows exceeding 3m in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 2.66 mm (12 ga) steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head. Formed adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by subcontractor responsible for installation.
- .13 Fire Rated Door and Frame Assemblies: Conform to CAN4-S104-M, CAN4-S105-M, NFPA 80 and NFPA 252.
- .14 Glass:
- .1 Comply with Section 08 80 00.
 - .2 Design glass and glazing to meet ASTM E1300, CAN/CGSB-12.20-M, including Appendices and design requirements listed in herein as applicable. Glass thicknesses given in this Section are minimum.
 - .3 General: Ensure glass bears manufacturer's labels indicating quality. Leave labels in place until final cleaning.
 - .4 Performance Criteria for Factory Sealed Insulating Glass Units:
 - .1 Factory sealed insulating glass units to requirements of ASTM E2188-02/E2189-02/E2190-02, CAN/CGSB-12.8-M using dual seal. Double sealed and atmospheric pressure equalized to prevent bowing of glass panes in vertical position. Edges of glass shall be straight cut, free of nicks, and other imperfection conducive to breakage. Maintain separation of panes with non-corrosive desiccant filled spacer core. Argon fill air space and hermetically seal inner and outer panes at periphery with flexible sealer.
 - .2 Manufacture factory Sealed Insulating glass units to IGMA recommendations and manufacturer shall be member of IGMA, participating in IGMA Certification Program.

2.3 FABRICATION

- .1 Welding: CSA W59-M.
- .2 Grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles and sand down to smooth, true, uniform finish.
- .3 Hardware Requirements and Preparations:
 - .1 Door and frame product shall be blanked, reinforced, drilled and tapped at factory for fully templated hardware only in accordance with approved hardware schedule and templates provided by hardware supplier. Check hardware list for requirements.
 - .2 Door and frame product shall be blanked and reinforced only for mortised hardware that is not fully templated.
 - .3 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges or non templated hardware apply, frame product shall be reinforced only, with drilling and tapping done by others in field.

DOORS AND FRAMES

- .4 Templated holes 12.7mm diameter and larger shall be factory prepared except mounting and through bolts holes which shall be by subcontractor responsible for installation on site, at time of application. Templated holes less than 12.7mm diameter shall be factory prepared only when required for function of device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- .5 Hinge reinforcing shall be 3.42 mm (10 ga) steel minimum, high frequency type be provided
- .6 Reinforcing for continuous hinges shall be 2.66 mm (12 ga) minimum.
- .7 Cylindrical lock, ASA strike and flush bolt reinforcing shall be 2.66 mm (12 ga) steel minimum.
- .8 Mortise lock and surface mounted hardware reinforcing shall be 1.52 mm (16 ga) steel minimum.
- .9 Provide all hardware mortises on perimeter frame members shall be grouted.
- .10 In masonry or concrete partitions with 0.76 mm (22 ga) steel grout guards. Where electrified hardware is specified on approved Hardware Schedule, steel door and frame product shall have CSA approved system consisting of CSA approved conduit, junction boxes and fifteen (15) wire harnesses complete with modular plugs for coordinated connection directly to electrified hardware. Refer to Section 08 71 00 –Door Hardware for openings that require electrified hardware unless indicated otherwise.
- .4 Frames - General:
 - .1 Fabricate frames for doors, screens and borrowed lights to profiles indicated.
 - .2 Reinforce frame as required for surface mounted hardware. For door frames wider than 1500 mm, reinforce door frame head and jamb and mullions at junction of head.
 - .3 Where floor finishes allow, fabricate frames to extend 38 mm below finished floor level
 - .4 Prepare each door opening for single stud door silencers: 3 for single door openings placed opposite hinges: 2 for double door openings approximately 150 mm (6") each side of centerline of head stop.
 - .5 Exterior frames:
 - .1 Frames are based on Fleming Therma-Series
 - .2 Frames shall be fabricated from 1.5 mm (16 ga) steel
 - .3 Fabricate thermally broken door frames in accordance with shop drawings. Provide wall and floor anchors suitable for installation conditions. Anchoring devices must not permit thermal conductivity from exterior frames to interior frame sections. Provide thermal break to separate interior and exterior frame sections.
 - .4 Supply, set-up and welded (SUW). Welds shall not cause thermal transfers between interior and exterior surfaces of frame sections.
 - .5 Interior and exterior sections of thermally broken frames, separated by a continuous thermal break.
 - .6 Thermally broken sections shall not be assembled by means of screws, grommets or other fasteners.
 - .7 Sections shall not be assembled by means of screws, grommets or other fasteners.
 - .8 Closed sections such as mullions or center rails shall be factory insulated with specified insulation
 - .9 Install Insulation of open sections such as jambs, heads and sills.

DOORS AND FRAMES

- .10 Incorporate head drips of same gauge material as frame and plug weld at 150 mm (6") on center, fill and sand smooth.
- .5 Interior Frames:
 - .1 Steel: Minimum 1.5 mm thick (16 ga) steel
- .6 Sidelight and Window Frame Assemblies:
 - .1 Frame profiles to match detail
 - .2 Steel: Minimum 1.5 mm thick (16 ga) steel.
 - .3 Supplied set-up and welded (SUW)
 - .4 Glazing Stops: Minimum 1.52 mm thick (16 ga) steel, formed, drilled and countersunk for fastenings.
- .7 Frame Type Frames:
 - .1 Mitre corners of frames. Cut frame mitres accurately and weld continuously across inside of entire profile.
 - .2 When required due to site access or due to shipping limitations, fabricate frame Product for large openings in sections, with splice joints for field assembly. Indicate joints for field assembly on shop drawings.
 - .3 Accurately cope and securely weld butt joints of mullions, transom bars, centre rails and sills. Grind welded joints to a smooth, uniform finish.
 - .4 Securely attach floor anchors to inside of each jamb profile.
 - .5 Weld in 2 temporary jamb spreaders at each frame to maintain alignment during shipment
 - .6 Use formed channel glazing stops, minimum 16 mm (5/8") in height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .8 Doors-General:
 - .1 Fabricate doors to be swing type flush with 1 continuous face free from joints, tool markings and abrasions and with provisions for glass and/or louvre openings as indicated on Door Schedule and Drawings.
 - .2 Coordinate louvre openings with Divisions 21, 22 and 23
 - .3 Fabricate exterior doors using polyisocyanurate (R12) insulated.
 - .4 Fabricate interior doors using honeycomb construction
 - .5 For acoustic doors, use manufacturer's proprietary door core to achieve required STC rating as determined and scheduled by Consultant.
 - .6 For honeycomb doors, longitudinal edges: mechanically interlocked, tack welded at; every 150mm (6") on center, top and bottom of door, above and below each edge cutout, filled and ground smooth with no visible seams.
 - .7 Fabricate doors with top and bottom inverted recessed spot welded channels.
 - .8 Provide flush PVC top cap on exterior doors.
 - .9 Reinforce, blank, drill and tap doors for mortised, templated hardware
 - .10 Reinforce doors for surface mounted hardware.
 - .11 Undercut 19 mm for air intake at washrooms and other doors indicated on Door Schedule
 - .12 Factory prepare holes 13 mm diameter and larger. Factory prepare holes less than 13 mm when required for function of device for knob, lever, cylinder, turn pieces or when these holes overlap function holes.
 - .13 Fabricate fire rated door assemblies as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by nationally recognized listing agency to individual manufacturer and tested in conformance with CAN4-S104-M. Provide labels for fire rated doors.

DOORS AND FRAMES

- .14 Fabricate fire rated doors where indicated in Door Schedule or Drawings, to meet required maximum temperature rise on unexposed side of door in accordance with OBC and ULC requirements.
- .9 Heavy Duty Interior Hollow Metal Doors:
 - .1 Fleming D 16
 - .2 Face Sheets: 1.5 mm thick (16 ga) minimum uncoated steel sheet
 - .3 Core: Honeycomb
 - .4 Longitudinal edges: mechanically interlocked, tack welded at; every 150mm on centre, top and bottom of door, above and below each edge cutout, filled and ground smooth with no visible seams.
 - .5 Glazing Stops: 1.5 mm thick (16 ga) minimum uncoated steel sheet, formed, drilled and countersunk for fastenings
- .10 Heavy Duty Interior Fire Rated Hollow Metal Doors:
 - .1 Fleming D 16 Series Doors.
 - .2 Face Sheets: 1.5 mm thick (16 ga) minimum uncoated steel sheet.
 - .3 Core: Honeycomb
 - .4 Longitudinal edges: Mechanically interlocked, tack welded at top and bottom of door, 150 mm on centre and above and below each edge cutout, filled and ground smooth with no visible seams.
- .11 Heavy Duty Exterior Hollow Metal Doors:
 - .1 Fleming D Series Doors
 - .2 Face Sheets: 1.5 mm thick (16 ga) minimum uncoated steel sheet.
 - .3 Core: Polyisocyanurate.
 - .4 Glazing Stops: 1.5 mm thick (16 ga) minimum uncoated steel sheet, formed, drilled and countersunk for fastenings.
 - .5 Longitudinal edges: mechanically interlocked, tack welded at; every 150mm on centre, top and bottom of door, above and below each edge cutout, filled and ground smooth with no visible seams.
 - .6 Exterior Top Caps: Factory installed PVC flush top caps
- .12 Temperature Rise Rated Doors [TRR Doors]
 - .1 Fleming [CW] Series Doors
 - .2 Face Sheets: 1.5 mm thick (16ga), minimum uncoated steel sheet.
 - .3 Core: Stiffened, insulated and sound deadened with proprietary core for where Temperature Rise Rated (TRR) fire labeled doors are specified on Door Finish Schedule.
 - .4 Longitudinal edges: Mechanically interlocked continuously welded and ground smooth with no visible seams.
- .13 Doors (Honeycomb Core Construction):
 - .1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .2 Fabricate each face sheet for interior door using a sheet steel laminated under pressure to honeycomb core
 - .3 Formed edges shall be true and straight with minimum radius for thickness of steel used.
 - .4 Lock and hinge edges shall be beveled 3 mm in 50 mm unless required otherwise to suit finish hardware or door swings.
 - .5 Top and bottom of doors shall be provided with inverted, recessed, 1.5 mm thick (16 ga) steel end channels, welded to each face sheet at 50mm on center maximum.
 - .6 Exterior doors shall be provided with factory installed flush PVC top caps. Fire labeled exterior doors shall be provided with factory installed flush steel top caps.

DOORS AND FRAMES

- .14 Glazing:
 - .1 Where doors to have glazing up to and including 8 mm thick as noted in section 08 80 50, Door Schedule and/or indicated on Drawings, provide doors with 1.52 (16 ga) steel glazing stops.
 - .2 Glazing trims and stops shall be accurately fitted, butted at corners with removable glazing stops located on non-secure side of floor.
 - .3 Prime Painting: Apply factory touch up primer at areas where zinc coating has been damaged during fabrication.
- .15 Hardware Reinforcements and Preparations:
 - .1 Door product shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
 - .2 Door products shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
 - .3 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware applies, frame product shall be reinforced only, with drilling and tapping done by others in the field.
 - .4 Templated holes 12.7mm diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by the contractor responsible for installation on site, at the time of application. Templated holes less than 12.7mm diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes. Hinge reinforcements shall be 10 gauge steel minimum, high frequency type shall be provided.
 - .5 Reinforcements for continuous hinges shall be 12 gauge minimum
 - .6 Doors shall be prepared for 114.3mm standard weight hinges (minimum).
 - .7 Doors in excess of 2450mm rabbet height shall be prepared for 4114.3mm heavy weight 4.6mm hinges minimum.
 - .8 Lock, strike and flush bolt reinforcements shall be 16 gauge steel minimum, with extruded tapped holes that provide equivalent number of threads as 12 gauge.
 - .9 Strike reinforcements shall be 16 gauge steel minimum.
 - .10 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 12 gauge steel minimum.
 - .11 Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts
 - .12 Where electrified hardware is specified on approved hardware schedule, steel door product shall be provided with system consisting of a fifteen (15) wire harness complete with modular plugs for coordinated connection directly to electrified hardware. Prepare for electrified hardware and security components as indicated by hardware schedule and security system drawings. Refer to Section 08 71 00 – Finish Hardware for openings that require electrified hardware.
- .16 Finishes:
 - .1 Remove weld slag and spatter from exposed surfaces.
 - .2 All tool marks, abrasions and surface imperfections shall be filled and sanded to present smooth and uniform surfaces.
 - .3 On exposed surfaces where zinc has been removed during fabrication, product shall receive a factory applied touch-up primer.
 - .4 Primer shall be fully cured prior to shipment.

DOORS AND FRAMES

- .17 Sizes and Tolerances:
 - .1 Manufacturing and installation tolerances shall be in accordance CSDMA – “Recommended Dimensional Standards for Commercial Steel Doors and Frames”.
- .18 Hardware Locations:
 - .1 Location of hardware on doors and frames products shall be as per the manufacturer’s published standards.
 - .2 Hardware preparation tolerances shall comply with the ANSI A115 series standards.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Supply steel doors and frames to Section 06 20 00 for installation.

END OF SECTION

WOOD DOORS

- 1.6.2. Make good defects during warranty period by replacing defective doors in finish to match adjacent similar doors or of original door finish. Defects shall include, but not be limited to bubbling, delamination of faces or edges, warp, twist bow exceeding 6mm, and telegraphing of core. "Replace" as used herein includes installing hardware, finishing, hanging and fitting.

2. PART PRODUCTS

2.1. MATERIALS

- 2.1.1. Conform to CSA 0132.2 for materials, except as specified otherwise herein.

2.1.2. Core Materials for Solid Core Doors:

Solid Eastern White Pine or Western Red Cedar conforming to CAN3-0188.1- M, Grade R.

- 2.1.3. Adhesive: CSA 0112 Series M, Type III.

2.1.4. Finish:

- a. Plastic Laminate faced doors: Conforming to CAN3-A172-M, Standard Grade, 2mm thick, 0.50mm thick backing sheet, sanded one side by same manufacturer, colour and finish choice by Architect from Arborite, Formica, Nevamar or Wilsonart complete range.

2.1.5. Fire-rated Assemblies:

- a. Fabricate assemblies required to have a fire-resistance rating to requirements of testing and labelling agency.
- b. Supply assemblies required to have a fire-resistance rating complete with appropriate label of testing and labelling agency affixed in a visible but unobtrusive location.

2.2. FABRICATION AND MANUFACTURE

2.2.1. General:

- a. Conform to CSA 0132.2 for solid core flush doors, except as specified otherwise herein.
- b. Size doors for 2mm clearance of heads and jambs and 10mm at sills.
- c. Prep rated doors for (but not limited to) heavyweight hinges (minimum 4 per leaf greater than 915mm wide and / or 2300mm high), continuous hinges, concealed vertical rod and mortise lock case exit devices, cylindrical locksets, and concealed overhead stops.

WOOD DOORS

2.2.2. Flush Doors:

- a. Core: Laminated wood framed or unframed core construction comprising narrow kiln dried wood strips not less than 40mm wide, grain running vertically and joints well staggered, electronically glue bonded;
- b. Edges: 19mm minimum thickness one piece full length Maple.
- c. Sealing: Seal top and bottom edges with one coat of sealer applied in door manufacturer's plant.
- d. Cutouts: Prepare doors in factory for any openings required. Fit loose stops and tack in place.
- e. STC: 50, at all Offices and Collaboration/Multi-purpose room.

3. PART EXECUTION

3.1. INSTALLATION

- 3.1.1. Supply wood doors to Section 06 20 00, Finish Carpentry, for installation.

END OF SECTION

WOOD DOORS

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ALUMINUM DOORS, FRAMES AND WINDOWS

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements

1.2. DESCRIPTION

1.2.1. Work Included:

- a. Double and single glazed entrance doors, hardware, frames, and screens and windows.

1.2.2. Related Work Specified Elsewhere:

- a. Masonry: Section 04 20 00
- b. Sealants: Section 07 92 00
- c. Wood doors: Section 08 21 00
- d. Hardware Section 08 71 00
- e. Glass and Glazing Section 08 80 50
- f. Gypsum board: Section 09 21 16
- g. Division 26, Electrical: For provision of power requirements.
- h. Division 28: For provision of access-control requirements and devices

1.3. QUALITY ASSURANCE

1.3.1. Requirements of Regulatory Agencies:

Conform to requirements of the following:

- a. The Code, Part 4, Structural Design and part 5, Wind Water and Protection.
- b. CAN3-S157-M, Strength Design In Aluminum;
- c. CSA-W59.2-M, Welded Aluminum Construction;
- d. CAN3 S16.1-M: For steel reinforcement and support brackets;
- e. CAN/CSA-A440-M90 Windows;
- f. CSA B651: Accessible Design for the Built Environment

1.3.2. Mock-up: Office Glazed Partition Only

- a. Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
- b. Build mockup of typical wall area as directed by Consultant on site.
- c. Subject to compliance with requirements, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.

ALUMINUM DOORS, FRAMES AND WINDOWS

1.4. SUBMITTALS

1.4.1. Shop Drawings:

- a. Submit Shop Drawings bearing seal of Ontario Registered Professional Structural Engineer responsible for design and fabrication.
- b. Indicate reinforcing steel sizes and associated design loads. Include plans, elevations, sections, full-size details, anchorage, locations of accessory items and attachments to other work. Indicate field measurements.

1.4.2. Samples:

- a. Submit Samples in accordance with Division 01 for units with factory-applied colour finishes. Submit two complete sets of colour chips representing manufacturer's full range of available colours and patterns. Confirm with Architect is physical samples need to be delivered to their office.

1.4.3. Installation Data:

- a. Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

1.5. WARRANTY

- 1.5.1. Warrant Work for a total of Two Years. Warrant insulating glass for a total of Ten Years.

2. PART PRODUCTS

2.1. MATERIALS

- 2.1.1. Aluminum Extrusions: AA 6063, T54 alloy and temper.

2.1.2. Finish:

- a. Black Anodized finish at exterior framing: caustic etch exposed aluminum sections followed by anodic oxide treatment, to Aluminum Association AA-M12 C22 A31.
- b. Clear Anodized finish at interior framing: caustic etch exposed aluminum sections followed by anodic oxide treatment, to Aluminum Association AA-M12 C22 A31.

2.1.3. Exterior Door Type:

- a. Entrance Doors: Double sweep with threshold.
 1. ThermaPorte 7700 series 600A by Alumicor - 146mm stiles, 143mm top rail and 178mm bottom rail.
 2. Series 360 Insulclad by Kawneer – 250mm intermediate and 165mm bottom rail.
 3. Approved equal by Commercial Aluminum or Aerloc Industries.

2.1.4. Exterior Frame and Screen Type:

- a. Frame Type: Thermally Broken
 1. FlushGlaze BF 3400 by Alumicor.
 2. TriFab VG Series 451T by Kawneer.

ALUMINUM DOORS, FRAMES AND WINDOWS

3. Approved equal by Commercial Aluminum or Aerloc Industries.
- 2.1.5. Interior Door Type: At dividing Corridors
 - a. Entrance Doors:
 1. Canadiana Series 600A by Alumicor – 146mm stiles, 143mm top rail and 178mm bottom rail.
 2. 350 Series by Kawneer – 250mm intermediate and 190mm bottom rail.
 3. Approved equal by Commercial Aluminum or Aerloc Industries.
 - 2.1.6. Interior Frame and Screen Type: At dividing Corridors
 - a. Frame Type:
 1. FlushGlaze TL 1800 by Alumicor.
 2. TriFab VG Series 450 by Kawneer.
 3. Approved equal by Commercial Aluminum or Aerloc Industries.
 - 2.1.7. Interior Frame and Screen Type: Except at dividing Corridors (at Offices and Collab/Multi-purpose)
 - a. Frame Type:
 1. Elite System by PC350, 13mm double glazing 0.090 laminate, STC 50, non-glazed return (corner post).
 2. Approved equal.
 - b. Finish: Factory finish extruded frame components, clear anodized powder coating.
 - c. Doors: See Section 08 21 00.
 - d. Provide all components from a single manufacturer for a complete system (e.g. clips, trim, plates, glazing beads, etc.).
 - 2.1.8. Windows:
 1. RainBlade 1970 by Alumicor.
 2. 518 IsoPort by Kawneer.
 - 2.1.9. Alum Breakshapes: 3mm thick, colour to match adjacent storefront / curtain wall frames.
 - 2.1.10. Glazing: See Drawings and Section 08 80 50.
 - 2.1.11. Hardware: See Section 08 71 00.
 - 2.1.12. Film: Applied laminate PVB film – translucent 'frosted' pattern.
 - 2.1.13. Sealants: Comply with Section 07 92 00.
 - 2.1.14. Sills: Extruded aluminum c/w aluminum end caps, depth to suit. Colour to match frames.
 - 2.1.15. Glass stops: lock-in screwless type.
 - 2.1.16. Glazing tapes: macro-polyisobutylene, highly adhesive and elastic, with continuous built-in shim.

ALUMINUM DOORS, FRAMES AND WINDOWS

- 2.1.17. Weathering and glazing gaskets: extruded, black, closed cell or dense elastomer of durometer appropriate to function.
- 2.1.18. Fastening Devices: stainless steel with not less than 12% chromium content. Exposed screws or pop rivets are not acceptable.
- 2.1.19. Bituminous Paint: Conform to CGSB 1-GP-108M, Type 2.
- 2.1.20. Foamed In Place Insulation: Conform to Section 07 20 00.

2.2. FABRICATION

- 2.2.1. Take field measurements before starting fabrication.
- 2.2.2. Cut and mechanically fit joints with hairline contact.
- 2.2.3. Fabricate sections drilled, tapped, welded, holed or slotted as may be required for proper installation and fixing of components and accessories, and supplied complete with necessary anchors, clips, batts and screws.
- 2.2.4. Fabricate members with sharply defined profiles, straight, square and true with surfaces in proper planes and exposed finished surfaces and edges smooth and free from defects.
- 2.2.5. Fabricate framing, bracing, reinforcing, thermal breaks and anchors with structural properties adequate to safely sustain and withstand anticipated strains and stresses.
- 2.2.6. Design and fabricate clip angles and support brackets to withstand all loads.
- 2.2.7. Install bolts, where permitted, tight and thread nicked to prevent loosening of nuts.
- 2.2.8. Apply two shop coats of rust-inhibiting primer over all ungalvanized steel components.
- 2.2.9. Apply two shop coats of zinc chromate primer or bituminous paint to all surfaces where necessary to prevent corrosion, contact of dissimilar materials.
- 2.2.10. Foam open spaces in frames with insulation.

3. PART EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide anchors to be built into structure to the appropriate Sections for setting in.
- 3.1.2. Seal joints between frame members and adjacent materials at window openings at outside and inside. Seal air and vapour barrier transition sheet around entire perimeter of each window frame. Comply with requirements of Section 07900, Sealants.
- 3.1.3. Supply fastenings and anchors required to be built in to Work of other Sections to other Sections as required, and direct their proper installation.
- 3.1.4. Provide extruded aluminum sills (with end caps) of proper size and thickness complete with concealed fastenings, to shed water and prevent entry of water into wall, and to suit wall condition. Make sills one continuous piece wherever practicable. Where length of sill necessitates joints to prevent oil-canning, or for other reasons, lap and make joints watertight.

ALUMINUM DOORS, FRAMES AND WINDOWS

3.1.5. Provide matching aluminum closer plates at exposed frame cavities.

3.2. GLAZING

3.2.1 Provide clearance equal to thickness of glass. Clean sealing surfaces at perimeter of glass, and sealing surfaces of rebates and stops, before applying any glazing material; use only solvents and cleaning agents recommended by glazing material manufacturer.

3.2.2. Centre glass in rebate to maintain specified clearances at perimeter on all four sides. Maintain centered position of glass in rebates on both sides of glass. Provide setting blocks as recommended by glass manufacturer as required, 70 to 90 points Shore "A" hardness, under each glass light; locate at quarter points.

3.3. ADJUST AND CLEAN

3.3.1. Remove foreign materials or droppings resulting from Work of this or other Sections.

3.3.2. Remove strippable protective coatings before they have thermoset, and leave glass, framing members, and adjacent Work clean and unblemished upon completion of Work.

3.3.3. Adjust all hardware for proper operation.

END OF SECTION

ALUMINUM DOORS, FRAMES AND WINDOWS

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GLAZED ALUMINUM CURTAIN WALL SYSTEM

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

- a. Aluminum tube framing system with vision glass.
- b. Glass, Insulated metal & Uninsulated metal infill panels.
- c. Spandrel Panels
- d. Aluminum breakshapes.
- e. Integral air barrier and vapour retarder.

1.2.2. Related Work Specified Elsewhere:

- a. ~~LEED Certification Requirements:~~ Section 01 35 00
- b. Steel fabricated attachment members: Section 05 12 00
- c. Metal Fabrications: Section 05 50 00
- d. Foamed in Place Insulation: Section 07 21 19
- e. Air Barriers: Section 07 19 00
- f. ~~Entrance Doors - Swing:~~ Section 08 41 50
- g. ~~Entrance Doors - Sliding:~~ Section 08 42 20
- h. Glazing: Section 08 88 50

1.3. QUALITY ASSURANCE

1.3.1. Requirements of Regulatory Agencies: Conform to the current version of:

- a. The Building Code Compendium;
- b. AA (Aluminum Association) DAF 45-2003 - Designation System for Aluminum Finishes.
- c. AAMA CW-DG-1-96 (R2005) - Aluminum Curtain Wall Design Guide Manual.
- d. AAMA CWG-1-89 (R2004) - Installation of Aluminum Curtain Walls.
- e. AAMA CW-10-04 - Care and Handling of Architectural Aluminum from Shop to Site.
- f. AAMA CW-11-85 - Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

- g. AAMA 501-05 - Methods of Test for Exterior Walls.
- h. AAMA 501.1-05 - Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- i. AAMA 611-98 - Voluntary Specifications for Anodized Finishes Architectural Aluminum.
- j. AAMA 1503-98 - Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
- k. AAMA 2603-02 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- l. AAMA 2605-05 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- m. AAMA TIR A1-04 - Sound Control for Fenestration Products.
- n. AAMA RPC-00 - Rain Penetration Control.
- o. ASTM A36/A36M-08 - Carbon Structural Steel.
- p. ASTM A123/A123M-08 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- q. ASTM A653/A653M-08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- r. ASTM B209M-07 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric) ASTM B209-07 - Aluminum and Aluminum-Alloy Sheet and Plate>>.
- s. ASTM B221M-07 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) ASTM B221-08 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes>>.
- t. ASTM E283-04 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- u. ASTM E330-02 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- v. ASTM E331-00 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- w. ASTM E413-04 - Classification for Rating Sound Insulation.
- x. ASTM E1105-00(2008) - Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
- y. CAN/CGSB-1.40-97 - Anti-corrosive Structural Steel Alkyd Primer.
- z. CAN/CGSB-1.181-99 - Ready-Mixed, Organic Zinc-Rich Coating.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

- 1.4. DESIGN AND PERFORMANCE REQUIREMENTS
- 1.4.1. Assume complete responsibility for the curtain wall design installation and associated works, for achieving or surpassing the design and performance criteria for all components and assemblies of the installation.
 - 1.4.2. Design and size components to withstand maximum dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall calculated in accordance with the Building Code Compendium to a minimum design pressure of +1.0 kPa, -1.0 kPa (+20lb/sq ft, -20 lb/sq ft).
 - 1.4.3. Accommodate without damage to system, components or deterioration of seals, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components, interstory drift a mid-span slab edge deflection of L/500. Do not reduce glass bite below 9mm (3/8") under deflected conditions.
 - 1.4.4. Thermal Resistance of Spandrel Wall System (Excluding Vision Areas): R20 thermal performance.
 - 1.4.5. Air Infiltration: Limit air infiltration through assembly to 0.03 l/s/sq m (0.06 cfm/min/sq ft of wall area, measured at a reference differential pressure across assembly of 75 Pa (1.57 psf) as measured in accordance with AAMA 501 and ASTM E283.
 - 1.4.6. It is the responsibility of this section to design and provide the air/vapour seal between the curtain wall and adjacent surfaces; e.g. engineered stone veneer walls as applicable, roof.
 - 1.4.7. Water Leakage: None.
 - 1.4.8. System to provide for expansion and contraction within system components caused by a cycling temperature range of 95 degrees C over a 12 hour period without causing detrimental effect to system components
 - 1.4.9. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network. Curtain wall system shall provide a continuous air barrier and a pressure equalized cavity drained to the exterior as per AAMA guidelines for achieving Rainscreen wall using rainscreen principles.
 - 1.4.10. Air and Vapour Seal:
 - a. Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with [inside] pane of glass and heel bead of glazing compound.
 - b. Position thermal insulation on exterior surface of air barrier and vapour retarder.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

1.5. SUBMITTALS

1.5.1. Shop Drawings:

- a. Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow drainage diagrams.
- b. Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
- c. Submit substantiating engineering data, test results of previous tests (by independent laboratory) which purport to meet performance criteria, and other supportive data.
- d. Seal and sign drawings by a Professional Engineer experienced in the design of curtain wall systems and registered in the Province of Ontario.

1.6. PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.6.1. Protect prefinished aluminum surfaces with wrapping and strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

1.7. WARRANTY

- 1.7.1. Provide a five (5) year warranty to include coverage for complete system for failure to meet specified requirements. Provide coverage for materials and workmanship of curtain wall system and sunshades. Without restricting the generality of the warranty, definition of defects shall include failure of the installation to meet the design requirements, leakage, failure of sealants & failure of glass. Provide a ten (10) year warranty on seal failure of the sealed double glazed units.
- 1.7.2. Warrant that curtain wall will remain watertight, weather-tight, air and vapour tight, structurally sound and free from distortion; that aluminum finishes will not develop excessive fading or non-uniformity of colour, and will not crack, craze, peel, flake or otherwise corrode; that glazing materials including vision and spandrel glass and sealants will be free from deterioration from sunlight, weather and oxidation, and will be free from permanent deformation

GLAZED ALUMINUM CURTAIN WALL SYSTEM

2. PART PRODUCTS

2.1. PRODUCT AND MANUFACTURER

- 2.1.1. **To match existing and tie into existing adjacent system:** Basis of design is 50.8mm wide x min 101.6mm deep. Heavy wall mullion may be used as required, supplied with 19.1mm min. exterior cap, pressure plates, adapters etc. 25.4mm sealed glass units used in all exterior areas:
- 2.1.2. Acceptable manufacturers for curtain wall system: Basis of design
- a. Alumicor - Thermawall 2600,
 - b. Kawneer - 1600UT,
 - c. Approved equal.
- 2.1.2. Materials:
- a. Extruded Aluminum: ASTM B221M, ASTM B221, 6063-T5, 6063-T6 alloy and temper.
 - b. Sheet Aluminum: ASTM B209M, ASTM B209.
 - c. Sheet Steel: [ASTM A653/A653M; galvanized with Z275 (G90) zinc coating.
 - d. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections.
 - e. Fasteners: Stainless steel.
- 2.1.3. Components:
- a. Mullion Profile: 50.8mm x minimum 101.6mm deep nominal dimension for vertical and horizontal members; Heavy wall mullion used as required, supplied with 19.1mm min. exterior cap, pressure plates, adapters etc.
 - b. Thermally broken with interior tubular section insulated from exterior pressure plate; matching stops and pressure plate of sufficient size and strength to provide bite on glass and infill panels; drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
 - c. Reinforce mullion as required.
 - d. Aluminum cladding with internal reinforcement of shaped steel structural section.
 - e. Spandrel Panel: SP- See Section 08 80 50
 1. Spandrel Panel Insulation: Rigid fibrous glass insulation, 75mm core with R-10 insulation.
 2. Back Pan/Metal closure Panel Air Seal: Galv. Metal sheet, as detailed, 22ga. Thick, reinforcing shall be provided if required for stability of the sheet.
 - g. Aluminum Breakshapes: 3mm thick pre-finished aluminum. Finish to match curtain wall mullion sections.
 - h. Flashings: 20ga. G-90 sheet or thick aluminum; finish to match curtain wall mullion sections where exposed. Secured with concealed fastening method.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

- i. Firestopping: Specified in Section 07 84 00.
 - j. Air Barrier: Specified in Section 07 27 00.
- 2.1.4. Glass and Glazing:
- a. Specified in Section 08 80 50.
 - b. Provide sealed insulating glass units to frame system and exterior entrance doors.
- 2.1.5. Sealants:
- a. Structural sealant - Dow Corning 983-Black or approved equal by Sika, G.E. Silicones that will cure to a durable watertight flexible silicone rubber joint seal that can accommodate +/- 50% movement.
 - b. Shop applied sealant - Dow Corning 791 Silicone-Black or approved equal by Sika, G.E. Silicones.
 - c. Back pan sealant - Dow Corning 1199 Silicone or approved equal by Sika, G.E. Silicones.
 - d. Field applied sealant - Dow Corning 791 Silicone or approved equal by Sika, G.E. Silicones.
 - f. Sealant color selected by Architect.
 - g. Primer: as recommended by manufacturer
 - h. Cleaner: as recommended by manufacturer.
 - i. Shims, Spacers, Setting Blocks and Anti-Walk Blocks: 40 to 60; 80 to 90 Durometer shore 'A' Hardness +/- respectively, EPDM neoprene rubber.
- 2.1.6. Fabrication:
- a. Field measure rough openings prior to fabrication.
 - b. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
 - c. Fabricate aluminum unitized or field assembled curtain wall sections to accommodate and interface with work of other contracts by means of rabbets, interlocks, miscellaneous angles, trim and filler sections, as required.
 - d. Accurately fit and secure joints and corners fitted to a tolerance of 1.5mm in true planes with adequate concealed fastenings and sealed. Make joints flush, hairline, and weatherproof where required.
 - e. Prepare components to receive anchor devices. Fabricate anchors.
 - f. Arrange fasteners and attachments to ensure concealment from view.
 - g. Reinforce interior horizontal head rail as required to receive Automatic roller blinds attachments in areas specified.
 - h. Reinforce framing members for external imposed loads.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

- i. Fabricate glazing recess of sufficient depth to cover glass edge-seal, 19mm minimum.
- j. Air seal junctions of all horizontal and vertical aluminum members with joint tape and sealant.
- k. Isolate dissimilar metals to avoid electrolysis and corrosion.

2.1.7. Finishes:

- a. Black anodized at exterior exposed to view components: Aluminum Curtain Wall Mullions, Aluminum Column Covers, base Flashings, Aluminum Mullion Caps.
- b. Clear anodized at interior exposed to view.
- c. Touch-Up Primer for Galvanized Steel Surfaces: SPCC-Paint 20 zinc rich.
- d. Concealed Steel Items: Galvanized to ASTM A123/A123M with 610 gm/sq m (2.0 oz/sq ft) coating thickness.
- e. Apply one (1) coat of bituminous paint to concealed aluminum, steel surfaces in contact with cementitious or dissimilar materials.

3. PART EXECUTION

3.1. INSTALLATION

3.1.1. General:

- a. Install curtain wall system to manufacturer instructions.
- b. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- c. Provide alignment attachments and shims to permanently fasten system to building structure.
- d. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances [and align with adjacent work.
- e. Provide thermal isolation where components penetrate or disrupt building insulation.
- f. Install sill & flashings.
- g. Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- h. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- i. Install glass and infill panels in accordance with Section 08 80 50, to glazing method required to achieve performance criteria. Exterior wet/dry method of glazing as specified.

GLAZED ALUMINUM CURTAIN WALL SYSTEM

- j. Install foamed in place insulation at all perimeter junctions with adjacent surfaces.
- 3.1.2. Tolerances:
- a. Maximum Variation from Plumb: 1.5 mm/m.
 - b. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 0.8 mm.
 - c. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 12 mm.
- 3.1.3. Field Quality Control:
- a. Curtain wall product manufacturers to provide field surveillance of the installation of their Products.
 - b. Field test system to AAMA 501.
- 3.1.4. Cleaning:
- a. Remove protective material from prefinished aluminum surfaces.
 - b. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
 - c. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

DOOR HARDWARE

PART 1 – GENERAL

1.1 WORK INCLUDED

- .1 Furnish, deliver and install all finish hardware.
- .2 It is intended that the following list of hardware will cover finish hardware to complete the project.
- .3 Bring to the Architect's attention any omissions, discrepancies that will affect work in this section during the bidding period

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED IN THIS SECTION

- .1 Power supplies, compressor/control boxes, junction boxes installed by 16 00 00.

1.4 REFERENCES

- .1 Door and Hardware Institute - Recommended locations for Architectural Hardware for Standard Steel Doors and Frames
- .2 Door and Hardware Institute - Recommended locations for Architectural Hardware for Flush Wood Doors
- .3 NFPA 80-Standard for Fire Doors and Windows, 1999 Edition
- .4 Door and Hardware Institute - Sequence Format for Hardware Schedule
- .5 Door and Hardware Institute - Key Systems and Nomenclature
- .6 Door and Hardware Institute - Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications
- .7 Door and Hardware Institute – Installation Guide for Doors and Hardware
- .8 Ontario Building Code

1.5 SUBMITTALS

- .1 Updated Finish Hardware Schedule:
Submit required submittals in accordance with Section 01 33 00. Prepare detailed hardware schedules in Door and Hardware (DHI) vertical format as detailed in Reference 1.5.4.
- .2 Product Data:
Provide in a three ring binder six (6) copies of product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.
- .3 Samples:
When requested in writing, provide (to the Consultants Site Office) one sample of each hardware item complete with fasteners, within thirty (30) calendar days of award of a purchase order. Samples to be clearly labeled with their hardware schedule designation and manufacturers' name and model number. Samples will be incorporated into the work.
- .4 Templates:
Submit templates within to all related trades when requested.
- .5 Keying Schedule
Provide three (3) copies of keying schedule for review prepared and detailed in Reference 1.5.5. Include all special keying notes and stamping instructions. Locks

DOOR HARDWARE

and cylinders are not to be ordered until the key schedule has been approved by the owner.

.6 Wiring Diagrams

Co-ordinate with related trades, meet with the owner and security provider and submit a written description of the functional use (mode of operation) of electrical hardware products specified. Include operation for ingress, egress, fire alarm, and after hours use where applicable. Include door and frame elevations showing the location of each item of electrical hardware to be installed, mode of operation including a diagram showing number and size of conductors. Indicate on elevation drawing items provided by related trades, include for back boxes, and 120V power sources. Provide point to point drawings showing terminal connections necessary for a complete installation.

.7 Operations and Maintenance Data

Prior to Substantial Completion, furnish to the owner, two (2) copies of an owner's operation and maintenance manuals in a three ring binder with the following information:

- .1 Name of hardware distributor, address and contact name
- .2 Copy of final "as-built" finish hardware schedule
- .3 Wiring diagrams, elevations, risers, point to point
- .4 Copy of final keying schedule
- .5 Copy of floor plans with keying nomenclature assigned to door numbers as per the approved keying schedule
- .6 Maintenance instructions for each product
- .7 Catalogue cut sheets and product specifications for each product
- .8 Parts list for each product
- .9 Installation instructions and templates for each product

1.6 QUALITY ASSURANCE

.1 Review installation procedures with the Contractor's Designated Installers. Hold instruction meetings with the installers prior to installation and subsequent review meetings during the installation period. Submit minutes of meetings to the Consultant.

.2 Alternates

Only approved products specified will be accepted. Make alternate requests in accordance with Division 1. Include product data and indicate benefit to the project.

.3 Supplier Qualifications

Successful hardware distributor to have a minimum of five (5) years experience in the door and hardware industry. Distributor to have on staff an Architectural Hardware Consultant (A.H.C.) whose name will be listed on the hardware schedule title page submittal and will be responsible for scheduling, detailing, (see Reference 1.5.4) ordering and co-ordination of the finishing hardware for this project. If so requested by the Architect/Owner and or installer this individual will be required to attend coordination meetings with the Owner, at a location as directed by the owner and to visit the jobsite for any installation problems that may occur.

DOOR HARDWARE

- .4 Designated Installers
Hardware Installers must have a minimum of five (5) years experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. Installers to attend review meetings with the Hardware Distributor.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Marking and Packaging
Mark cartons with heading number, door number, and key-set symbol where applicable in original packaging provided by the manufacturer. Pack packaged hardware in suitable wrappings and containers to protect it from damage during shipping and storage.
Enclose accessories, fastening devices and other loose items with each applicable item of hardware.
- .2 Delivery
Deliver hardware to related trades.
- .3 Storage
Store in a clean, dry room with lockable man door and adequate shelving to permit organization so item numbers are readily visible.

1.8 WARRANTY

- .1 Provide warranties by the accepted manufacturers:

Hardware Item	Length of Warranty
Mortise Hinges	Lifetime
Locks (Mortise)	3 years
Exit Devices	3 years
Door closers -mechanical	10 years
Door Operators - Electro mechanical	2 years
Electric Hold Open Devices - Electro mechanical	2 years
Overhead stops/holders	1 year
Floor/Wall stops	1 year
Electric Strikes/Key Switches/Power Supplies	1 year

1.9 MAINTENANCE

- .1 Maintenance Service
After the building is occupied arrange an appointment with the maintenance staff from Brock University for instruction of proper use, servicing, adjusting and lubrication of hardware furnished. Submit to the consultant a list of attendees and meeting date.
- .2 Extra Materials
Provide the following items in proper manufacturers cartons once the job has been completed:
- .1 5 of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

DOOR HARDWARE

PART 2 – PRODUCTS

2.1 MANUFACTURERS

Products listed in the hardware groups are from the manufacturers listed below:

ITEM	MANUFACTURER
Full Mortise Hinges	Ives
Locksets, Latchsets/Deadbolts	Schlage
Exit Devices	Von Duprin
Cylinders	Medeco
Flush Bolts	Ives
Door Closers	LCN
Overhead Door Holders/Stops	Glynn Johnson
Door Pulls/Flatware	Canadian Builders Hardware
Flatware	Gallery
Wall/Floor Stops	Ives
Weather/Smoke/Sound/Smoke Seals	ZERO
Sound seals/Door bottoms	ZERO
Door Sweeps/Thresholds	ZERO
Automatic Door Operators/Actuators	Horton
Electric Strikes	Hess
Power Supplies	Schlage Electronics,
Safety Coat Hooks	Frost
Mullions	Post Latch Industries

2.2 MATERIALS

.1 Screws and Fasteners:

Screws to be matching finish to their product and to be manufacturer's standard. Door closers, door holders and exit devices installed on fire rated wood doors and hollow metal doors to be attached with the appropriate fasteners to meet code requirements.

.2 Materials-Acceptable Manufacturers (Note: Supply all products in a given category from the same manufacturer):

.1 Mortise Hinges

Provide five knuckle ball bearing hinges with NRP option on reverse bevel doors with locking hardware. Hinge width to accommodate door closer projection, door trim and allow for 180-degree swing. Doors up to 2286mm in height, supply 3 hinges, doors greater than 2286mm in height add one hinge for every additional 760mm of door height. Doors 915mm wide and less furnish 114 mm high hinges, doors greater than 915mm wide furnish 127mm high hinges, heavy weight or standard weight as specified. Supply ferrous (steel), stainless steel material for interior and/or fire-rated doors and stainless steel for exterior doors.

As Specified: Ives Hinges, 5BB1, 5BB1HW

DOOR HARDWARE

.2 Surface/Flush Bolts/Co-Ordinators:

Manual Flush Bolts-Metal Doors:

Manual flush bolt for metal doors to be cUL listed for 3-hour fire doors with ½" diameter bolt tip with ¾" throw. Standard rod length to be 12", supply longer length rods to suit higher height doors. Supply dustproof strikes with flushbolts.

Supply as Specified: Ives FB458 series

.3 Locksets/Deadlocks/Privacy Sets:

Mortise:

Grade 1 Operational, Grade 1 Security, mortise lock for commercial and institutional buildings. Manufacture lock cases from fully wrapped, heavy 12 gage steel with a protected leading edge and screw configuration that limits access to operating parts. Lock components to be manufactured of zinc dichromate plated steel. Latch bolts to have a standard 2 ¾" backset with a full ¾" throw. Latchbolts to be non-handed, field reversible with out opening the lock case. Latchbolts to be 2 piece anti-friction, manufactured from stainless steel. Solid latchbolts and/or plastic anti-friction devices are not acceptable. Deadbolts to be 1 ¾" total length have standard 1" throw with a minimum ¾" internal engagement when fully retracted. Deadbolts to be constructed of stainless steel, incorporating a security roller pin with a minimum Rc60 rating for surface hardness. Lever assembly (external) to be one piece design attached by threaded bushing. Lever assembly (internal) to be attached by screw less shank. Lever attachments by common tools (allen nuts and/or set screws) are not acceptable. Thru bolt lever assemblies through the door for positive interlock. Levers to have independent rotation in both directions. Lever operation to be free wheeling (clutch) when in the locked mode. Spring cages are to be incorporated into the lever assemblies. Hub blocking plate to be solid, cast stainless steel. Manufacturers utilizing open hub designs are not acceptable. Spindles to be independent, designed to "break away" at a maximum of 75psi torque. Mounting tabs are to be automatic self adjusting, vertically and horizontally for door bevel and strike alignment. Cylinders to be secured by a cast stainless steel, dual retainer. Manufacturers utilizing screws and/or stamped retainers are not acceptable.

Supply as Specified: Schlage "L" series

Strike Plates

Provide lockset and latchset strike plates with lip centre dimensions sized to minimally clear trim. Where strike lip extends beyond the projection of the casing or other trim, provide curved lip strikes. Strike plates applied to inactive leaf of paired openings to have flat lip sized to fit flush with the face of the door skin.

.4 Exit Devices/Device Trims/Mullions:

Heavy Duty

Exit device to be cUL listed for panic hardware and fire exit hardware.

DOOR HARDWARE

Supply exit devices and fire exit devices featuring coil compression springs on device mechanism subassemblies and dead latching mechanisms for active latchbolts. Supply exit devices with smooth mechanism case and "the quiet one" fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad engraved "PUSH" and raised edge to minimize pinching. Roller strikes to be standard on rim and surface vertical rod devices, mortise exit devices (626) complete with strikes that match the same finish as the device. Doors greater than 915mm wide supply long bar exit devices, doors greater than 2134mm high supply extension rods for required series. 1,000,000cycle testing independently certified by ETL. Supply as Specified: Von Duprin 98 series

Exit Device Trim

Supply device trim featuring recessed cylinder mounting and coil compression spring design with shear pin protection for lever designs. Similar lever designs for exits as specified for locksets. Supply as Specified Von Duprin 996 series

Mullions:

Mullions Non-Rated:

Steel mullion prepared for two strikes for use with Von Duprin rim devices to provide single door performance and security on double door applications. Supply as Specified: Post Latch

.5 Door Closers:

Door closers to have the following features (see separate closer sections below for further information):

- fully hydraulic, rack and pinion action with high strength cast iron cylinders and one piece forged steel pistons.
- include high efficiency, low friction pinion bearings.
- hydraulic fluid of a type requires no seasonal adjustments, ULTRA X™ fluid has constant temperature control from -35° C to +49° C.
- hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.
- separate adjustments for backcheck, general speed and latch speed.
- door closers with special template (ST-) numbers include required associated product, information sheets and instructions
- size 1 manual door closers to provide less than 5 pounds opening force on a 900mm door leaf.
- door closer with Pressure Relief Valves **are not accepted.**
- door closer bodies, arms, covers to be powder coated
- closers with powder coat finishes to exceed a minimum 100-hour salt spray test, as described in ANSI A156.18 and ASTM B117.
- closers detailed with plated finishes to include plated covers (or finish plates), arms and visible fasteners.

DOOR HARDWARE

Medium Duty Mechanical (Interior/Exterior):

Non-sized (1-6) and non-handed cylinder body to have 1 1/4" piston diameter with 5/8" single heat-treated shaft. Track closer cylinder body non-sized (2-4) or (1-2). Closers to have forged steel main arm and forearm EDA and CUSH type arms. Optional arms to be interchangeable within the series of closers, except track arm type closers. Closers complete with full covers.

Supply as Specified: LCN1460 series

Heavy Duty Mechanical (Top Jamb Mount):

Non-sized (1-5) and handed cylinder body to have 1 1/2" piston diameter with 11/16" double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory. Track closers sized 1,3 or 4. Closers to have forged steel main arm. Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN 4020 series

Heavy Duty Mechanical (Parallel Arm Mount):

Non-sized (1-5) and handed cylinder body to have 1 1/2" piston diameter with 11/16" double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory. Track closers sized 1,3 or 4. Closers to have forged steel main arm and forearms. Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN 4110 series

"NOTE: LOW ENERGY OPERATORS SUPPLIED AND INSTALLED BY THIS SECTION"

Heavy Duty Electric Operator:

Two in one swing door auto door operator, cUL listed for fire door applications.

- Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.
- Push 'n go permits non-switch activation
- Electromechanical unit with microprocessor control
- Tested internally to over ten million cycles
- Certified by cUL for use on labeled doors.
- Adjustable hold open period of 2 to 30 seconds in automatic or manual mode
- Push applications

Supply as Specified: Horton 4100, 7100 series

DOOR HARDWARE

- .6 Actuators:**
Wall Type
Wall plate switch to be hard-wired actuator with round, stainless steel touch plates 150 mm (6") diameter. Engraved blue filled handicap symbol conforms to most accessibility codes. Units to include heavy grade components for vandal resistant mounting and weather resistant switch standard.
Supply as specified: CM-45/2
Supply as specified: CM-43LP
- .7 Overhead Door Stops/holders:**
Heavy Duty Surface Mounted:
Surface overhead stops/holders to be stainless steel base, non-handed for single-acting doors with a heavy-duty channel/slide-arm design and offset jamb bracket to allow for simple field modifications of functions. Channel to be surface mounted to the door with thru bolts and the jamb bracket is surface mounted to the jamb.
Supply as Specified: Glynn-Johnson 900 series
- Heavy Duty Concealed Mounting:**
Concealed overhead stops/holders to be stainless steel base, non-handed for single or double-acting doors with a low profile channel, mortised in the door and jamb bracket is mortised in the doorframe. Unit to be fully concealed when door is in the closed position. Units to be field adjustable for function changes if required.
Supply as Specified: Glynn-Johnson 100 series
- .8 Door Pulls/Flatware**
Door Pulls are to be ¾" (19mm), 1" (25.4 mm), 1 ¼" (31.2mm) diameter
Flatware to be of stainless steel material, .050 gauge.
Supply as Specified: CBH 6037-2, (Door Pulls) 1 ¼" diameter, mounting as indicated in the hardware sets
CBH 903 T304 B4E c/w tape mounting (Kickplates 40mm less door width single door and 25mm less door width double doors)
- .9 Floor/Wall Stops:**
Wall Stops:
Wall stops to be constructed of stainless steel base with special retainer cup that makes the rubber stop tamper resistant. Convex design of rubber bumper.
Supply as Specified: Ives WS406/407CVX
- .10 Gasketing/Threshold/Sweep/Sound/Smoke Seals:**
Supply as Specified: ZERO
- .11 Keyswitch, Electric Strikes/ Power Supplies, Power Transfers, Mortar Guards**
Keyswitch:

DOOR HARDWARE

Keyswitch housing to be cast zinc to protect against vandalism, housing to provide a concealed rear mounting attachment which cannot be compromised when the cylinder is attached with a set screw.
Supply as Specified: RCI 960N-MA-LED SPDT

Electric Strikes:

Grade 1, electric strikes to be cUL listed burglary-resistant and electric strike for fire doors and frames. Electric strikes to be stainless steel construction, non-handed available in 12V DC with continuous duty solenoid and accept 3/4" throw latchbolts.
Supply as Specified: HESS 1006 FS KD

Power Supplies:

Power supplies to be Underwriter Laboratories (UL) listed for general-purpose use tested to meet UL1012 specifications. Power supplies to have 12/24VDC field selectable output voltage with output current of 3 amps at 12VDC and 2 amps at 24VDC with supply output voltage filtered and regulated. The power supply to be inherently modular by design for ease of installation and to provide flexibility for future system modifications when necessary.
Supply as Specified: Schlage Electronics PS900 series

Power Transfer

Provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2" x 4 1/2" butt hinges or 3/4" offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer units shall contain ten 24 awg UL approved conductors. Rating: 10 Amps at 24 VDC (Class 1 low voltage)
Supply as Specified: Von Duprin EPT

Molex Connectors:

Provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies

Door Position Switch:

The contact shall contain a hermetically sealed magnetic reed switch. Contact and magnet housing shall snap-lock into a 3/4" or 1" diameter hole. Housings shall be molded of flame retardant ABS plastic. The magnet shall be made of Alnico V. Rare Earth Magnet shall be made of neodymium iron boron.
Supply as Specified: FLAIR MSS100-4WY DPDT

DOOR HARDWARE

Electric Washroom Accessories:

Provide electric washroom accessories to complete the installation of automatic door operators for universal and barrier free washroom requirements

- Supply as Specified: Camden - Push to lock,
 CM45/8GRS/SE1
 Camden – Illuminated Actuator
 CM45/4GRS/SE1
 Camden – Key Switch CM-170/3
 Camden – Advanced Logic Relay CX-33
 Camden – Emerg. Call Kit CX-WEC10K2

.12 Safety Coat Hooks

Supply as Specified: Frost Code 1150

2.3 FINISHES

- .1 Unless otherwise specified, finishes to be brushed chrome (626).
 .2 Finishes are specified as follows:

Item	BHMA#	Description	Base Materials
Hinges	630	satn stainless steel	stainless steel
Hinges	652	satn chrome plated	steel
Lock Trim	626	satn chrome plated	brass/bronze
Exit Devices	626	satn chrome plated	brass/bronze
Door Closer	689	powder coat aluminum	steel
Door Pulls	630	satn stainless steel	stainless steel
Protective Plate	630	satn stainless steel	stainless steel
Door Stops/holders			
Overhead	630	satn stainless steel	stainless steel
Wall/Floor	626	satn chrome plated	brass/bronze
Thresholds	628	anodized aluminum	aluminum
Weatherstrip	628	anodized aluminum	aluminum
Miscellaneous			
Coat hooks	626	satn chrome plated	brass/bronze
Mullions	628	powder coat aluminum	steel
Key Switches	630	satn stainless steel	stainless steel
Electric Strikes	630	satn stainless steel	stainless steel

2.4 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

- .1 Permanent cylinders and keys to the existing Medeco keyway will be supplied and installed by Brock Lock Shop.
 .2 Provide temporary construction keying system during construction period. See Misc Hardware for quantity of keyed alike cylinders.

DOOR HARDWARE

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.
- .2 Ensure that door frames and finished floor are plumb and level to permit proper engagement and operation of hardware.
- .3 Submit in writing a list of deficiencies determined as part of inspection required in 3.1.1 and 3.1.2 to supervising consultant prior to installation of finished hardware. Correct door frame installation before proceeding with finish hardware installation.

3.2 INSTALLATION

- .1 Hardware Installers must have a minimum of five (5) years experience in installation of hardware.
Provide verification of installer's qualification to Consultant for approval. Installers to attend review meetings with the hardware distributor.
- .2 Install hardware at mounting heights as specified in the manufacturers templates or specific references in approved hardware schedule or approved elevation drawings.
- .3 Where mounting height is not otherwise specified, install hardware at mounting heights as indicated in 1.5.1, 1.5.2.
- .4 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.
- .5 Ensure that locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. **Handing is part of installation procedure.**
- .6 Ensure that exit devices are of the correct hand and adjust device cam for proper outside trim function prior to installation. **Handing is part of installation procedure.**
- .7 Follow manufactures installation instructions. Adjustment of door closers is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.
- .8 Delayed action door closers are to be adjusted to forty (40) second delay for barrier free accessibility and movement of materials. Time period to be approved by Owner.
- .9 Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops/holders. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.
- .10 Counter sink through bolt of door pull under push plate during installation.
- .11 Install blocking material of sufficient type and size in cavities of metal and wood stud walls and partitions. Located concave and convex type door bumpers at the appropriate height to properly contact protruding door trim.
- .12 Prior to installation of hardware, install hardware on the following doors for review by the consultant. Do not proceed with installation of hardware until mock up

DOOR HARDWARE

doors have been reviewed for proper installation. Install hardware on a classroom door, exterior pair of doors with outside cylinder operation and auto door operator, single or pair of stair door/s with, pair for doors with a hardware removable mullion, single office/classroom door with electric strike and access control reader. Upon written approval of hardware installation by the Consultant remaining doors and hardware can be installed.

3.3 FIELD QUALITY CONTROL

- .1 Verify each door leaf opens closes and latches properly. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation, owner to sign off on verification of operation. Verify electric door release hardware operates properly upon activation of the fire alarm system.
- .2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.
- .3 Before completion of the work but after the hardware has been installed, submit a certificate to the architect stating that final inspection has been made and that hardware has been checked for installation and operation by a technician from the manufacturer and hardware consultant.
- .4 Retain the services of Allegion Canada Inc. to perform an inspection of hardware with a written report forwarded to the consultant and owner.

3.4 ADJUSTING AND CLEANING

- .1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.
- .2 Adjust doors with self closing devices or automatic closing devices for proper operation after the HVAC system is balanced and adjusted. Verify spring power of non sized door closers is properly adjusted.
- .3 Hardware to be left clean and free of disfigurements.
- .4 Instruct owner personnel in the proper operation, adjustment and maintenance of hardware.
- .5 Check locked doors against approved keying schedule.

3.5 PROTECTION

- .1 Protect hardware from damage during construction. Wrap locks panic hardware, fire exit hardware, door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove and reinstall or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturer's warranty


3.6 HARDWARE GROUPS

See attached Section 08 71 01 Hardware Groups.

END OF SECTION

Brock University for the MacKenzie Chown Goodman School of Business

Legend:










-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

MCA218 MCA219

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MOUNTING PLATE	4020-18G		689	LCN
8	EA	HINGE	5BB1HW 127X114MM NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	REMOVABLE MULLION	POST LATCH		689	UNK
1	EA	ELEC PANIC HARDWARE	RX-QEL-35A-EO-CON 24 VDC 4'	 ⚡	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-35A-NL-OP-388-CON 24 VDC 4'	 ⚡	626	VON
1	EA	RIM CYLINDER	10W0400V (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	MORTISE CYLINDER	10W0500-26-H3S-Z01		626	MED
2	EA	LONG DOOR PULL	CBH6037-2 #6 MTG (LENGTH = 4" LESS DOOR HT) 1-1/4Dia 4 stand offs: 1 each top & Btm. 2 intermediate standoffs equally spaced		630	CBH
1	EA	OH STOP	100S		630	GLY
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	AUTO OPERATOR	4100LE (PUSH SIDE)		⚡ 689	HOR
2	EA	ACTUATOR, TOUCHLESS	8310-813		⚡ BLK	LCN
1	EA	OPERATOR KEY SWITCH, 3 POSITION	CM-170-3 on/off/hold switch for operator			CAM
1	EA	ADVANCED LOGIC RELAY	CX-12			CAM
2	EA	WIRE HARNESS	CON-___ TO SUIT		⚡	SCH
2	EA	WIRE HARNESS	CON-6W		⚡	SCH
1	EA	POWER SUPPLY	PS904 900-4RL 120/240 VAC	 ⚡	LGR	SCE
2	EA	DOOR CONTACT	FLAIR MSS100-4WY DPDT		⚡	UNK
1	EA	CARD READER	BY SECURITY SUPPLIER			UNK

THE FULL SCOPE OF WORK MEDECO CYLINDERS BY PINDERS SECURITY PRODUCT: (MEDECO CYLINDERS PURCHASED BY GC THROUGH CONTRACT WITH PINDERS PROVIDING SERVICES BELOW.)





- 1) GC TO PROVIDE SUB-ASSEMBLED MEDECO CYLINDERS TO PINDERS FOR PINNING.
- 2) GC TO PROVIDE DIGITAL VERSION OF APPROVED SHOP DRAWING DOOR HARDWARE SCHEDULE TO PINDERS.
- 3) PINDERS TO WORK OUT KEYING HIERARCHY WITH BROCK AND CREATE KEYING SCHEDULE.
- 4) PINDERS TO MASTER KEY PIN MEDECO CYLINDERS AS PER KEYING SCHEDULE.
- 5) PINDERS TO PROVIDE TWO CUT MEDECO KEYS PER CODE
- 6) PINDERS TO SUPPLY KEY DATA AND LOCATION DATA TO OWNER FORMATTED FOR IMPORT INTO KEY WIZARD SOFTWARE.
- 7) PINDERS TO SUPPLY KEY INVENTORY AND KEYING SCHEDULE FORMATTED FOR OWNER INPUT INTO KEY WIZARD SOFTWARE.
- 8) OWNER (BROCK) TO INSTALL PERMANENT MEDECO CYLINDERS IN LOCKS AND PANIC AND FIRE EXIT HARDWARE

Hardware Group No. 02

For use on Door #(s):

MCA221A	MCA222	MCA225	MCA226	MCA227	MCA228
MCA230	MCA233	MCA234	MCA235		

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03B L583-363		626	SCH
1	EA	MORTISE CYLINDER	10W0200-26-H3S-Z34 (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	STRIKE	BY PC350 FRAME SUPPLIER			UNK
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	COAT HOOK	CODE 1150		630	UNK

NOTE: MOUNT COAT HOOK ON WALL, EXACT LOCATION AS DIRECTED BY MCCALLUM SATHER.





Full mortise door bottom Model #364AA by Zero.

Hardware Group No. 03

For use on Door #(s):

MCA229 MCA231 MCA232

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03B L583-363		626	SCH
1	EA	MORTISE CYLINDER	10W0200-26-H3S-Z34 (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	STRIKE	BY PC350 FRAME SUPPLIER			UNK
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	COAT HOOK	CODE 1150		630	UNK










Full mortise door bottom Model #364AA by Zero.

Hardware Group No. 04

For use on Door #(s):

MCA224

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	ELECTRIC STRIKE	4500CX4501-1/2 (1/2" LIP EXTENSION)		630	HES
1	EA	CLASSROOM LOCK	L9070L 03B		626	SCH
1	EA	MORTISE CYLINDER	10W0200-26-H3S-Z34 (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	AUTO OPERATOR	4100LE (PUSH SIDE)		689	HOR
2	EA	ACTUATOR, TOUCHLESS	8310-813		BLK	LCN
1	EA	OPERATOR KEY SWITCH, 3 POSITION	CM-170-3 on/off/hold switch for operator			CAM
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	ADVANCED LOGIC RELAY	CX-12			CAM
1	EA	DOOR CONTACT	FLAIR MSS100-4WY DPDT			UNK
1	EA	CARD READER	BY SECURITY SUPPLIER			UNK

Hardware Group No. 05

For use on Door #(s):

MCA223-2 MCA223-3

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM NRP		652	IVE
1	EA	PASSAGE SET	L9010 03B		626	SCH
2	EA	MORTISE CYLINDER	10W0500-13-H3S-Z01		626	MED
1	EA	MAGNETIC LOCK	M420P ATS/LED 12/24 VDC		628	SCE
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH
2	EA	KEY SWITCH	960N-MA-LED SPDT		628	RCI
1	EA	POWER SUPPLY	PS902 900-2RS-FA 120/240 VAC		LGR	SCE

NOTE: INSTALL MAGNETIC LOCKS AS PER OBC CODE. TIE BACK TO MASTER RE-SET SWITCH

Hardware Group No. 06

For use on Door #(s):

MCA223-1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-35A-L-06-CON 24 VDC		626	VON
1	EA	MORTISE CYLINDER	10W0500-26-H3S-Z01		626	MED
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	AUTO OPERATOR	4100LE (PUSH SIDE)		689	HOR
2	EA	ACTUATOR, TOUCHLESS	8310-813		BLK	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH
1	EA	ADVANCED LOGIC RELAY	CX-12			CAM
1	EA	WIRE HARNESS	CON-___ TO SUIT			SCH
1	EA	WIRE HARNESS	CON-6W			SCH
1	EA	DOOR CONTACT	FLAIR MSS100-4WY DPDT			UNK
1	EA	CARD READER	BY SECURITY SUPPLIER			UNK

Full mortise door bottom Model #364AA by Zero.

Brock University for the MacKenzie Chown Goodman School of Business

Hardware Group No. 07

For use on Door #(s):

MCA223

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA		4110-61 SRT		689	LCN
3	EA	HINGE	5BB1 127X114MM NRP		652	IVE
1	EA	PANIC HARDWARE	LD-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	10W0400V (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	CYLINDER PULL	CBH 350		626	CBH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH

Full mortise door bottom Model #364AA by Zero.

Hardware Group No. 08

For use on Door #(s):

MCA221B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 114X102MM NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB458		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-TLR-L 4B BATTERY OPERATED		626	SCE
1	EA	K&L CYLINDER	20C20249		626	MED
1	EA	OH STOP	410S		630	GLY
1	EA	WALL STOP	WS406/407CVX		630	IVE

Hardware Group No. 09

For use on Door #(s):

MCA220

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MOUNTING PLATE	4020-18		689	LCN
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	STOREROOM LOCK	L9080L 03B		626	SCH
1	EA	MORTISE CYLINDER	10W0200-26-H3S-Z34 (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4011 ST-1544		689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT X B4E		630	CBH









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Hardware Group No. 10

For use on Door #(s):

MCA219-EX1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MOUNTING PLATE	4020-18G		689	LCN
8	EA	HINGE	5BB1HW 127X114MM NRP		630	IVE
1	EA	REMOVABLE MULLION	POST LATCH		689	UNK
1	EA	PANIC HARDWARE	CD-35A-EO 4'		626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388 4'		626	VON
1	EA	RIM CYLINDER	10W0400V (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
2	EA	MORTISE CYLINDER	10W0500-26-H3S-Z01		626	MED
2	EA	LONG DOOR PULL	CBH6037-2 #6 MTG (LENGTH = 4" LESS DOOR HT) 1-1/4Dia 4 stand offs: 1 each top & Btm. 2 intermediate standoffs equally spaced		630	CBH
1	EA	OH STOP	100S		630	GLY
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	AUTO OPERATOR	4100LE (PUSH SIDE)	↗	689	HOR
2	EA	ACTUATOR, TOUCHLESS	8310-813	↗	BLK	LCN
1	EA	OPERATOR KEY SWITCH, 3 POSITION	CM-170-3 on/off/hold switch for operator			CAM
1	EA	WEATHER STRIP BY DOOR SUPPLIER				UNK
2	EA	DOOR SWEEP	8192AA X DR WIDTH		AA	ZER
1	EA	THRESHOLD	625A X DR WIDTH		A	ZER









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Hardware Group No. 11

For use on Door #(s):

MCA218-EX1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MOUNTING PLATE	4020-18G		689	LCN
8	EA	HINGE	5BB1HW 127X114MM NRP		630	IVE
1	EA	REMOVABLE MULLION	POST LATCH		689	UNK
1	EA	PANIC HARDWARE	CD-35A-EO 4'		626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388 4'		626	VON
1	EA	RIM CYLINDER	10W0400V (BROCK MAINTENANCE DEPT TO SUPPLY AND KEY)		626	MED
2	EA	MORTISE CYLINDER	10W0500-26-H3S-Z01		626	MED
2	EA	LONG DOOR PULL	CBH6037-2 #6 MTG (LENGTH = 4" LESS DOOR HT) 1-1/4Dia 4 stand offs: 1 each top & Btm. 2 intermediate standoffs equally spaced		630	CBH
1	EA	OH STOP	100S		630	GLY
1	EA	OH STOP	100S ADJ		630	GLY
1	EA	SURFACE CLOSER	4021		689	LCN
1	EA	AUTO OPERATOR	4100LE (PUSH SIDE)	↗	689	HOR
2	EA	ACTUATOR, TOUCHLESS	8310-813	↗	BLK	LCN
1	EA	OPERATOR KEY SWITCH, 3 POSITION	CM-170-3 on/off/hold switch for operator			CAM
1	EA	WEATHER STRIP BY DOOR SUPPLIER				UNK
2	EA	DOOR SWEEP	8192AA X DR WIDTH		AA	ZER
1	EA	THRESHOLD	625A X DR WIDTH		A	ZER

Legend:

↗ Electrified Opening

Door#	HwSet#
MCA218 ↗	01
MCA218-EX1 ↗	11
MCA219 ↗	01
MCA219-EX1 ↗	10
MCA220	09
MCA221A	02
MCA221B ↗	08
MCA222	02
MCA223	07
MCA223-1 ↗	06
MCA223-2 ↗	05
MCA223-3 ↗	05
MCA224 ↗	04
MCA225	02
MCA226	02
MCA227	02
MCA228	02
MCA229	03
MCA230	02
MCA231	03
MCA232	03
MCA233	02
MCA234	02
MCA235	02

GLASS AND GLAZING

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Glass, and glazing for sections referencing this section for Products and installation.
- 1.3 RELATED SECTIONS
- .1 Section 06 20 00 - Finish Carpentry: components with requirement for glass.
.2 Section 07 92 00 - Joint Sealants: Sealant and back-up material.
.3 Section 08 11 03 - Standard Hollow Metal Doors: Glazed doors.
.4 Section 08 41 13 – Aluminum Doors, Frames and Windows.
- 1.4 REFERENCES
- .1 ANSI Z97.1-04e1 - Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
.2 ASTM C542-05 - Specification for Lock-Strip Gaskets.
.3 ASTM C864-05 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
.4 ASTM C920-05 - Elastomeric Joint Sealants.
.5 ASTM C1036-01 - Flat Glass.
.6 ASTM C1172-03 - Laminated Architectural Flat Glass.
.7 ASTM C1048-04 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
.8 ASTM C1193-05a - Use of Joint Sealants.
.9 ASTM C1503-01 - Silvered Flat Glass Mirror.
.10 ASTM D412-06a -Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
.11 ASTM D1149-99 - Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber.
.12 ASTM D2240-05 - Test Method for Rubber Property - Durometer Hardness.
.13 ASTM E84-07 - Test Method for Surface Burning Characteristics of Building Materials.
.14 ASTM E283-04 - Test Method For Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
.15 ASTM E330-02 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
.16 ASTM E773-01 - Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
.17 ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies
.18 CAN/CGSB 12.1-M90 - Tempered or Laminated Safety Glass.
.19 CAN/CGSB 12.2-M91 - Flat, Clear Sheet Glass.
.20 CAN/CGSB 12.3-M91 - Flat, Clear Float Glass.

GLASS AND GLAZING

- .21 CAN/CGSB 12.4-M91 - Heat Absorbing Glass.
- .22 CAN/CGSB 12.8-97 - Insulating Glass Units.
- .23 CAN/CGSB 12.9-M91 - Spandrel Glass.
- .24 CAN/CGSB 12.10-M76 - Glass, Light and Heat Reflecting.
- .25 CAN/CGSB 12.12-M90 - Plastic Safety Glazing.
- .26 CAN/CGSB 12.20-M89 - Structural Design of Glass for Buildings.
- .27 CGSB 19-GP-5M - Sealing Compound, One Component, Acrylic Base, Solvent Curing (Incorporating Amendment No. 1)
- .28 GANA (Glass Association of North America)
- .29 Glazing Manual (2004).
- .30 FGMA Sealant Manual.
- .31 Laminated Glazing Reference Manual (2006).
- .32 IGMAC (Insulating Glass Manufacturers Association of Canada) - Sealed Insulating Glass: Certification Program.
- .33 IGMA (Insulating Glass Manufacturers Alliance).
- .34 LSGA (Laminators Safety Glass Association) Laminated Glass Design Guide 2000.
- .35 UL 9 – Fire Tests of Window Assemblies
- .36 ULC Standard CAN4-S104: Fire Tests of Door Assemblies
- .37 ULC Standard CAN4-S106: Fire Tests of Window Assemblies

1.5 PERFORMANCE REQUIREMENTS

- .1 Provide glass and glazing materials for continuity of building enclosure vapour retarder and air barrier:
 - .1 To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapour retarder seal.
 - .2 To maintain a continuous air barrier and vapour retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- .2 Glass shall be heat strengthened or tempered as required in order to meet the wind loads, failure probability specified or to accommodate thermal stresses and as required to meet building regulations.
- .3 Glass within 457mm (18") of the floor shall be tempered.
- .4 Design horizontal rails and glazing up to 1100mm above finished floor in accordance with OBC requirements for guards.
- .5 Comply with "SB-10 Requirements" noted on drawing no. A003.
- .6 Fire-rated glass ceramic clear and wireless glazing material listed for use in non-impact safety-rated locations such as transoms and borrowed lites with fire rating requirements ranging from 20 to 90 minutes with required hose stream test. Conforms to positive pressure test standards.

1.6 SUBMITTALS

- .1 Product Data on Glass and Plastic Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- .2 Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.
- .3 Fire-rated Glass:
 - .1 Glazing materials bear manufacturer's permanent label designating type of glass, fire rating and UL mark. Provided labels represent a quality control

GLASS AND GLAZING

- program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
 - .2 Product test listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
 - .4 Samples: Submit three (3) samples 300mm x 300 mm in size, exemplifying glass, plastic units, colouration and design.
 - .5 Samples: Submit 150mm long bead of glazing sealant, of each colour as selected by the architect.
 - .6 Certificates: Certify that Products meet or exceed specified requirements.
 - .7 Manufacturer's Certificate: Certify that sealed insulated glass, meets or exceeds specified requirements..
 - .8 Glazed Guard:
 - .1 Indicate sections, elevations and details indicating all system components, materials, thickness, reinforcing, tapping and drilling arrangements.
 - .2 Ensure a register structural engineer is responsible for production and review of Shop Drawings.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
 - .1 Extra Stock Materials: Provide three (3) of each glass size and each glass type including the glass used in the railings, hollow metal units, and of insulated glass units.
- 1.8 QUALITY ASSURANCE
 - .1 Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, GANA Laminated Glazing Reference Manual, IGMA and in accordance with the building code (Latest edition).
 - .2 Maintain [one (1) copy on site.
 - .3 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.
 - .4 Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
 - .5 Glazed Guard Certification: Submit certification from registered professional structural engineer carrying a minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario who shall affix his/her seal and signature to certificate stating guard system is capable of supporting its own weight and loading.
- 1.9 MOCK-UP
 - .1 Provide mock-up of 300mmx 300mm including glass, air barrier and vapour retarder seal.
 - .2 Locate where directed.
 - .3 Approved mock-up may not remain as part of the Work.
- 1.10 ENVIRONMENTAL REQUIREMENTS
 - .1 Do not install glazing when ambient temperature is less than 10 degrees C (50 degrees F).

GLASS AND GLAZING

- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- 1.11 WARRANTY
- .1 Section 01 78 10: Warranties.
 - .2 Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
 - .3 Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.
- PART 2 PRODUCTS
- 2.1 MANUFACTURERS - FLAT GLASS MATERIALS
- .1 Trulite Industries and FireLite as manufactured by Nippon Electric Glass Company Ltd.
 - .2 Other acceptable manufacturers offering functionally and aesthetically equivalent products.
 - .1 Guardian Glass.
 - .2 Old Castle Glass.
 - .3 SCHOTT North America Inc., PYRAN Platinum
 - .3 Float Glass: ASTM C1048, CAN/CGSB-12.3-M91, minimum 6mm thick clear. Size as noted on drawings.
 - .4 Heat Absorbing Glass: ASTM C1036, CAN/CGSB-12.4-M, Type 1 and 2 to suit application, Class B, Style, Grade and tint selected by Consultant, minimum 6mm thick. As noted on the drawings and specifications.
 - .5 Heat Strengthened Glass (HSGL): Conforming to ASTM C1048, Kind HS. Perform heat strengthening using horizontal tong free method; surface compression less than 7500 psi.
 - .6 Laminated Glass (LGL): Conforming to ASTM C1048, CAN/CGSB-12.1-M, Type 1, Class B, Category II, clear PVB interlayer of 2.286 mm thickness.
 - .7 Tempered or laminated safety glass: minimum 6mm thick, clear or translucent tempered float or plate to ASTM C1048, CAN/CGSB-12.1-M90, Type 2 tempered, Class B clear transparent float glass, Category II. Perform heat strengthening using horizontal tong free method; surface compression not less than 7500 psi. Sizes and thickness noted on drawings.
 - .8 Tempered Laminated Glass (L-TGL): Two layers of 6 mm (1/4") thick fully tempered safety glass conforming to ANSI Z97.1, ASTM C1048 and CAN/CGSB-12.1-M, Type 2, Class B, Category II laminated together under heat and pressure with clear PVB interlayer of 1.5 mm and 2.3 mm thick between them to create single unit. Perform heat strengthening using horizontal tong free method; surface compression less than (7500 psi).
 - .9 Fire-rated Glass Ceramic: UL 10C, minimum 5mm thick clear. Size as noted on drawings.
 - .1 Labelling: Permanently label each piece with manufacturer logo, UL logo and fire rating in sizes up to 2.14 sq. m (3,325 sq. in.), and with the manufacturer label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
 - .2 Fire Rating: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance

GLASS AND GLAZING

with [ASTM E2010-01] [ULC Standards CAN4 S-104 and CAN4 S-106] [NFPA 257] [UL 9 and UL 10B].

2.2 MANUFACTURERS - SEALED INSULATING GLASS UNITS

- .1 Trulite Industries.
- .2 Other acceptable manufacturers offering functionally and aesthetically equivalent products.
 - .1 Guardian Glass.
 - .2 Viracon.
 - .3 Old Castle Glass.
 - .4 AFGD Glass Inc.; www.afgd.com
 - .5 PPG Canada Inc.; www.ppg.com
- .3 Insulating Glass Units: Double glazing units conforming to CAN2-12.8-M,
 - 1. At Storefront and Windows not forming part of an Exit:
Factory sealed, Argon filled Insulating Low-E Glass Unit: 25mm overall thick. To meet the values noted on the chart below,
Outboard glass 6mm heat strengthened with soft Low E coating on surface 2,
12mm air space,
Inboard glass 6mm clear Tempered glass.
 - .1 Visible Light transmittance: 35%.
 - .2 SHGC: 0.26.
 - .3 SC:0.11-0.61
 - .4 U-Value SI: 1.38 W/m²
 - 2. At Entrance Doors and Sidelights forming part of an Exit:
Factory sealed, Argon filled Insulating Low-E Glass Unit: 25mm overall thick. To meet the values noted on the chart below,
Outboard glass 6mm Tempered with soft Low E coating on surface 2,
12mm air space,
Inboard glass 6mm clear Tempered glass.
- .4 Warm edge non-metallic polyisobutylene or thermo plastic spacer. SuperSpacer by Edgetech or I-Spacer by Technoform.
- .5 Soft Low E coating on Surface 2 at South and West facing windows (VG1, VG3) and on Surface 3 (VG2 & VG3) facing windows.
- .6 Mitred corners.
- .7 Edge Seal Material: grey colour.
- .8 Design horizontal rails and glazing up to 1100mm (3'-6") above finished floor in accordance with OBC requirements for guards.

2.3 MANUFACTURERS - GLAZING COMPOUNDS

- .1 Silicone Sealant:
 - .1 Dow 790 or approved equal. Colour as selected by Architect.
 - .2 Spectrum Pro-Glaze. Color as selected by Architect.
 - .3 Dow 995. Colour as selected by Architect.
 - .4 Fire-rated Glass Ceramic:
 - .1 Dow Corning 795
 - .2 Tremco Spectrem 2

2.4 MANUFACTURERS - GLAZING ACCESSORIES

GLASS AND GLAZING

- .1 Manufacturer as mentioned below for each accessory.
- .2 Lock Strip Gaskets: ASTM C542, ozone-resistant neoprene compound, with lock-strip (zipper) component that friction-fits into position to retain glass pane/unit, [H-shape,] [reglet type,] tensile strength of 14 MPa (2000 psi) tested to ASTM D412, Durometer hardness of 75 tested to ASTM D2240, sized to accommodate glass thickness.
- .3 Setting Blocks: 40 to 60; 80 to 90 Shore A durometer hardness tested to ASTM D2240, EPDM neoprene rubber by Good year Industrial Products or approved equal. Length of 25 mm for each square metre of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area.
- .4 Spacer Shims: Neoprene, 40 to 50; 50 & 80 Shore 'A' durometer hardness + - 5 respectively EPDM neoprene rubber by Goodyear Industrial Products. Resistance to sunlight, weathering, oxidization and permanent deformation under load and compatibility with all materials in the glazing system, shall be the prime essential of spacers, shims and setting blocks.
- .5 Glazing Tape:
 - .1 Non fire-rated: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapour retarder seal. 440 Tape by Tremco Ltd., or approved equal
 - .2 Fire-rated Glass Ceramic: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
- .6 Mirror adhesive: Mirro-Mastic by Palmer products Corporation or approved equal.
- .7 Stainless Steel 'J' Strip: Type #302, #4 brushed finish, non-magnetic, 16 ga thick.
- .8 Glazing Gaskets: Black Neoprene compression gasket of sufficient thickness to suit glazing channel retaining slot to be under 25% compression minimum when installed.
- .9 Glazing Clips: Manufacturer's standard type.
- .10 Glass railing system: Dry Glaze Taper-Loc System by C.R. Laurence Company, AC Glass and Mirror Ltd., Hi-Tech Glazing Supplies or equal. B5S series heavy aluminum square shoe base as noted on drawings c/w base shoe anchor bolts, brushed stainless steel cladding and end caps and top cap rails.
- .11 Glass mounted hand rail bracket: 316 Grade Stainless Steel (ss) by C.R. Laurence Company, or equal. As noted on drawings
- .12 Wood handrails (for glass mounted and wall mounted ss hand rail bracket) – NOT USED THIS PROJECT: 38mm dia. Clear Maple. by C.R. Laurence Company, or approved equal. As noted on drawings.
- .13 Glass stand off system – NOT USED THIS PROJECT: 38mm (1.5" diameter) Brushed Stainless Steel by C.R. Laurence complete with mounting hardware, or approved equal. As noted on drawings
- .14 Provide continuous support as detailed on drawings.
- .15 Glazing U channels: Shallow 25.4mm and Deep 38.1mm Wet/Dry glaze U-channel, brushed stainless steel finish by C.R. Laurence.
- .16 Stainless Steel rods for exterior canopies as specified on drawings, by C.R. Laurence.
- .17 Supply two (2) suction cups with glazing accessories.

GLASS AND GLAZING

- .18 Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units destined for removal for smoke control.
- PART 3 EXECUTION
- 3.1 EXAMINATION
- .1 Section 01 70 00: Verify existing conditions before starting work.
 - .2 Verify that openings for glazing are correctly sized and within tolerance.
 - .3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
- 3.2 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 Install sealant in accordance with manufacturer's written instructions.
- 3.3 INSTALLATION
- .1 Install glazing in accordance with material manufacturer's directions.
 - .2 Glaze in temperatures above +5 degree C.
 - .3 Comply with FGMA (Flat glass marketing Assoc.) glazing manual.
 - .4 Orient heat strengthened and tempered glass so that roller marks are horizontal.
- 3.4 EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)
- .1 Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with sealant.
 - .2 Place setting blocks at 1/3 points with edge block no more than 150mm from corners.
 - .3 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
 - .4 Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
 - .5 Trim protruding tape edge.
- 3.5 INSTALLATION - EXTERIOR BUTT GLAZED METHOD (SEALANT ONLY)
- .1 Temporarily brace glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
 - .2 Temporarily secure a small diameter non-adhering foamed rod on back side of joint.
 - .3 Apply sealant to open side of joint in continuous operation; thoroughly fill the joint without displacing the foam rod. Tool the sealant surface smooth to concave profile.
 - .4 Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.
 - .5 Remove masking tape.

GLASS AND GLAZING

- 3.6 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)
- .1 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
 - .2 Place setting blocks at 1/3 points with edge block no more than 150mm from corners.
 - .3 Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
 - .4 Place glazing tape on free perimeter of glazing in same manner described above.
 - .5 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
 - .6 Knife trim protruding tape.
- 3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)
- .1 Cut glazing tape to length and install against permanent stops, projecting 1.6 mm above sight line.
 - .2 Place setting blocks at 1/3 points with edge block no more than 150mm from corners.
 - .3 Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
 - .4 Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm and 6 mm below sight line.
 - .5 Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.
 - .6 Trim protruding tape edge.
- 3.8 INSTALLATION - PLASTIC FILM
- .1 Install plastic film with adhesive, applied in accordance with film manufacturer's written instructions.
 - .2 Place without air bubbles, creases or visible distortion.
 - .3 Fit tight to glass perimeter with razor cut edge.
- 3.9 FIELD QUALITY CONTROL
- .1 Inspection will monitor quality of glazing.
- 3.10 MANUFACTURER'S FIELD SERVICES
- .1 Section 01 78 10: Prepare and start components.
 - .2 Glass and glazing product manufacturers to provide field surveillance of the installation of their Products.
 - .3 Monitor and report installation procedures & unacceptable conditions.
- 3.11 CLEANING
- .1 Remove glazing materials from finish surfaces.
 - .2 Remove labels after Work is complete.
 - .3 Clean glass and adjacent surfaces.

GLASS AND GLAZING

3.12 PROTECTION OF FINISHED WORK

- .1 After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

GLASS AND GLAZING

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GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to Division 01, General Requirements.

1.2 SECTION INCLUDES

- .1 Work Included: Provide gypsum board work including but not limited to following:
 - .1 supplementary steel supports for ceilings.
 - .2 reinforcement for suspension systems for lighting fixtures, access hatches, etc.
 - .3 steel studs and furring channels.
 - .4 concealed sheet steel reinforcing.
 - .5 ceiling, bulkhead and soffit suspension system.
 - .6 exterior sheathing board.
 - .7 gypsum board ceilings, partitions, bulkheads and soffits.
 - .8 shaft wall.
 - .9 corner beads, casing beads, trim, control joints and corner reinforcement.
 - .10 taping and filling.
 - .11 acoustically insulated gypsum board partitions.
 - .12 acoustic caulking to acoustically insulated gypsum board partitions.
 - .13 fire rated wall assemblies.
 - .14 installation in gypsum board, access hatches, panels and doors supplied by other trades.
 - .15 studless sound attenuating fire rated partitions with STC 60 rating.

1.3 RELATED SECTIONS

- .1 Following description of work is included for reference only and shall not be presumed to be complete:
 - Section 07 84 00: Firestopping, smoke seals and penetration firestopping.
 - Section 09 91 10: Finish painting of gypsum board.

1.4 REFERENCES

- .1 ASTM A653M-04a - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .2 ASTM A666-03 - Specification for Annealed or Cold Worked Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar
- .3 ASTM C475M-02 - Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
- .4 ASTM C514-04 - Specification for Nails for the Application of Gypsum Board
- .5 ASTM C645-04a - Specification for Non-Load Bearing (Axial) Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board
- .6 ASTM C754-04 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
- .7 ASTM C834-00e1 - Specification for Latex Sealants
- .8 ASTM C840-04a - Specification for Application and Finishing of Gypsum Board
- .9 ASTM C919-02 - Standard Practice for Use of Sealants in Acoustical Applications
- .10 ASTM C920-02 - Standard Specification for Elastomeric Joint Sealants

GYPSUM BOARD ASSEMBLIES

- .11 ASTM C954-04 - 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
 - .12 ASTM C1047-04 - Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - .13 ASTM C1325-04 - Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets
 - .14 ASTM C1396M-04 - Specification for Gypsum Board
 - .15 ASTM C1177M-04e1 - Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - .16 ASTM C1280-04 - Specification for Application of Gypsum Sheathing Board
 - .17 ASTM C1396M-04 - Specification for Gypsum Board
 - .18 ASTM D3273-00 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - .19 ASTM E84-04 - Test Method for Surface Burning Characteristics of Building Materials
 - .20 ASTM E90-04 - Test Method for Laboratory Measurement for Airborne Sound Transmission Loss of Building Partitions
 - .21 ASTM E96-00e1 - Standard Test Methods for Water Vapor Transmission of Materials
 - .22 ASTM E119-00a - Test Methods for Fire Tests of Building Construction and Materials
 - .23 ASTM E814-02 - Test Method for Fire Tests of Through-Penetration Fire Stops
 - .24 CSA A123.3-96 - Asphalt Saturated Organic Roofing Felt
 - .25 CAN/CGSB-51.33 M89 - Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction
 - .26 ULC - Underwriters' Laboratories of Canada
 - .27 CAN/ULC-S101-M89 - Standard Methods of Fire Endurance Tests of Building Construction and Materials
 - .28 CAN/ULC-S102-M88 - Surface Burning Characteristics of Building Materials and Assemblies
 - .29 CAN4-S114-M80 - Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - .30 ULC-S115-95 - Fire Tests of Firestop Systems
- 1.5 DEFINITIONS
- .1 Drywall- Gypsum Wall Board.
- 1.6 SYSTEM DESCRIPTION
- .1 Design Requirements:
 - .1 Obtain services of professional engineer with experience in type of work of comparable complexity and scope, licensed to practice in Province of Ontario to design, review and provide professional services for work of this Section.
 - .2 Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements. Do not suspend any items from structural steel deck. Do not support work of this Section from, nor make attachments to, ducts, pipes, conduits or support framing of other trades.
 - .3 Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

GYPSUM BOARD ASSEMBLIES

- .4 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.
- .5 Design suspension system to support weight of mechanical and electrical items such as air grilles, lighting fixtures, drapery track, drapes and with adequate support to allow rotation / relocation of light fixtures.
- .6 Design penetration resistance security partitions using security resistance welded to heavier gauge stud to suit design requirements and as indicated on Drawings.
- .7 Design exterior soffit and ceiling system where applicable to withstand positive and negative wind loads effect to suit Project design requirements.
- .8 Design sub-framing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.
- .9 Design metal stud reinforcements from hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm colour-yellow/18 ga) where required to support of manufactured components without limitations items such as washroom accessories, expansion control covers and similar items. Design weld connections ensuring rigid and secure installation capable of offering resistance to minimum 227 kg pull force. Consider galvanized items in moist areas. Do not design using wood blocking for this purpose.
- .10 Design fire rated construction including ceiling, partition or fire protective membranes and furring to approved ULC design or other design acceptable to authorities having jurisdiction, to provide design fire rating indicated and/or required. Submit written evidence of acceptable test design.
- .11 Provide sound rated construction having STC rating indicated and tested in accordance with ASTM E90.

1.7 SUBMITTALS

- .1 Shop Drawings: Submit shop drawings in accordance with Section 01 30 00 showing design, construction, sound attenuating construction, adjacent construction, elevations, finishes and relevant details of furring, enclosures and partitions which require fire rating.
- .2 Certificates:
 - .1 Submit certification from Structural Engineer registered in Province of Ontario, who shall affix his/her seal and signature to certificate, stating that installed suspended ceiling system is capable of supporting its own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by Mechanical and Electrical Divisions.
 - .2 Obtain approval of electrical utility authorities having jurisdiction for support of light fixtures, by ceiling grid and supports, to satisfy requirements of electrical inspection department of Ontario Hydro. Adjust grid, fixing devices and support hangers as required to obtain approval.
- .3 Samples: Submit samples in accordance with Section 01 33 00. Submit following samples in sizes indicated:
 - .1 each trim accessory minimum 300 mm long.

GYPSUM BOARD ASSEMBLIES

1.8 QUALITY ASSURANCE

- .1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of Products, systems and assemblies specified.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site with manufacturer's original labels intact. Do not remove wrappings until ready for use.
- .2 No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.
- .3 Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged Products from moisture or wetting.

1.10 PROJECT CONDITIONS

- .1 Cooperate and coordinate with Sections applying wet trades and trades installing mechanical and electrical services. Do not install work of this Section in any area unless satisfied that work in place has dried out and that no further installation of materials requiring wetness, moisture or dampness is contemplated. Relative humidity in area of work of this Section shall not exceed 55% for duration of Project. Coordinate stud layout at partitions accommodating wall mounted fixtures by other trades.
- .2 Ensure temperature of surrounding areas is min 13 deg C (55 deg F) and max 21 deg C (70 deg F) for 7 Days before and during application of gypsum board; maintain for 4 Days thereafter. Ensure heat is provided at appropriate time before work has started to bring surrounding and adjacent materials up to required temperature and maintained as specified. Avoid concentrated or irregular heating during drying by means of deflectors or protective screens.
- .3 Ensure ventilation is provided for proper drying of joint filler and adhesive and to prevent excessive humidity. Do not force dry adhesives and joint treatment.
- .4 Provide protection of materials and work of this Section from damage by weather and other causes. Perform work in areas closed and protected from damage due to weather. Protect work of other trades from damage resulting from work of this Section. Make Good such damage immediately.
- .5 Coordinate installation and cooperate with mechanical and electrical trades to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with ceiling and soffit systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 Bailey Metal Products Ltd.; www.bmp-group.com
 - .2 Chicago Metallic; www.chicagometallic.com
 - .3 CGC Inc; www.cgcinc.com

GYPSUM BOARD ASSEMBLIES

- .4 Georgia-Pacific Canada, Inc.; www.gp.com
- .5 Gordon Incorporated.; www.gordongrid.com
- .6 Roll Formed Specialty; www.rollformed.com
- .7 Certainteed Gypsum; www.certainteed.com
- .8 Trim-Tex Inc.; www.trim-tex.com
- .9 Unifix Inc.; www.unfixinc.ca

2.2 MATERIALS

- .1 Steel Studs: ASTM C645, Galvanized sheet steel, minimum 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm/25 ga) thickness, zinc coating Z275, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths practicable. Provide heavier gauges where required due to height.
- .2 Heavy Duty Studs at Openings: ASTM C645, Galvanized sheet steel, minimum 1.519 mm (designation thickness 54mils/minimum base steel thickness 1.367 mm (0.0538 in.)/colour-Green/16 ga) thickness, zinc coating Z275, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths practicable. Provide heavier gauges where required due to height.
- .3 For studs supporting Security Mesh Sheet: ASTM C645, Galvanized sheet steel, minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm colour-Yellow/18 ga) thickness, zinc coating Z275, screw able with crimped web and returned flange, of depth shown in max. continuous lengths practicable. Provide heavier gauges where required due to height. Provide 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm (0.0428 in.)/colour-Yellow/18 ga) at partitions to receive security mesh for resistance against penetrations at partitions shown on Drawings.
- .4 Provide knockout openings in web at 460 mm oc to accommodate (if required) horizontal mechanical and electrical service lines and bracing.
- .5 Concealed Sheet Steel Reinforcing: Commercial quality cold rolled galvanized sheet steel to ASTM A653M with zinc coating designation of ASTM A653M, Z275 in minimum thickness of 0.912 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm colour-White/20 ga) ; or ASTM A666, Type 304 sheet stainless steel.
- .6 Security Mesh Sheet: Security mesh sheets shall be steel panels used for resistance to penetration behind gypsum board partitions where scheduled on Drawings. Security mesh sheet shall be carbon steel conforming to ASTM A569, galvanized of design and pattern specified herein. Medium security ASM .75 -13F, 75 lbs/100 sq ft, sheet size Short Way of Diamond SWD x Long Way of Diamond LWD lengths to suit design, center to center opening SWD x LWD 0.923 x 2.10, thickness 0.070", 73% open area by Alabama Metal Industries Corporation (AMICO).
- .7 Floor and Ceiling Partition Track for Gypsum Board: ASTM C645, Galvanized sheet steel, minimum 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm/25 ga) overall thickness zinc coating Z275, with minimum 30 mm (1-1/4") legs, top track having longer legs where required to compensate for deflection of structure above. Width to suit metal studs.
- .8 Furring Channels: Galvanized sheet steel, minimum 0.914 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm (0.0329 in.)/colour-White/20 ga) or 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm/25 ga) overall thickness zinc coating Z275 screw channels, 67 mm wide x 22 mm deep.

GYPSUM BOARD ASSEMBLIES

- .9 Carrying Channels for Gypsum Board: ASTM C645, galvanized sheet steel, minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm/colour-yellow/18 ga) overall thickness zinc coating Z275, 38 mm high with 19 mm flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.
- .10 Carrying Channels for Cement Board: Galvanized sheet steel, minimum 1.519 mm (designation thickness 54mils/minimum base steel thickness 1.367 mm colour-Green/16 ga) overall thickness zinc coating Z275, 38 mm high with 19 mm flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.
- .11 Resilient Channel Furring: ASTM C645, ARC-1 Resilient Channel® by CGC Inc. or other approved manufacturer.
- .12 Core Board Runner: ASTM C645, 35 mm x 22 mm x 0.914 mm designation thickness 33mils/minimum base steel thickness 0.836 mm (0.0329 in.)/colour-White/20 ga) galvanized metal angle runner.
- .13 Steel Spring Isolator Hangers for Sound Isolation: Steel spring encased in welded steel brackets of all size recommended by manufacturer to suit load conditions and to provide minimum 30 mm static deflection with at least 50% over load reserve deflection capacity. Factory pre-compress spring element to within 6 mm (1/4") of anticipated operating height. Brackets shall be cadmium plated designed to carry 500% overload without failure. Design hangers to accommodate rod misalignment over 3m. Equip hanger assembly with eyebolts both top and bottom. Sound spring isolator hangers shall be by Vibron Limited or Valcoustics Canada Ltd., or Mason Industries, Inc. represented by Tecoustics.
- .14 Hangers: 6 mm for cement board areas and 4.8 mm nominal diameter mild steel rod coated with rust inhibitive paint for elsewhere.
- .15 Inserts for Concrete Slabs: Tie wire anchors, Red Head TW-1614 by ITW Canada Inc., Parabol Wire Hanger distributed by Acrow-Richmond Ltd., T 14 Eyebolt by Ramset Ltd. or Tie Wire Drive TW 932 by Isometric Ltd.
- .16 Tie Wire: 1.519 mm (designation thickness 54mils/minimum base steel thickness 1.367 mm colour-Green/16 ga) nominal diameter galvanized, soft annealed steel.
- .17 Screws for Sheet Steel Members: ASTM C954, self drilling, self tapping gypsum board screws, 25 mm (1") long #6 for single layer application, 41 mm long #7 for double layer application and as follows:
 - .1 For single layer application over metal framing; self-drilling, self-tapping, case hardened, No. 6 contoured Phillips head or Type S bugle head, sized for minimum 15.9 mm penetration into steel framing and 25 mm into wood framing]. All fasteners shall be corrosion resistant. Use drill point screws for abuse resistant gypsum fiber panels.
 - .2 For double layer application over gypsum backing board and existing gypsum board; 38 mm Type G bugle head. For each additional layer of board, increase length of fasteners proportionally.
- .18 Fasteners for Cement Board: Galvanized or coated staker type screw, 32 mm long such as Permabase screws.
- .19 Gypsum Board (GB): Conforming to CSA A82.27-M, Canadian product with minimum 90% recycled content, 1.2m wide by longest lengths practicable, thickness indicated:
 - .1 Gypsum Board (Walls): Provide 15.9 mm thick if not noted on drawings:
 - .1 Provide 9.5 mm thick gypsum board on curved walls.
 - .2 Gypsum Board (Ceiling): 15.9 mm thick gypsum board. Use anti sag sheets.

GYPSUM BOARD ASSEMBLIES

- .20 Moisture Resistant Gypsum Board (MRGB): Provide 1 of following:
 - .1 ASTM C1177M, glass mat reinforced, silicone treated core gypsum board, ASTM D3273 with a rating of 10, no mold growth after 4 weeks exposure, Permeance of < 1.2 ng/(Pa/s/m⁵) or Perms (with no tile or coating) according to ASTM E96, 12.7 mm or Type X, 15.9 mm DensGuard DensArmor Plus Interior Guard@ by Georgia-Pacific Canada, Inc.
 - .2 Interior gypsum board panels manufactured from 95% recycled materials made up of gypsum with blend paper fibres engineered to provide strength, resistance to abrasion, indentation, penetration, water resistant through core and no mold growth after 4 weeks exposure with a rating of 10, in accordance with ASTM D3273, smooth paintable surface, non-fire rated 12.7 mm or fire rated, 15.9 mm Fiberock Brand Aqua-Tough Interior Panel by CGC Inc. or Proroc M2Tech by CertainTeed Gypsum.
- .21 Fire Rated Gypsum Board having Testing Agency Fire Rating Identification Stamp on Each Sheet : ASTM C1396M, Type X, 12.7 mm and/or 15.9 mm thick gypsum board 1200 mm wide, maximum practical length and tapered edge as required by each fire resistance assembly. Gyproc Fireguard Type X or Type C by Georgia-Pacific or CGC Sheetrock Firecode or Firecode C by CGC Inc. Fi-Rock Type X or Type C by Westroc Inc.
- .22 Gypsum Exterior Soffit and Sheathing Board: Glass mat reinforced, treated core gypsum board conforming to ASTM C1177M and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 12.7 mm or Type X 15.9 mm thick exterior ceiling panel, weather and sag resistant, DensGuard Dens Glass Gold by Georgia-Pacific Canada, Inc.
 - .1 Joint Tape: 50mm wide 10x10 glass mesh.
 - .2 Joint Compound: G-P Gypsum setting-type joint compound, compatible with exterior stucco system.
- .23 Impact Resistant Gypsum Board (IRGB): Multipurpose board, core of fibre-reinforced gypsum and perlite between layers of fibre-reinforced gypsum with fibreglass mesh reinforcement embedded; 12.7 mm or 15.9 mm thickness equivalent to Type X gypsum board when tested in accordance with ASTM E119 and CAN/ULC-S101-M. Abuse Resistant, Fiberock Brand Sheathing, VHI by CGC Inc.
- .24 Abuse Resistant Gypsum Board (ARGB): Enhanced gypsum core encased in heavy duty paper facers on front and back, 15.9 mm, conforming to ASTM C1396M and attaining a maximum of 0.014" as tested to ASTM D4060 (H-18 abrasion wheel, 500 grams, 200 cycles), a maximum of 0.123" indentation as tested to ASTM D5420 (72 in lbs) and a minimum of (133 ft lbs) as tested to ASTM E695 (50 lb bag) Type X in fire rated assemblies. ToughRock Abuse Resistant Gypsum Board by Georgia-Pacific Canada, Inc. or Proroc Extra Abuse board with M2Tech by CertainTeed Gypsum.
- .25 Foil Faced Gypsum Board at Exterior Walls Where Indicated: 15.9 mm (5/8") thick foil backed gypsum board.
- .26 Core Board: 25 mm by 600 mm sizes with tongue and grooved edges.
- .27 Cement Board (CEM.BD): 12.7 mm thick water resistant tile backer board, Durock Tile Backer Board by CGC Inc., AWonder Board@ by Roc-Crete Ltd., Permabase by Unifix Coatings Inc. or Pancroc by Westroc Ltd.
- .28 Fibre-Reinforced Cement Flat Panels: Fibre-reinforced cement consisting of Portland cement, cellulose fibres, silica, water and filler, natural grey colour, tested in accordance with ASTM E84 and CAN/ULC-S102-M, core 3 mm to 13 mm maximum thickness, panel size 1200 mm wide x maximum practical length. ASupra-Board by Cemfort Inc.

GYPSUM BOARD ASSEMBLIES

- .29 Joint Treatment for Gypsum Board Including Joint Cement, Tape, Topping Compound and Accessories: Conforming to ASTM C475 and gypsum board manufacturers recommendations. Confirm following Products with gypsum board manufacturer prior to application.
- .30 Joint Treatment and Rendering for Cement Board: Durabond 90 Compound by CGC Inc. and 75 mm wide nylon mesh or approved type as recommended by board manufacturer.
- .31 Dust Barrier: Minimum 0.152 mm (6 mil) polyethylene, CAN/CGSB-51.33-M, Type 2.
- .32 Resilient Sponge Tape: Self sticking adhesive on 1 side, closed cell neoprene sponge tape, Rubatex by Rubatex Corp. or Perma Stik 122X by Jacobs and Thompson Inc., foamed vinyl Arnofoam by Arno Adhesive Tapes Incorporated or Greyflex Expanding Foam Sealant by Emsel Corporation.
- .33 Laminating Compound: Asbestos-free, as recommended by manufacturer. Manufacturer's standard, multi-purpose construction adhesive. Sheetrock brand laminating compound by CGC Inc., or Dehydratine 9T by W.R. Grace and Co., or Stangard Foamastic by Standard Chemicals Ltd. At fire-rated construction, use adhesive which conforms to that used in applicable fire tests.
- .34 Joint Tape: For regular gypsum board, use either kraft paper joint tape with feathered edges and minute perforations 50 mm wide or glass fibre Grand Prix tape manufactured by CGC and for MRGB or cement board, use glass fibre tape only. For exterior joints, 50 mm and 100 mm widths, Duracrete Exterior Tape, open weave, with pressure sensitive adhesive 1 side.
- .35 Joint Fillers and Topping Compound: Either slow or fast setting, low shrinkage type free of asbestos fillers and as recommended by manufacturer. Use Gyproc 90" by Georgia-Pacific Canada, Inc. or Durabond 90" by CGC Inc. or Prorac 90 by CertainTeed Gypsum at exterior soffits.
- .36 For fire rated assemblies setting compound shall be tested in accordance with ASTM E814 and ULC-S115 for required rating. Gyproc Fire-Halt Sealant Setting Compound by Georgia-Pacific Canada, Inc.
- .37 Sealant for Moisture Resistant Gypsum Board Edges: Sheetrock Brand W/R Sealant by CGC Inc., or similar type acceptable to Consultant.
- .38 Corner Bead: ASTM C1047, Dur-A-Bead #114" at corners by CGC Inc. at reveals, or similar. Provide custom shapes of similar materials and design as noted.
- .39 Metal Trim: CGC No.200 A or BMP D 4411 in lieu of "J" Mould. Do not provide "J" Mould (CGC No. 400-A) unless specifically noted on Drawings as 'Exposed "J" Mould'.
- .40 Rigid Vinyl Inside/Outside Corner Fillets: Rigid vinyl incorporating continuous fins for fastening and gypsum board joint compound filling. Punch fins with staggered holes to facilitate screw securement. Ensure vinyl is primed to accept materials associated with wall finishes. Provide following components:
 - .1 Inside Corner: R. Bullnose Inside Corner Bead by Trim-Tex Inc. for 38 mm radius.
 - .2 Outside Corner: R. Bullnose Corner Bead by Trim-Tex Inc. for 38 mm radius.
 - .3 Splayed Inside Corner: Inside Splayed R. Bullnose Inside Corner Bead by Trim-Tex Inc. for 38 mm radius.
 - .4 Splayed Outside Corner: Outside Splayed R. Bullnose Corner Bead by Trim-Tex Inc. for 38 mm radius.
 - .5 Accessories: Provide A0913, 0914 and 0915" by Trim-Tex Inc. as required.
- .41 Flexible Casing Beads: 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm/25 ga) steel, wipe coated, angle shaped in size to fit over edge of gypsum board, to suit curved applications.

GYPSUM BOARD ASSEMBLIES

- .42 Extruded Aluminum Inside/Outside Corner Fillets: Aluminum extrusions consisting of aluminum alloy 6063-T5 incorporating continuous fins for fastening and gypsum board joint compound filling. Punch fins with staggered holes to facilitate screw securement. Ensure aluminum is primed to accept materials associated with wall finishes. Provide following components:
 - .1 Inside Corner:
 - .1 Model SI-9-075 by Pittcon Soffforms Corp. for 19 mm (3/4") radius.
 - .2 Final Forms I, 600 Series, Part No. 634-90 by Gordon Incorporated; www.gordongrid.com for 19 mm (3/4") radius.
- .43 Reveals: Gordon #312-1/2 by Gordon; www.gordongrid.com or ASTR-050-050" by Pittcon Soffforms Corp. aluminum trim reveal at back of aluminum window insulated panels, mill finish for site painting. Provide following components:
 - .1 Outside Corner:
 - .1 Model SO-9-075 by Pittcon Soffforms Corp. for 19 mm (3/4") radius.
 - .2 Final Forms I, 100 Series, Part No. 134-90 by Gordon Incorporated; www.gordongrid.com for 19 mm (3/4") radius.
- .44 Reveals:
 - .1 Soffit Shadow Mould: Fry reglet "W" molding sized to suit soffit finish thickness or equal by Gordon Inc.
 - .2 Provide 20 spring clips with non scuff pad and screw.
 - .3 Provide 20 flexible wire hangers 300 mm (12") long.
- .45 Light Louvres: Tex Cell, type 43TC by American Louvre of Canada, in flat white finish.
- .46 Light Pockets: [#LP 700 800 for Lay in tile ceiling,] [#SLP 700 800 for GPDW ceiling] by Pittcon Industries Inc., lengths to suit inside surfaces, finished in flat white paint.
- .47 Attachment Clips: Revoe Clips by Revoe Manufacturing Ltd., type to suit design requirements complete with screws and other fastening system.
- .48 Control Joints: Pre fabricated control joints prepared to suit site conditions; No. 093 by CGC Inc. zinc alloy control joint.
- .49 Access Doors and Panels:
 - .1 Supplied as part of Division 21, 22, 23 and 26 for installation as part of this Section.
 - .2 Access Panels for Items Other Than Mechanical and Electrical:AN/W Series, Flush Non-Rated Access Panels@ by Nystrom Building Products; www.nystrom.com or ADW-5040" by Acudor Products Inc.; www.acudoracornltd.com, or by Zurn Industries Canada Ltd., or by LeHage Industries Ltd., or by A. G. Baird Limited, or by Stelpro Limited sized to suit requirements of other Sections, but minimum size 410 mm x 410 mm with drywall bead frame and key operated cylinder lock.
- .50 Shaft Wall: - NOT USED THIS PROJECT
 - .1 Supply components from same manufacturer. Ensure components are compatible and tested by approved independent testing facilities acceptable to authorities having jurisdiction.
 - .2 Shaftwall framing, shaftliner, gypsum board and joint treatment materials shall provide 1 or 2 or 3 hour fire resistance rating as noted on Drawings when tested in accordance with ASTM E119.
 - .3 Shaftwall Framing including Galvanized Metal Studs and Runners: 64 mm, 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm (0.0179 in.)/25 ga) thick galvanized steel, designed for use in shaft wall construction. C-T Studs, J-L Corner and J track and other associated components by Georgia-Pacific Canada, Inc. or C-H or C-T and E studs, J runners and other associated components, CGC Cavity Shaft Wall by

GYPSUM BOARD ASSEMBLIES

- CGC Inc. or Proroc M2Tech Shaftliner by CertainTeed Gypsum or Dens Glass Ultra Shaftliner by Georgia-Pacific Canada, Inc. or Glasroc Shaftliner by CertainTeed Gypsum fabricated specially for gypsum shaftliner and facing boards in lengths up to 3600 mm. Shaftwall System for elevator shafts shall not have pointed ends of screws penetrating into shaft.
- .4 Liner Panels: 25 mm shaft wall liner panels with bevelled edges.
 - .5 Face Boards: 13 mm or 15.9 mm thick fire-rated gypsum boards.
- .51 Sound Control Materials:
- .1 Sound Attenuation Batts: CAN/ULC-S702, mineral (glass and rock wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102-M. Non combustible in accordance with requirements of CAN4-S114-M. Acceptable Products: QuietZone Acoustical Batts by Owens Corning Canada Inc., Roxul AFB - Acoustical Fire Batts by Roxul Inc., "Fibrex Sound Attenuation Batt (SAFB) Insulation" by Fibrex Insulations Inc., or Thermafibre Sound Attenuation Blankets by CGC Inc., Noisereducer by CertainTeed Gypsum, of sufficient thickness to meet required STC rating for sound rated partitions and of width to suit metal framing spaces.
 - .2 Strip Impalement Clips: 25 mm wide strip of Insul-Hold by Insul-Hold Canada Ltd., fabricated from 0.531 mm (designation thickness 18 mils/minimum base steel thickness 0.455 mm/25 ga) galvanized sheet metal in 30 m (100') rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.
 - .3 Acoustic Sealant: ASTM C834 and ASTM C920, Class 25, Non-hardening, QuietZone Acoustic Sealant by Owens-Corning Canada Inc. or Tremco Acoustical Sealant by Tremco Ltd.
 - .4 Elastomeric Sealant: As recommended by manufacturer of fibre-reinforced gypsum sheathing board.
 - .5 Gaskets: Closed cell neoprene, 3 mm thick x 64 mm wide.
 - .6 Asphalt Felt: CSA A123.3; No. 15 Type.

PART 3 EXECUTION

3.1 PARTITION TYPES

- .1 Refer to Drawings for partition types.
- .2 Provide partitions complete to underside of structure, unless otherwise indicated on Drawings.

3.2 INSTALLATION

- .1 Give minimum 48 hours notice for Consultant's inspection of internal wall insulation, vapour barriers and services prior to concealing with gypsum board.
- .2 Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.
- .3 Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of fibre-reinforced gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been

GYPSUM BOARD ASSEMBLIES

- corrected. Beginning of installation shall indicate acceptance of substrate conditions.
- .4 Carry out work using skilled tradesmen carefully supervised by competent foremen. Take all measurements accurately.
 - .5 Install framing, blocking and furring in accordance with ASTM C645, ASTM C1280 and ASTM C840.
 - .6 Maintain wallboard panels minimum 6 mm and maximum 13 mm above floor to prevent moisture transfer. Unless otherwise shown, extend panels to minimum 100 mm above finished ceiling and to underside of deck or structure where exposed and at fire rated and sound control partitions. Omit taping and filling of concealed surfaces above ceiling line, except at fire rated and sound control partitions and walls.
 - .7 Erect plain wallboard vertically or horizontally, whichever results in fewer end joints. Keep end joints away from prominent locations and central portions of ceilings. Locate vertical joints at least 300 mm from jamb lines of openings.
 - .8 Space screws for regular wallboard at 300 mm oc along board edges and in board field on walls and ceilings; at fire-rated assemblies, reduce spacings to comply with labelling authorities assembly listings. For other specialty boards screw spacing shall be in accordance with manufacturer=s recommendations.
 - .9 Drive screws with power screw-gun and set with countersunk heads slightly below surface of board. Do not secure gypsum board by installing screws into aluminum or steel window and door frames.
 - .10 Install resilient sponge tape where gypsum board ceilings abut heads of door frames and where wallboard abuts heads or jambs of exterior door and window frames. Adhere tape to casing bead and compress during installation. Compressed thickness; 1.6 mm.
 - .11 At partitions except shaft walls, apply 1 continuous 6 mm bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials. Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.
 - .12 Apply sealant beads at perimeter of all other services and like objects which penetrate wallboard in accordance with manufacturer's directions.
 - .13 Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services. Consultant reserves right to relocate access panels up to 3600 mm from locations shown on Drawings due to site conditions, providing ample warning is given prior to installation.
 - .14 Provide access panels in locations and sizes required by other Sections. Coordinate with other Sections for locations and sizes. Install in accordance with manufacturer=s instructions.
 - .15 At high impact resistant gypsum board provide 0.914 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm colour-White/20 ga) metal studs. Provide control joints 900mm Inboard glass 6mm clear Tempered glass on centre maximum and at both sides of door jambs.
 - .16 Metal Framing for Partitions and Bulkheads:
 - .1 Comply with recommendations of CGC Drywall Steel Framed Systems Folder 09250 SA 923 for metal stud partition, ceiling, column fireproofing and bulkhead detailing.
 - .2 Install members true to lines and levels and to maintain surface flatness with maximum variation of 3mm (1/8 A) in 300mm in any direction.
 - .3 Provide partition tracks at floor and underside of ceiling or structure above. Align accurately. Lay out to partition layout.
 - .4 Erect partial height and curved partitions as indicated.

GYPSUM BOARD ASSEMBLIES

- .5 Place studs vertically at 400 mm oc unless otherwise specified, not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks. Cross brace studs as required to provide rigid installation.
- .6 Provide heavy duty double boxed studs at each side of openings to extend in 1 piece from floor to underside of structure above.
- .7 Co ordinate erection of studs and installation of service lines.
- .8 Provide continuous gasket to separate metal framing from masonry and concrete.
- .9 Do not secure studs to exterior window framing, or to ceiling grid members.
- .10 Provide continuous gasket between ceiling and floor tracks, and structure.
- .11 Metal Stud Reinforcements: Provide hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 1.214 mm (designation thickness 43 mils / minimum base steel thickness 1.087 mm (0.0428 in.) / colour-yellow / 18 ga) where required to support manufactured components. Weld connections. Ensure rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Galvanize stud reinforcements in moist areas. Do not use wood blocking for this purpose. Provide additional reinforcing framing studs or furring channels secured between studs for attachment and support without limitations following:
 - .1 washroom accessories.
 - .2 fire hose cabinets.
 - .3 access panels.
 - .4 architectural woodwork.
 - .5 miscellaneous specialties.
 - .6 fitments and fixtures.
 - .7 equipment.
- .17 Provide security mesh at penetration resistance partitions where indicated. Weld mesh to (designation thickness 43 mils / minimum base steel thickness 1.087 mm colour-yellow / 18 ga) steel studs and tracks with 3mm x 13mm weld at 200 mm (8") o.c. Edge welds shall be within 50mm.
- .18 Provide continuous horizontal furring channels as backing to wall cabinets.
- .19 Access Doors and Panels: Install access doors and panels supplied as part of work of Divisions 21, 22, 23 and 26 and where required as part of work of this Section in walls, bulkheads, ceilings and soffits.
- .20 Metal Furring:
 - .1 Erect furring in accordance with manufacturer's directions and as specified herein.
 - .2 Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated. Allow for thermal movement.
 - .3 Furr around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.
 - .4 Provide metal furring channels fastened to masonry or concrete surfaces in parallel rows at 400 mm oc unless gypsum board is indicated to be adhered directly to masonry or concrete surfaces. Shim metal furring channels to provide a level surface.
- .21 Shaft Wall:
 - .1 Construct shaft wall assemblies to provide fire resistance ratings indicated, from both sides, and to maintain airtight seal.

GYPSUM BOARD ASSEMBLIES

- .2 Install shaft wall studs at centres to meet design requirements in accordance with manufacturer's instructions or fire rated test design. Provide framing to enclose sides, tops and bottoms of shafts terminating at floor or in ceiling space, to maintain fire rating of shaft assembly.
- .3 Install shaft wall liner in accordance with manufacturer's instructions at areas where specially designed studs require shaft wall liner panel application as required.
- .4 Apply continuous sealant around partitions to ensure airtight shaft enclosures. Firestopping and smoke seals at penetrations specified under Section 07 84 00.
- .5 Where shaft wall height exceeds maximum available panel height, liner panel joints shall be positioned within upper and lower third points of wall and shall be staggered to prevent continuous horizontal joint.
- .6 Frame around duct openings through shaft walls with 'J' runners.
- .22 Gypsum Board Application:
 - .1 Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Ensure moisture resistant gypsum board is installed on any wall/partition containing a plumbing fixture (i.e. water closets, sinks, tubs, etc.).
 - .2 Provide metal trim casing bead at junctions with dissimilar materials. Provide reveals at junctions with dissimilar materials where indicated.
 - .3 Provide curved uniform surfaces by wetting or dampening board or scoring back gypsum board and form to profiles indicated. Provide additional screws and framing members to maintain design curve. Apply joint compound and trowel smooth to provide continuous, smooth radius free from flat spots, facets and trowel marks. Allow gypsum boards to dry thoroughly before handling.
 - .4 Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.
 - .5 Cut and fit gypsum board to accommodate or fit around other parts of Work. Provide work of this Section accurately and neatly.
 - .6 Butt gypsum board sheets together in moderate contact. Do not force into place. Place tapered or wrapped edges next to 1 another.
 - .7 Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints. If butt joints do occur stagger and locate them as far from centre of walls and ceilings as possible. Accurately fit exposed butt joints together and make edges smooth.
 - .8 Support ends and edges on framing.
 - .9 Fasten gypsum board to metal furring and metal studs with screws. Space screws at 200 mm (8") oc at board edges and 300 mm oc on board field. Ensure perimeter screws are not less than 9 mm nor more than 13 mm from edges and ends are opposite screws on adjacent boards.
 - .10 Gypsum Board - Single Layer:
 - .1 Ceilings: Apply gypsum board to metal furring with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Space screws at 200mm oc.
 - .2 Partitions: Apply gypsum board to metal studs with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Locate vertical joints at least 300mm from jamb lines of openings. Space screws at 200mm oc at board edges and 300mm oc on board field.

GYPSUM BOARD ASSEMBLIES

- .3 Ceiling and Partition Fasteners: Ensure perimeter screws are not less than 9mm nor more than 13mm from edges and ends are opposite screws on adjacent boards. Drive screws with power screw gun and set with countersunk head slightly below surface of board.
- .4 Joints: Finish all joints unless specified otherwise.
- .11 Gypsum Board - Double Layer:
 - .1 Lay out work to minimize end joints on face layer; to offset parallel joints between face and base layers by at least 250 mm and to apply face layer at right angles to base layer.
 - .2 Base Layer: Base layer shall be same as face layer, or backing board, and applied at right angles to framing members. Secure base layer with screws spaced 300 mm oc to each member. Ensure perimeter screws are not more than 13 mm from edges and ends are opposite screws on adjacent boards. Ensure surface of erected base layer is straight, plumb or level and without protrusions before face layer is applied.
 - .3 Face Layer: Apply face layer at right angles to base layer with adhesive. Apply adhesive with notched spreader to leave 9 mm x 13 mm ribbons, 38 mm apart over entire back side of face layer. Erect board immediately after spreading adhesive. Supplement adhesive with screw fasteners. Provide temporary support for board until adhesive bond has fully developed. As alternative to adhesive specified, joint cement mixed with water in accordance with manufacturer's directions may be used. Allow joint cement and water mixture to stand 30 minutes before using.
 - .4 Joints: Finish joints in face layers only, unless otherwise required to achieve fire resistant ratings indicated, as hereinafter specified. Setting compound for fire rated construction shall conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings.
- .23 Gypsum Board Laminated to Concrete and/or Concrete Block Masonry:
 - .1 Base shall be straight, dry uncoated, clean and free from efflorescence.
 - .2 Mix laminating adhesive in accordance with manufacturer's directions. Allow to stand 30 minutes before using.
 - .3 Apply adhesive with notched trowel to leave 9 mm x 13 mm ribbons, 32 mm apart over entire back side of face layer.
 - .4 Erect gypsum board immediately after spreading adhesive. Use moderate pressure to develop full adhesive contact with substrate.
 - .5 Temporarily secure gypsum board in place with concrete nails or bracing. Ensure joints are accurately aligned. Avoid impact or movement of boards until adhesive sets firmly. Remove temporary support when adhesive has set.
 - .6 Do not treat joints of laminated gypsum board for at least 24 hrs after lamination.
- .24 Cement Board Application:
 - .1 Provide cement board in accordance with manufacturer's written installation instructions.
 - .2 Provide finished work plumb, level and true, free from perceptible waves or ridges, square with adjoining parts of Work.

GYPSUM BOARD ASSEMBLIES

- .3 Cut and fit as required to accommodate or fit around work of other Sections. Provide work of this Section accurately and neatly. Butt sheets together to moderate contact. Do not force cement boards into place.
 - .4 Where possible apply boards perpendicular to framing and in lengths that will span ceilings and walls. Accurately fit exposed butt joints together and make edges smooth.
 - .5 Support ends and edges on framing.
 - .6 Secure cement board to metal furring and metal studs with special screws recommended by cement board manufacturers.
 - .7 Provide rendering coating to cement board exposed in finished Work and feather coating if applicable to be inconspicuous.
- .25 Interior Ceilings:
- .1 Comply with recommendations of CGC Drywall Steel Framed Systems Folder 09250 SA 923
 - .2 Provide hanger wires spaced at maximum 1200 mm oc along carrying channels and within 150 mm of ends of carrying channel runs. Secure hanger wires to inserts in structure above.
 - .3 Provide carrying channels maximum 1200 mm oc and within 150 mm of walls. Secure with hanger wire saddle tied along channels. Provide 25 mm clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm over 3600 mm.
 - .4 Provide metal furring channels at right angles to carrying channels at maximum 600 mm oc and within 150 mm of walls. Provide 25 mm clearance between furring ends and abutting walls. Attach furring channels to carrying channels with saddle tie of double strand tie wire.
 - .5 Provide additional cross reinforcing at bulkheads and at other openings.
 - .6 Provide ceiling gypsum board, smooth and level.
- .26 Gypsum Board Sheathing and Sheathing Board:
- .1 Apply board to studs and strapping with screws. Erect board with long dimension at right angles to supports. Locate end joints over supporting members. Locate vertical joints at least 300 mm from jamb lines of openings. Space screws as per structural design requirements on board field.
 - .2 Install gypsum board at windows, doors and other openings as detailed to form a continuous fire stop assembly ready for application of transition membrane.
- .27 Exterior Soffits:
- .1 Comply with recommendations of CGC Drywall Steel Framed Systems Folder 09250 SA 923
 - .2 Provide hanger wires spaced at maximum 1200 mm oc along carrying channels and within 150 mm of ends of carrying channel runs. Secure hanger wires to inserts in structure above.
 - .3 Provide carrying channels maximum 1200 mm oc and within 150 mm of walls. Secure with hanger wire saddle tied along channels. Provide 25 mm clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm over 3600 mm.
 - .4 Provide metal furring channels at right angles to carrying channels at maximum 400 mm oc and within 150 mm of walls. Provide 25 mm clearance between furring ends and abutting walls. Attach furring channels to carrying channels with saddle tie of double strand tie wire.
 - .5 Provide additional cross reinforcing at light troffers and at other openings.

GYPSUM BOARD ASSEMBLIES

- .6 Provide gypsum soffit board, smooth and level using joint treatment as recommended by gypsum board manufacturer. Provide a skim coat over entire soffit surface to smoothen soffit and equalize surface porosity.
- .28 Metal Trim and Accessories:
 - .1 Provide metal trim casing beads at reveals; at ceiling wall intersections and partition perimeters; and at intersection of dissimilar constructions such as gypsum board to concrete.
 - .2 Provide metal trim casing beads where gypsum board abutts against a surface having no trim concealing junction.
 - .3 Provide a 13 mm separation gasket between metal trim casing beads and window frames or other cold surfaces or provide sponge tape between gypsum board partition or furring framing, where such framing abuts exterior door or window frame. sponge tape between floor and gypsum board partition track. Tape shall be either full width or 1 strip 9 mm (3/8") wide on each side of framing member.
 - .4 Provide casing bead and sponge tape where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on Drawings. Unless indicated otherwise, use tape 3 mm narrower than casing bead to provide recess at exposed side. Compress tape by 25%.
 - .5 Provide metal trim casing beads where indicated on Drawings.
 - .6 Provide prefinished metal angle trim supports and provide light pockets and eggcrate grilles and/or louvres in accordance with manufacturer's instructions. Install light pockets and eggcrate grilles and/or louvre units square, straight and in 1 piece where possible or with inconspicuous joints at long runs.
- .29 Control Joints:
 - .1 Provide pre fabricated, pre-manufactured control joints and/or prepared to suit site conditions control joints and in accordance with manufacturers instructions and in accordance with ASTM C840.
 - .2 Set in gypsum facing board, supporting control joints with studs or furring channels on both sides of joint. Ensure double studs with discontinuous tracks and double suspended ceiling furring channels have been installed prior to commencing board and bead application at control joints. Provide control joints at following locations:
 - .1 support construction changes.
 - .2 partition, ceiling or furring runs exceed 900 mm).
 - .3 Provide control joints full height floor to ceiling or door header to ceiling in partitions and furring runs.
 - .4 Provide control joints from wall to wall in ceiling areas.
 - .5 Provide continuous polyethylene dust barrier behind and across control joints.
 - .6 Obtain Consultant's acceptance of exact locations of control joints.
- .30 Sound Control:
 - .1 Where indicated on Drawings, provide sound rated partitions and ceiling in locations indicated to meet required minimum Sound Transmission Class STC rating. Gypsum board shall be applied on both sides of sound proofed partitions. Follow manufacturer's details and recommendations.
 - .2 Provide sound attenuation insulation to completely fill height of stud cavities. Tightly butt ends and sides of blankets within cavities. Cut

GYPSUM BOARD ASSEMBLIES

- blankets to fit small spaces. Carefully fit blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.
- .3 Staple blankets to back of gypsum board as recommended by gypsum board manufacturer.
 - .4 At sound attenuating suspended ceiling and enclosures having spring isolator hangers, terminate ceiling or enclosure at adjacent construction by providing continuous isolator strip and sealed joint.
 - .5 Sealant:
 - .1 Conform to ASTM C919 for use of sealants in sound attenuation partitions.
 - .2 Apply acoustical sealant around partition cutouts including, but not limited to, electrical outlets and boxes, plumbing and duct outlets, and other miscellaneous wall and floor penetrations or gaps.
 - .3 Apply minimum 13 mm diameter bead of acoustic sealant continuously around periphery of each face of partition to seal gypsum board/structure junction where partitions abut fixed building components in accordance with recommendations of 'CGC Drywall/Steel Framed Systems, Folder SA923 09250'.
 - .31 Joint Treatment Gypsum Board:
 - .1 Verify board is firm against framing members and screw heads are properly depressed.
 - .2 Mix joint compound or ready to use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing. Permit mixed material to stand 30 minutes before using. Do not mix more material than can be used within 1 hour. Do not use set or hardened compound. Clean tools and equipment after mixing each batch.
 - .3 Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions. Fill either manually, using hand tools of trade, or by a mechanical taping and filling machine of proven efficiency.
 - .4 Remove plastic tape from control joints after finishing with joint compound.
 - .5 After final coats of filler have dried at least 24 hours, sand surface lightly with No. 00 sandpaper to leave it smooth, ready for decoration.
 - .6 Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.
 - .7 Levels of Finish: Provide following levels of finish in accordance with ASTM C840:
 - .1 Level 0: No taping, finishing or accessories required for temporary construction or areas where final decoration is not required.
 - .2 Level 1: Use this level in plenum areas above ceilings, attics, areas where assembly would generally be concealed or in building service corridors and other areas.
 - .3 Level 2: Use this level where water resistant gypsum backing board (ASTM C630M) is used as substrate for tile; may be used in garages, warehouse storage, or other similar areas where surface appearance is not of primary concern.
 - .4 Level 3: Use this level in appearance areas which are to receive heavy or medium texture spray or hand applied finishes before

GYPSUM BOARD ASSEMBLIES

final painting or where heavy grade wall coverings are to be applied as final decoration.

- .5 Level 4: Use this level where flat paints, light textures or wall coverings are to be applied.
- .6 Level 5: Use this level to provide a uniform surface and minimize possibility of joint photographing and of fasteners showing through final decoration.
- .7 Exposed Moisture Resistant Gypsum Board Finish: All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Cover fasteners heads and accessories with 3 separate coats of joint compound. Ensure surface is smooth and free of tool marks and ridges.

3.3 FIRE RATED PARTITIONS

- .1 Ensure materials for fire rated construction conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings. Where dissimilar components are built into fire rated assemblies ensure continuity of fire separation by boxing in elements with gypsum board and framing to suit authorities having jurisdiction. Work in cooperation with Section providing firestopping work.
- .2 Provide fire rated enclosures, separations and assemblies as indicated on Drawings conforming to requirements of authorities having jurisdiction.
- .3 Where required, secure sound attenuation blanket insulation between studs as specified in Article on Sound Control Partitions.

3.4 CUTTING AND PATCHING

- .1 Cooperate and coordinate with other Sections to obtain satisfactory gypsum board finish work. Do all cutting, patching and Make Good as required by installation of work of other Sections.

3.5 CLEANING

- .1 Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed.

END OF SECTION

TILE

- 1. PART GENERAL

- 1.1. GENERAL REQUIREMENTS
 - 1.1.1. Conform to Division 01 - General Requirements.

- 1.2. DESCRIPTION
 - 1.2.1. Work Included
 - a. Provide tile for the Work.
 - 1.2.2. Related Work Specified Elsewhere
 - a. Gypsum Board backing: Section 09 21 16

- 1.3. QUALITY ASSURANCE
 - 1.3.1. Qualifications of Applicator: Be a member company in good standing of the Terrazzo, Tile and Marble Association of Canada for five (5) years in projects of comparable size.

- 1.4. JOB CONDITIONS
 - 1.4.1. Environmental Conditions: Execute Work of this Section while temperature is maintained between 10°C and 22°C for period of 72 h before commencement, during and following installation. Avoid concentrated or irregular heating during curing period.
 - 1.4.2. Protection: Protect Work of this Section against damage by other trades for min. 72 h after application of grouting by prohibiting passage of traffic over tile. Cover completed floors with non-staining construction paper until other construction in tiled areas is complete. Do not immerse in water and protect tile Work from freezing for at least 28 days after installation.

- 1.5. SUBMITTALS
 - 1.5.1. Samples:
 - a. Submit for review in accordance with Section 01 30 00, 300mm square or a minimum of 4 tiles per sample of each colour and type of tile, mounted on suitable backing material with specified adhesive and grout. Include samples of base, trim and accessories, separately. Identify type of tile and location specified on each sample. Confirm with Architect if physical samples are required to be delivered to their office.
 - b. Samples shall be representative of permissible colour range.
 - c. Install mock-up panel of each application, for review and approval by Architect. May be included in Work if approved by Architect.

TILE

1.5.2. Extra Stock: At completion of Work, furnish to Site as directed, 3% extra stock of ceramic tile and trim in colours, patterns and sizes furnished to the project. Wrap in original protective containers, permanently labeled as to exact contents.

1.6. WARRANTY

1.6.1. Provide ten (10) year labour and material warranty on mortars, waterproofing, bond coat, adhesive, grout and sealers.

2. PART PRODUCTS

2.1. MATERIALS

2.1.1. Tile:

- a. Tile to conform to latest edition of CAN/CGSB-75.1-M88 and have passed ASTM C627, cycles 1 through 10 testing.
- b. Provide all special shapes and finished tiles such as caps, inside and outside corners, solid trim pieces, bullnose, safety treads and catalogued accessories as required for complete Work in conformance to applicable Codes and to the satisfaction of the Architect; provide metallic transition/adapters to other floor materials.
- c. Acceptable Products:
T1 - Uptown Series, Washington Colour, Matte Finish by Olympia tile, 600 mm x 600 mm, Glocal Series by Mirage/Centura, 600 mm x 600 mm or approved equal..
T2 - Air Series, Grafite Colour, Matte Finish by Olympia tile, 300 mm x 604 mm, Glocal Series by Mirage/Centura, 600 mm x 600 mm or approved equal.
or equal by Centura, Division 9, Cera Gres, or Stone-Tile.
- e. Where tile does not come with finished edge tiles, provide prefabricated metallic edge strip at all exposed edges.
- f. Wall: Glazed porcelain, Class MR 1 Can/CGSB-75.1-M88.
- g. Floor: unglazed porcelain, Class MR 1 Can/CGSB-75.1-M88

2.1.2. Setting Materials:

- a. Cement: Portland cement conforming to CAN3-A5-M, white and grey.
- b. Sand: CAN3-A23.1-M for setting bed; to CSA A82-57-M, for grout. White silica sand for white and light coloured grout.
- c. Water: Potable, non-staining, from domestic water supply.
- d. Hydrated Lime: ASTM C206-79 or C207, Type S.
- e. Latex Modified Thin-Set Mortar: "No.52 Versatile Thin-Set Mortar" by Flextile, Mapei Canada, or Laficrete International Ltd.
- f. Primer/Sealer: Type recommended by tile and mortar manufacturer.

2.1.3. Grouting Materials:

- a. Epoxy grout, low VOC, water cleanable, chemical resistant, factory blended.
 1. Acceptable product: As recommended by Tile manufacturer. Colour selected by Architect.

TILE

2.1.4. Sealer for Tile and Grout: As recommended by tile manufacturer.

2.1.5. Joint Sealant: Type 4 in accordance with requirements of Section 07 90 00.

3. PART EXECUTION

3.1. EXAMINATION

3.1.1. Ensure that substrate is clean, sound, well cured (min. 28 days for concrete), and has required slope to drains. At existing tile areas to be re-tiled, sound all areas and remove all loose tile. Provide leveling coat where required to bring surfaces to true even plane within 1:800 for walls and 1:1000 for floors. Allow leveling coat to completely cure prior to installation of tile finish.

3.1.2. Flood test, in the presence of Architect, substrate prior to installing tile to ensure proper slope to drains.

3.1.3. Ensure compatibility of primers, adhesives and fillers supplied under this Section, and which bear contact with substrate.

3.2. PREPARATION

3.2.1. Wall Surfaces:

- a. Completely remove oil, grease, loose mortar, dust and all contaminants from areas scheduled to receive ceramic tile.
- b. Prime very porous concrete block with primer, brush or roller applied at full strength.

3.3. INSTALLATION

3.3.1. General:

- a. Determine locations of all control joints and accessories before starting tile Work.
- b. Prepare materials and set tile in accordance with Terrazzo, Tile and Marble Association of Canada's Manual No. 200-1979 and as specified herein.
- c. Set all tile in stacked bond pattern.
- d. Except where tiles have setting tabs, and except for expansion, control and isolation joints, maintain 3mm joints for ceramic tile
- e. Set tile flat and level with uniform joints throughout, properly aligned. Align all floor and wall joints. Provide uniform slopes to floor drains.
- f. Lay out tile Work so tiles less than 1/2 width do not occur and with minimum amount of cutting. Locate cuts to be least conspicuous.
- g. Mix tiles from several boxes prior to installation to assure that colour variations from tile to tile are evenly distributed throughout the field.
- h. Back up tile curbs and other shaped pieces solid with mortar. Rigidly set, reinforce or otherwise make firm and secure such pieces.
- i. Keep face of tile and joints clean of setting compound.
- j. Do necessary cutting and drilling of fixtures, fittings, and built-in or penetrating units without marring the tile. Replace all cracked or damaged tile.

TILE

- k. Installation, grouting and curing shall only occur when ambient temperature is above 7°C but not exceeding 29°C. Observe recommended working temperatures of additives and bonding agents.
 - l. Extend tiles behind mirrors, cabinets, cupboards and other fixed objects at walls, except as otherwise detailed.
 - m. Form external angles with round edge tile extending over edge of square edge adjacent tile. Internal angles shall be formed square, carrying 1 flat tile past edge of other.
 - n. Provide strings, caps, coves, corners, angles and other moulded pieces to suit requirements.
 - o. Cut tiles to conform with irregularities in wall lines and vertical planes along outer edges. Smooth cut edges with carborundum block or by other means to provide clean straight edge.
 - p. Re-point joints after cleaning to eliminate imperfections.
 - q. Clean tile Work progressively. Do not allow tinted grout to stain absorbent tile. Do not use acids for cleaning. Seal grout in accordance with manufacturer's recommendations using TTMAC certified Products only.
 - r. Ensure no traffic is allowed on freshly laid tile for at least 72 h and until full set is achieved. Verify set prior to grouting.
- 3.3.2. Thin-Set Mortar
- a. Perform surface preparation, mixing and application in accordance with manufacturer's instructions. Apply mortar over flat surfaces using notched tooth trowel to produce a bed of approximately 3 to 6 mm in thickness.
 - b. Do not dampen tile set in adhesive.
 - c. Tap tile firmly into position sufficiently to obtain minimum 80% positive contact. Adjust tile before initial set takes place.
- 3.3.3. Grouting
- a. Apply grout in strict accordance with manufacturer's printed instructions.
 - b. Force grout into joints for full depth, level with surface of tile. Scrape surplus grout from surface of tile thoroughly and quickly. After grout has attained slight initial set, completely clean up and polish surfaces of tile.

END OF SECTION

ACOUSTIC CEILINGS TILES

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Suspended metal grid ceiling system and perimeter trim.
.2 Acoustic tile and clouds.
.3 Hanging acoustic panels.
- 1.3 RELATED SECTIONS
- .1 Section 21 13 00 - Sprinklers: Sprinkler heads in ceiling system.
.2 Section 26 50 00 - Light fixtures in ceiling system.
.3 Section 27 10 00 - Public Address and Music Devices: Speakers in ceiling system.
.4 Section 28 31 00 - Fire Alarm: Fire alarm components in ceiling system.
- 1.4 REFERENCES
- .1 ASTM C635/C635M-07 - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
.2 ASTM C636/C636M-08 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
.3 ASTM C665-06 - Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
.4 ASTM E580/E580M-08 - Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.
.5 ASTM E1264-08 - Classification of Acoustical Ceiling Products.
.6 CAN/CGSB-92.1-M89 - Sound Absorptive Prefabricated Acoustical Units.
.7 CAN/ULC-S702-97 - Thermal Insulation Mineral Fibre for Buildings.
.8 CISCA (Ceilings and Interior Systems Contractors Association) – Ceiling Systems Handbook.
.9 UL - Fire Resistance Directory.
.10 ULC - Fire Resistance Directory.
- 1.5 SYSTEM DESCRIPTION
- .1 Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1:240.
.2 Suspension system for ceilings shall be capable of supporting a ceiling and all superimposed loads applied by mechanical and electrical equipment attached to or bearing on ceiling.
- 1.6 SUBMITTALS
- .1 Product Data: Provide data on metal grid system components, acoustic units.
.2 Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system and.

ACOUSTIC CEILINGS TILES

- .3 Samples: Submit two (2) 150mm x 150mm illustrating material and finish of acoustic units. Confirm with Architect if physical sample is required to be delivered to their office.
 - .4 Samples: Submit two (2) samples each, 150 mm long, of suspension system. Confirm with Architect if physical sample is required to be delivered to their office.
 - .5 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- .1 Supply a minimum of one full carton of each type of acoustic tile, packed in original cardboard cartons, marked with manufacturer and product name, for future repairs and place where direct by the Architect.
- 1.8 REGULATORY REQUIREMENTS
- .1 Conform to applicable code for fire rated assembly and combustibility requirements for materials.
- 1.9 ENVIRONMENTAL REQUIREMENTS
- .1 Maintain uniform temperature of minimum 16 degrees C and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.
- PART 2 PRODUCTS
- 2.1 MATERIALS - SUSPENSION SYSTEM
- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and specifications:
 - .1 Armstrong World Industries Canada Ltd.; www.armstrong.com
 - .2 Bailey Metal Products Ltd.; www.bmp-group.com
 - .3 CGC Inc.; www.cgcinc.com
 - .4 BPB Canada Inc.; www.bpb-na.com
 - .5 Architectural Components Group Inc.; www.ACGI.com
 - .2 Hangers: Min. 2.68mm steel wire, mild steel rod or mild steel strip.
 - .3 Purlins: CSA-S136-M, Cold Formed Steel Structural Members, or ASTM A283-81, Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
 - .4 Fasteners: Design to transmit required loads into concrete structure.
 - .5 Galvanizing: All sheet materials to be galvanized to Z275. All irregular products to be galvanized in accordance with CSA G164-M.
 - .6 Finish: All metal products shall be steel galvanized to Z275. All exposed surfaces shall first receive a prepaint treatment, CGSB 31-GP-116M, and then a baked-on factory finish with satin sheen enamel in white to match acoustic tile. Colour: White.
 - .7 Main Tees: Nominal 3600mm, rectangular bulb at top of web, 38mm high web, 19mm face width designed to lock into consecutive lengths to function structurally as a single unit with face at joint perfectly aligned and presenting a

ACOUSTIC CEILINGS TILES

- fight inconspicuous seam. Expansion cut-outs in main tees controlling buckling caused by heat expansion.
 - .8 Cross Tees: 610mm long, same design as main tee, except designed to connect at main tee to form positive lock without play, loss or gain in grid dimensions with offset over-ride of face over main tee face flange to provide flush tee faces at joints. Provide 38 mm web height of cross-tee for fire rated assemblies.
 - .9 Edge Moulding: Min. of 0.46mm thick steel, 14mm wide legs, capable of supporting all superimposed loads.
 - .10 Hold-Down Clips: Of 0.42mm thick spring steel as recommended by acoustic tile manufacturer, and special access clips where specified.
 - .11 Fixture Clips: As recommended by acoustic tile manufacturer.
- 2.2 MATERIALS - ACOUSTIC TILE UNITS
- .1 Acoustic Tile: 610 mm x 1220mm x15mm Cortega 769 series as manufactured by Armstrong World Industries Canada Ltd. with a square edge and colour White.
 - .2 Preformed Clouds: Basis of design: Formation by Armstrong World Industries Canada Ltd.
 - .1 Acoustic Tile: Ultima series, lay-in
 - .2 Trim: AXIOM Vector (inverted) for Formations, 150mm
 - .3 Size: 1,200mm dia. circle and 1,830mm dia. circle
- 2.3 ACCESSORIES
- .1 Acoustic Sealant for Perimeter Moldings: Specified in Section 07 92 00.
- PART 3 EXECUTION
- 3.1 EXAMINATION
- .1 Verify that layout of hangers will not interfere with other work.
- 3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM
- .1 Install suspension system to manufacturer instructions and as supplemented in this section.
 - .2 Install system capable of supporting imposed loads to a deflection of 1/240 maximum.
 - .3 Lay out system to a balanced grid design with edge units no less than 50 percent of acoustic unit size.
 - .4 Locate system on room axis according to reflected plan.
 - .5 Run main tees at right angles to length of light fixtures.
 - .6 Space main tees 2 feet (600mm) o.c. in one direction and securely tie to hangers.
 - .7 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
 - .8 Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
 - .9 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

ACOUSTIC CEILINGS TILES

- .10 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
 - .11 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.
 - .12 Do not eccentrically load system, or produce rotation of runners.
 - .13 Perimeter Molding:
 - .1 Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant with continuous gasket.
 - .2 Use longest practical lengths.
 - .3 Mitre corners.
 - .4 Provide at junctions with other interruptions.
- 3.3 INSTALLATION - ACOUSTIC UNITS
- .1 Install acoustic units to manufacturer's instructions.
 - .2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
 - .3 Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.
 - .4 Install units after above ceiling work is complete.
 - .5 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
 - .6 Cutting Acoustic Units:
 - .1 Cut to fit irregular grid and perimeter edge trim.
 - .2 Cut edges to field cut units.
 - .7 Where bullnose concrete block corners, round obstructions occur, provide preformed closures to match perimeter molding.
- 3.4 INSTALLATION - HANGING ACOUSTIC PANEL SYSTEM
- .1 Install acoustic units to manufacturer's instructions.
 - .2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- 3.5 FIRE-RESISTANCE RATED CEILINGS
- .1 Provide fire-resistance rated ceilings where required, including proper construction of framing and furring and proper thickness of acoustic units, to produce hourly fire-resistance ratings called for. Requirements for materials, methods of erection and application specified under appropriate headings of this Section apply, except where more stringent requirements are defined for particular fire-resistance rating by Underwriters' Laboratories of Canada.
- 3.6 ERECTION TOLERANCES
- .1 Maximum Variation from Flat and Level Surface: 3mm in 3 m.

ACOUSTIC CEILINGS TILES

3.7 ADJUSTING AND CLEANING

- .1 After interior finishing work has been substantially completed, or when directed by Consultant, inspect acoustical treatment work. Replace broken, chipped or damaged work, reset loose units or units out of place and touch up marred surfaces with matching paint. Upon completion of Project, acoustical treatment finished surfaces shall be clean and free from dirt and other markings and in good condition acceptable to Consultant.

END OF SECTION

ACOUSTIC CEILINGS TILES

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ACOUSTIC WOOD CEILING

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

Provide suspended ceiling system, hangers, tees and acoustical ceiling panels for a complete acoustic ceiling for the Work.

1.2.2. Related Work Specified Elsewhere:

- a. Hangers by: Section 09 51 13
- b. Gypsum board ceilings by: Section 09 21 16
- c. Mechanical: Division 24
- d. Electrical: Division 26

1.3. QUALITY ASSURANCE

Acoustic Ceiling System to be ASTM 635 Light Duty Standard, installed in accordance with ASTM 636.

1.4. SUBMITTALS

- 1.4.1. Product Data: Provide data on metal grid system components, acoustic units.
- 1.4.2. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
- 1.4.3. Samples: Submit duplicate full size samples of each type acoustical units. Confirm with Architect if physical sample is required to be delivered to their office.
- 1.4.4. Reference Data: Provide finish materials catalogue cuts and maintenance instructions for insertion in Operating Manuals and Reference Data, Section 01 33 00.

1.5 MOCK-UP

- 1.5.1. Construct mock-ups in accordance with Section 01 45 01 - Quality Control.
- 1.5.2. Construct mock-up where directed.

ACOUSTIC WOOD CEILING

- 1.5.3. Allow two (2) working days for inspection of mock-up by Architect and Owner's Representative before proceeding with ceiling work.
- 1.5.4. When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.
- 1.6. Environmental Requirements
 - 1.6.1. Permit wet work to dry before commencement of installation.
 - 1.6.2. Maintain uniform minimum temperature of 15°C and humidity of 20 - 40% before and during installation.
 - 1.6.3. Store materials in work area 48 hours prior to installation.
- 1.7. Extra Materials
 - 1.7.1. Provide extra materials of acoustic units in accordance with Section 01 77 01 - Closeout Submittals.
 - 1.7.2. Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
 - 1.7.3. Extra materials to be from same production run as installed materials.
 - 1.7.4. Clearly identify each type of acoustic unit, including colour and texture.
 - 1.7.5. Deliver to Owner's Representative, upon completion of the work of this section.
 - 1.7.6. Store where directed by Owner's Representative.
- 1.8. Closeout Submittals
 - 1.8.1. Provide maintenance data for acoustical ceilings for incorporation into manual specified in Section 01 77 01 – Closeout Submittals.
- 2. PART PRODUCTS
 - 2.1. MATERIALS
 - 2.1.1. Acceptable Products: Flame Spread Rating must be less than 25.
 - a. Decoustics Continuous Linear Wood, 152mm module width, 133mm plank width, 16 mm thick on fire retardant wood product base. Equal by Armstrong or Eomac. Veneer to be book-matched, FSC certified. Lay-in with T bar grid.
 - b. Felt fiber infill strip. Colour: Black.

ACOUSTIC WOOD CEILING

- 2.1.2. Finish: All metal products shall be steel galvanized to Z275. All exposed surfaces shall first receive a prepaint treatment, CGSB 31-GP-116M, and then a baked-on factory finish with satin sheen enamel in white to match acoustic tile.
- 2.1.3. Main Tees: Nominal 3600mm long, rectangular bulb at top of web, 38mm high web, 19mm face width designed to lock into consecutive lengths to function structurally as a single unit with face at joint perfectly aligned and presenting a tight inconspicuous seam. Colour: Black.
- 2.1.4. Cross Tees: 610mm long, same design as main tee, except designed to connect at main tee to form positive lock without play, loss or gain in grid dimensions with offset over-ride of face over main tee face flange to provide flush tee faces at joints. Colour: Black.
- 2.1.5. Edge Moulding: Min. of 0.46mm thick steel, 14mm wide legs, capable of supporting all superimposed loads.
- 2.1.6. Hold-Down Clips: Of 0.42mm thick spring steel as recommended by acoustic tile manufacturer, and special access clips where specified. Colour: Black.
- 2.1.7. Fixture Clips: By manufacturer.
- 2.1.8. Tie Wire: Min. 1.59mm soft annealed steel wire.

3. PART EXECUTION

3.1. PREPARATION

- 3.1.1. Co-ordinate with Section 09 51 13 to ensure adequate and properly placed hangers.
- 3.1.2. Co-operate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in acoustic ceilings.

3.2. INSTALLATION

- 3.2.1. Neatly and symmetrically fit and run suspended ceiling to true lines, evenly balance in all areas to pattern as directed.
- 3.2.2. Unless noted on drawings, center ceiling system on room axis leaving equal border tiles or panels not less than 1/2 a full width.
- 3.2.3. Cut recess into tiles at partition walls that are to be set up into tiles. Seal cut portion of tile with paint to match tile finish.
- 3.2.4. Recessed items shall re be centered on acoustical panels, except where indicated otherwise. Consult with mechanical and electrical trades to co-ordinate the work. Provide support where required.

ACOUSTIC WOOD CEILING

- 3.2.5. Turn bottom of hanger rods or straps upwards at tees and securely wrap 3 times with tie wire, or wrap hanger wire around tees and double twist tie.
- 3.2.6. Run main tees at right angles to length of light fixtures.
- 3.2.7. Space main tees 600mm o.c. in one direction and securely tie to hangers.
- 3.2.8. Space cross tees 1220mm o.c. at right angles to the main tees and properly lock at intersections.
- 3.2.9. Level the suspended systems with a maximum tolerance of 1/8" (3mm) over 3600mm and 6mm over all.
- 3.2.10. Use the longest practical lengths of tees, furring and running channels to minimize joints. Make joints square, tight, flush and reinforced with concealed splines. Assemble framework to form a rigid and interlocking system.
- 3.2.11. Use edge moulding where ceiling abuts vertical surface.
- 3.2.12. Join abutting sections of main tees to unify sections structurally and present an unnoticeable joint.
- 3.2.13. Intersections of all tees and edge moulding shall be flush on the exposed surface.
- 3.2.14. Provide fixture clips at all four corners of electrical fixtures.

END OF SECTION

RESILIENT FLOORING

1. PART GENERAL

1.1. GENERAL REQUIREMENTS

1.1.1. Conform to Division 01, General Requirements.

1.2. DESCRIPTION

1.2.1. Work Included:

Provide resilient base and sub-floor prep.

1.2.2. Related Work Specified Elsewhere:

a. Concrete floors: Section 03 30 00

1.3. SUBMITTALS

1.3.1. Samples:

Submit samples in accordance with Section 01 30 00.

1.3.2. Maintenance Materials:

Supply 2% (accent) to 5% (field) extra tiles of each colour in unopened packages for future repairs. Place where directed.

1.3.3. Reference Data:

Submit complete list of Products, colours and patterns used to Operating Manuals and Reference Data specified in Section 01 30 00 as specified therein.

2. PART PRODUCTS

2.1. MATERIALS

2.1.1. Colours and Patterns:

As selected by the Architect from the manufacturer's complete range.

2.1.2. Resilient Tile Flooring: - NOT USED THIS PROJECT

2.1.3. Resilient Base:

100% PVC, 102mm high x 30m roll lengths x 3mm thick with grooved back and standard toe, Johnsonite or Allstate or Roppe, colour to be determined (TBD), conforming to CAN/CSA-A126.5.

2.1.5. Primer: As recommended by adhesive manufacturer.

2.1.6. Adhesives: As recommended by manufacturers

RESILIENT FLOORING

2.1.7. Levelling underlayment: - NOT USED THIS PROJECT

Ardex 'Liquid BackerBoard Self-Levelling Underlayment' complete with Ardex 51' primer or approved equal by Reardon Co. or Mapei, non-shrink compound.

2.1.8. Thresholds and Edge Reducer Strips: - NOT USED THIS PROJECT

One piece, PVC by Johnsonite or Allstate or Roppe.

a. SLTC-XX-A at 1/4" to 1/8" materials. Slim Line Transition at curved floor transitions

b. CTA-XX-A at 1/4" to 1/8" materials. Transition Adaptor

c. CTA-XX-HT at 1/4" to 0.08"/2mm. Wheeled Traffic Transition

d. CTA-XX-J at 1/4" to floor. Wheeled Traffic Transition

e. CTA-XX-N at 1/8" to 1/8" materials. Wheeled Traffic Transition

3. PART EXECUTION

3.1. PREPARATION

3.1.1. At existing concrete floor: Remove irregularities from concrete substrate using mechanical scouring machine. Apply levelling underlayment in accordance with manufacturer's instructions. Levelling coat is to bring surfaces to true even plane. Sand leveling compound to eliminate all irregularities in substrate.

3.1.2. Allowable tolerance: 1mm in 1000mm.

3.2. INSTALLATION

3.2.1. General:

Apply adhesive uniformly with an approved notch tooth spreader at the recommended rate. Do not spread more adhesive than can be covered before initial set takes place. Use waterproof adhesive on concrete slabs on grade.

3.2.2. Tile: - NOT USED THIS PROJECT

a. Lay true, level and even with tight aligned joints.

b. Carefully scribe, cut and fit to walls, doorways, and around all permanent fixtures and openings. When resilient tile terminates against other flooring at doorways, terminate tile under door in its closed position.

c. Lay tile with grain running in one direction. Spread varying colours across field to present an even colouring to entire field.

d. Roll floor in accordance with manufacturer's recommendations to ensure adhesion and elimination of air pockets.

RESILIENT FLOORING

3.2.3. Base:

- a. Install resilient bases in accordance with manufacturer's recommendations.
- b. Use preformed external angle pieces and stops.
- c. Use full length pieces, accumulated short lengths not permitted.
- d. Butt joints and keep flush without gaps.

3.2.4. Thresholds and Edge Reducer Strip: - NOT USED THIS PROJECT

- a. At edge of dissimilar floor finishes, resilient and other flooring, other than carpet, Provide one piece thresholds and edge reducer strips.
- b. Secure in place with adhesive to manufacturer's recommendations.

3.3. ADJUST AND CLEAN

3.3.1. Clean:

Remove surplus adhesive from face of tiles and base as Work progresses. As soon as possible after adhesive has set thoroughly, clean tile and base surfaces in accordance with manufacturer's directions.

END OF SECTION

RESILIENT FLOORING

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CARPET TILE

1.5. PRODUCT DELIVERY, STORAGE AND HANDLING

1.5.1. Delivery: Deliver carpet to Site clearly tagged to show installation location suited for best colour matching.

1.5.2. Storage: Store in a heated area maintained at minimum temperature of 10°C, or at such temperature as recommended by the product manufacturer.

1.6. JOB CONDITIONS

1.6.1. Protection: Restrict traffic by other Sections during installation

1.7. WARRANTY

1.7.1. Product:

Warrant carpet for a total period of Fifteen Years against wear, edge ravel, zippering, backing resiliency, static control and delamination including full product replacement in areas of wear to include the whole room when defined by 3 interior walls or visible area of open office. Warranty not to be pro-rated and to include product re-installation.

1.7.2. Installation:

Warrant installation for a total period of Two years, including seaming and delamination.

2. PART PRODUCTS

2.1. MATERIAL

2.1.1. See Room Finish Schedule.

a. C1: Collection Uproar Series by Tandus Centiva; Colour: Architect to select from ; Applicable rooms: Offices and Collab. rooms, size 500mm x 500mm, or equal by Interface or Mohawk

b. C2: Collection Uproar Series by Tandus Centiva; Colour: TBD, Applicable rooms: Collab/Multi-purpose, size 500mm x 500mm, or equal by Interface or Mohawk.

2.1.2. Adhesive System: Low VOC, water based as recommended by carpet manufacturer.

2.1.4. Seam Cement: Low VOC, water based as recommended by carpet manufacturer.

2.1.5. Edge Adaptors: SLTC-XX-A carpet to ceramic tile or similar to meet site conditions. Colour by Architect from complete range. By Tarkett or equal.

CARPET TILE

- 2.1.6. Binder Bars: Aluminum, screw-down type as recommended by carpet manufacturer.

3. PART EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine Work of other Sections affecting Work of this Section, and report any defects or discrepancies to the Consultant.
- 3.1.2. Commencement of installation shall constitute acceptance of substrates as satisfactory.

3.2. PREPARATION

- 3.2.1. Floor shall be clean and free of cracks and protrusions.
- 3.2.2. Fill gaps or cracks more than 2mm wide and minor depressions with cementitious compound. Grind protrusions smooth.
- 3.2.3. Vacuum clean floors prior to installation.
- 3.2.4. Prime floors prior to installation with primer as recommended by manufacturer.

3.3. INSTALLATION

- 3.3.1. Install work of this Section after all Sections have completed their Work and just prior to completion of the Project.
- 3.3.2. Install materials in strict accordance with manufacturer's directions.
- 3.3.3. Lay carpet smooth and level, free from ridging, pulling, drifting or other imperfections detrimental to appearance or wearing qualities.
- 3.3.4. Roll carpet with 56.70 kg roller to ensure complete contact with the adhesive.
- 3.3.5. Lay pile in the same direction in any one area.
- 3.3.6. Cut carpet to exact fit, completely covering all designated areas.
- 3.3.7. Neatly cut carpet for floor outlets, trench ducts and similar items.
- 3.3.8. Lay carpet with seams parallel to walls unless indicated otherwise.
- 3.3.9. Position edges of carpet in door openings, under door, in its closed position
- 3.3.10. Protect exposed edges of carpet with edging binder bars.

CARPET TILE

3.4. ADJUST AND CLEAN

3.4.1. Cleaning:

- a. Immediately following installation, inspection and approval of work, vacuum-clean carpet and remove debris.

3.4.2. Protection of Completed Work:

- a. Cover the entire carpeted area with plastic covering held in place by masking tape at the seams and stay-tacking around the perimeter.
- b. Do not remove carpet protection until directed by the Architect.

END OF SECTION

ACOUSTIC WALL PANELS

1. PART GENERAL

1.1 GENERAL REQUIREMENTS

- 1.1.1. Conform to Division 01, General Requirements.

1.2 DESCRIPTION

1.2.1. Work Included:

- a. Provide Acoustic Wall Panels complete with mounting system.

1.3 QUALITY ASSURANCE

- 1.3.1. Qualifications: Provide work of this section, executed by competent installers with minimum 5 years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

- 1.3.2. Single source responsibility: Obtain system components for each panel system type from a single source with resources to provide *Products* of consistent quality in appearance and physical properties without delaying progress of the *Work*.

1.4. Submittals

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.

1.4.2. Product data:

- b. Submit Product data sheets for work of this section, complete with required anchors.

1.4.3. Acoustic data:

- a. Submit acoustic data, from a certified acoustic testing agency, verifying that *Products* meet specified acoustic design requirements.
- b. Acoustic data shall include detailed descriptions of both mounting method and test method used to calculate acoustical performance, complete with references to codes and standards used in such calculations.

1.4.4. Samples:

- a. Submit 2 - 300 mm x 300 mm (12" x 12") samples of each component of panel system to Consultant for review.
- b. Samples shall fully represent materials to be supplied in colour, texture, finish and construction.

1.4.5. Shop drawings:

- a. Submit shop drawings, indicating panel layout and system components, for

ACOUSTIC WALL PANELS

each panel system, in accordance with Section 01 33 00.

- b. Include plans, elevations, sections and large scale details, and indicate components and methods of assembly, materials and their characteristics, fastenings, finishes, and other fabrication information required for the work of this section. Indicate assembly joint lines.
 - i. Sample elevation of acoustic panels is not sufficient. Include elevations of every project specific wall showing intended acoustic panel layout.
- c. Submit coordination drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.
- d. Show relation to adjoining construction, details of outside and inside corners and door openings.

1.4.6. Mock-ups:

- a. Submit 915 mm x 915 mm (36" x 36") mock-up of each panel system, for review and acceptance by *Consultant*.
- b. Install at the *Place of the Work* a pre-selected mock-up of full size panel system.
- c. Obtain *Consultant's* acceptance of surface, finish and workmanship as a standard by which remainder of the *Project* will be judged. Apply material in accordance with manufacturer's written application instructions. Mock-up must be approved and accepted prior to start of system application. Maintain mock-up during construction for workmanship comparison. Do not alter, move or destroy mock-up until the work is completed and approved by *Consultant*.

1.4.7. Closeout submittals:

- a. Submit closeout submittals in accordance with Section 01 77 00.
- b. Maintenance data: Submit maintenance data for incorporation into maintenance manuals.
- c. Maintenance materials: At completion, hand over to the Owner an additional 1% of each type of fabric installed in the *Work*.

1.5. Delivery, Storage, and Handling

- 1.5.1. Ship panels in rigid crates to avoid damage. Bent or deformed material shall be rejected.
- 1.5.2. Deliver panels and system components to the *Place of the Work* in original, unopened packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

ACOUSTIC WALL PANELS

- 1.5.3. Before installing panels, permit them to reach room temperature and stabilized moisture content. Acclimatization period shall be 24 hours, minimum, longer as recommended by panel manufacturer.
 - 1.5.4. Handle panels carefully to avoid chipping edges or damaging units in any way.
 - 1.6. Warranty
 - 1.6.1. Warrant work of this section for a period of 2 years.
 - 2. PART PRODUCTS
 - 2.1. Approved Manufacturers: Akustus, Eomac, or Decoustics,
 - 2.1.1. Materials:
 - 1. Rectangle Wall Panels, polyester fibre, chamfered edge, CDPH emission tested, min. 50% recycled content, 2 colour combination (50:50), 600 mm x 1200 mm size, 18mm thick, by Akustus or equal by Fitz-Felt.
 - 2.2.2. Acoustical performance: NRC 0.60 minimum
 - 2.2.4. Mounting method: Mount panels to walls with panel clips and wall clips (clips mechanically mounted to the back of the panels and walls) by manufacturer.
 - 2.2.5. Flammability:
 - a. Fabric must conform to Class A flame spread rating of 25 or under in accordance with CAN/ULC-S102-03.
 - b. Fabrics that do not meet the CAN/ULC-S102-03 test requirements will be flame treated to meet NFPA 701 Small or Large Scale Vertical Burn tests unless inherently flame retardant.
3. PART EXECUTION
 - 3.1. Installation - Panels
 - 3.1.1. Do not start installation until exterior glazing has been completed and exterior openings are closed in. Maintain uniform temperatures of at least 16°C for 72 hours prior to commencement of the work of this section and maintain temperature until completion of the work of this section.
 - 3.1.2. Do not commence installation until work of other sections behind panels has been completed, inspected and accepted by *Consultant*.
 - 3.1.3. Install panels to clean, dry and firm substrates in accordance with manufacturer's written instructions.
 - 3.1.4. Panel arrangements as indicated. Coordinate layout with *Consultant* prior

ACOUSTIC WALL PANELS

to commencing installation.

- 3.1.5. Install finished work rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated. Make allowance for thermal and structural movement.
 - a. Plumb and level tolerance: of 3 mm in 3000 mm (1/8" in 10'-0").
- 3.1.6. Panels shall have no visible fastenings.
- 3.1.7. Install fabric systems with grain patterns and seams level, plumb and true.

END OF SECTION

PAINING

- PART 1 GENERAL
- 1.1 GENERAL REQUIREMENTS
- .1 Conform to Division 01, General Requirements.
- 1.2 SECTION INCLUDES
- .1 Surface preparation and field application of paints and coatings.
.2 Engage a qualified independent inspector, acceptable to MPI and Architect, to verify that work conforms to Contract Documents. Include cost of inspection in Contract.
- 1.3 RELATED SECTIONS
- .1 Section 03 30 00 - Concrete.
.2 Section 04 26 19 - Unit Masonry.
.3 Section 05 12 00 - Structural Steel.
.4 Section 05 21 00 - Steel Joist Framing.
.5 Section 09 21 16 - Gypsum Board.
.6 Section 23 05 53 - Mechanical Identification.
.7 Section 26 05 53 - Electrical Identification.
- 1.4 REFERENCES
- .1 AWWA (American Water Works Association) - C218-02 - Standard for Coating the Exterior of Aboveground Steel Water Pipelines & Fittings.
.2 AWWA (American Water Works Association) - D102-06 - Coating Steel Water Storage Tanks.
.3 MPI (Master Painters Institute) – [Architectural Painting Specifications Manual] [Maintenance Repainting Manual].
.4 NACE (National Association of Corrosion Engineers).
.5 OPCA (Ontario Painting Contractors Association) - Architectural Painting Specification Manual.
.6 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.
- 1.5 SUBMITTALS
- .1 Product Data: Provide data on all finishing products.
.2 Samples: Submit two (2) draw-down samples, for each colour selected.
.3 Submit consent of surety with Bid Submission as proof of ability to supply a 100% two (2) year Maintenance Bond, if an MPI Accredited Quality Assurance Association's guarantee option is not used.
.4 Provide data to Operating Manuals and Reference Data specified in Section 01 33 00. Include SMDS reports indicating the off-gassing or VOC characteristics of the product.
.5 Submit two sets of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site as required.

PAINTING

- 1.6 MAINTENANCE MATERIAL SUBMITTALS
 - .1 Extra Stock Materials:
 - .1 Provide the Owner with all opened, but not completely used materials in resealed containers, minimum 2 litres of each colour, marked with colour number for maintenance purposes.
- 1.7 QUALITY ASSURANCE
 - .1 All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction or approved equal.
 - .2 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual.
 - .3 All painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
 - .4 Engage a qualified independent inspector, acceptable to MPI and Architect, to verify that work conforms to Contract Documents. Include cost of inspection in Contract.
 - .5 Submit 'Request for Assignment of Inspector and List of Paint Products' to MPI, at least 4 weeks prior to commencement of work.
 - .6 The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work
 - .7 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years experience.
- 1.8 REGULATORY REQUIREMENTS
 - .1 Conform to applicable code for flame and smoke rating requirements for finishes.
- 1.9 MOCK-UP
 - .1 Prepare small sample room for each painted finish/colour, giving prime coat to one wall, two coats to second wall, and three coats to third wall. Leave sample room for that purpose until majority of work is finished. Each coat to be tinted a different colour from previous coat.
 - .2 Locate [where directed by Architect
 - .3 Approved mock-up may remain as part of the Work.
- 1.10 DELIVERY, STORAGE, AND PROTECTION
 - .1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

PAINTING

- .2 Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.
- 1.11 ENVIRONMENTAL REQUIREMENTS
- .1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer and MPI.
 - .2 Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer and MPI.
 - .3 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.
 - .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
- 1.12 WARRANTY
- .1 Provide and pay for either the local MPI Accredited Quality Assurance Association's two (2) year guarantee, or, alternatively, a 100% two (2) year Maintenance Bond - both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements
- PART 2 PRODUCTS
- 2.1 MATERIALS
- .1 To meet LEED (Leadership in Energy and Environmental Design) program requirements, use only MPI listed materials having an "L" rating designation.
 - .2 Standards:
 - .1 Water Based Paint Standard:
 - .1 In accordance with Environmental Choice Program guideline ECP-07-89, water based paint shall be formulated or manufactured free from formaldehyde, halogenated solvents, aromatic hydrocarbons, mercury or mercury compounds, or be tinted with pigments of lead, cadmium, chromium VI and their oxides.
 - .2 Paint must have Flash Point of 61.0 deg C or greater, and not contain Volatile Organic Compounds in excess of 250 g/l.
 - .3 Paint must comply with Green Seal Organization for VOC limits (www.greenseal.org).
 - .2 Solvent Base Paint Standard:
 - .1 In accordance with ECP guideline ECP-12-89, solvent based paint shall not be formulated with formaldehyde, halogenated solvents, aromatic hydrocarbons in excess of 10% of weight, mercury or mercury compounds, or be tinted with pigments of lead, cadmium, chromium VI and their oxides.
 - .2 Paint shall have Flash Point of 37.8 deg C or greater, and not contain Volatile Organic Compounds in excess of 380 g/l.

PAINTING

- .3 Paint must comply with Green Seal Organization for VOC limits (www.greenseal.org).
- .3 Acceptable Products:
 - .1 Dulux Lifemaster and Dulux Diamond or approved equivalent.
 - .2 In accordance with Environmental Choice Program guideline ECP-07-89; free from formaldehyde, halogenated solvents, aromatic hydrocarbons, mercury or mercury compounds
- .3 Mixing and Tinting: Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.
 - .1 Pigments to be free from lead, cadmium, chromium VI and their oxides.
- .4 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- .5 Finish, Colour, Gloss/Sheen:
 - .1 Color selection will be based on five (5) base colors and five (5) accent colors with a maximum of five (5) deep or bright color.
 - .2 Gloss level ratings of all painted surfaces shall be as noted on Finish Schedule. Refer to MPI Painting Manual for gloss level definitions and requirements.
 - .3 Paint gloss in accordance with the following MPI values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 max.
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 min.
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that are ready to receive work as instructed by the product manufacturer.
- .2 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- .3 Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

- .1 Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- .2 Correct defects and clean surfaces which affect work of this section.
- .3 Seal with shellac and seal marks which may bleed through surface finishes.

PAINTING

- .4 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- .5 Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- .6 Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply [latex based] [compatible] sealer or primer.
- .7 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- .8 Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- .9 Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- .10 Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- .11 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- .12 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- .13 Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- .14 Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- .15 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand and or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- .16 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- .17 Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- .18 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- .19 Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- .20 Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

PAINTING

- .21 Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- .22 Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

- .1 Apply products to manufacturer and MPI instructions.
- .2 Do not apply finishes to surfaces that are not dry.
- .3 Apply each coat to uniform finish.
- .4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- .5 Sand lightly between coats to achieve required finish.
- .6 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- .7 Allow applied coat to dry before next coat is applied.
- .8 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- .9 Prime concealed surfaces of [interior] [and] [exterior] woodwork with primer paint.
- .10 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 EXTERIOR FINISHING

- .1 Paint exterior surfaces in accordance with the following MPI Painting Manual requirements:
 - .1 Asphalt Surfaces: (zone / traffic marking for drive and parking areas, etc.)
EXT 2.1B Alkyd zone / traffic marking finish.
 - .2 Concrete Horizontal Surfaces: (decks, stairs, driveways, parking and court areas, etc.)
EXT 3.2F Alkyd zone / traffic marking finish.

3.5 INTERIOR FINISHING

- .1 Paint exterior surfaces in accordance with the following MPI Painting Manual requirements:
 - .1 Concrete Horizontal Surfaces: (floors and stairs)
INT 3.2G Waterborne concrete floor sealer semi gloss finish.
 - .2 Concrete Masonry Units: (smooth and split face block and brick)
INT 4.2E Institutional low odor / low VOC semi gloss finish.
 - .3 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.)
INT 5.1S Institutional low odor / low VOC semi gloss finish.
 - .4 Plaster and Gypsum Board: (gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes)
INT 9.2M Institutional low odor / low VOC satin finish.
- .2 Allow for high contrast/bold paint colours on north and south partitions of Collab A223A through A223F, south partition of Corridor A221F (against with Office A228), east partition of Corridor A221E (against with Office A231) and west wall of Link A218.

PAINTING

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 Refer to Section 23 05 53 and Section 26 05 53 for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.
- .2 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
 - .1 where exposed-to-view in all exterior and interior areas.
 - .2 in all interior high humidity interior areas.
 - .3 in all boiler room, mechanical and electrical rooms.
- .3 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks. Do not paint over nameplates.
- .4 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint. Paint the inside of light valances gloss white.
- .5 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- .6 Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- .7 Paint interior surfaces of air ducts, [and convector and baseboard heating cabinets] that are visible through grilles and louvres with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvres, grilles, [and convector and baseboard cabinets] to match face panels.
- .8 Paint exposed conduit and electrical equipment occurring in finished areas.
- .9 Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- .10 Colour code equipment, piping, conduit, and exposed duct work.
- .11 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.7 FIELD QUALITY CONTROL

- .1 Engage a qualified independent inspector, acceptable to MPI and Architect, to verify that work conforms to Contract Documents. Include cost of inspection in Contract.
- .2 Make good painted surfaces rejected by the inspector at no cost to Contract in accordance with MPI Painting Manual requirements.
- .3

3.8 CLEANING

- .1 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.9 PROTECTION AND CLEAN-UP

- .1 Protect all newly painted exterior surfaces from elements condensation and contamination until paint coatings are completely dry. Erect barriers or screens and post signs to warn of or limit or direct traffic.

PAINTING

- .2 Remove all spilled, splashed, splattered or over sprayed paint as work progresses, remove waste materials and keep area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- 3.10 SCHEDULE - EXTERIOR SURFACES
- .1 Exterior Galvanized Steel: Unpainted.
 - .2 Exterior Metal (Ferrous): Exposed Structural and Miscellaneous Steel:
 - .1 1 coat shop applied, oil Alkyd primer (metal surfaces already primed need only touchup),
 - .2 1 coat 100% Acrylic emulsion, waterborne, corrosion resistant paint as tie-coat at 1.5 - 2 mils DFT.
 - .3 2 coats semi-gloss Acrylic emulsion finish at 1.2 mils/coat DFT. Total 3.9 - 4.4mils DFT.
 - .4 Exterior Steel: Rust inhibitor paint by Tremclad or Rustolium or Devoe.
- 3.11 SCHEDULE - INTERIOR SURFACES
- .1 Interior Metal (Ferrous): Exposed Structural and Miscellaneous Steel:
 - .1 1 coat shop applied, oil Alkyd primer (metal surfaces already primed need only touchup),
 - .2 1 coat 100% Acrylic emulsion, waterborne, corrosion resistant paint as tie-coat at 1.5 - 2 mils DFT.
 - .3 2 coats semi-gloss Acrylic emulsion finish at 1.2 mils/coat DFT. Total 3.9 - 4.4mils DFT.
 - .2 Gypsum Board:
 - .1 1 coat Latex primer sealer at 1.0mil DFT.
 - .2 2 coats interior Latex enamel at 1.5mils/coat DFT. Total 4.0mils DFT.
 - .3 3 coats interior Latex enamel at 1.5mils/coat DFT. Total 6.0mils DFT at high contrast/bold colours.
 - .3 Painted Woodwork:
 - .1 1 coat undercoater, low-odour, pigmented, interior alkyd primer at 1.5mil DFT. VOC complying. Back paint wood base.
 - .2 2 coats interior Latex enamel at 1.5mils/coat DFT. Total 4.5mils DFT.
 - .4 Clear and Stain Finish for Wood:
 - .1 1 coat lacquer sanding sealer at 1.5mil DFT. VOC complying. Back paint wood base.
 - .2 1 coat wood stain
 - .3 2 coats clear lacquer at 1.5mils/coat DFT. Total 4.5mils DFT.
 - .5 Knot and Sapwood Sealer: White shellac.
 - .6 Concrete Block:
 - .1 1 coat high-solids, pigmented block filler used full body, VOC complying, 3mils DFT.
 - .2 2 coats vinyl acrylic Latex enamel, 1.5 mils/coat DFT. Total 6mils DFT.

PAINTING

- .7 Painted Concrete: 2 coats high-solids purpose made floor paint with non-slip surface.

- .8 Insulated and Uninsulated Pipes, Ducts, Conduit, Valves, Fittings and Equipment and Ancillary Items where "Exposed" in Completed Work:
 - .1 Insulated Work: 1 coat Latex primer sealer, 1 mil DFT. 2 coats interior Latex enamel, 1.5mils/coat. Total 4.0mils DFT.
 - .2 Non-insulated Work: 1 coat structural steel primer, 1 mil DFT. 2 coats interior Latex enamel, 1.5mils/coat. Total 4.0mils DFT.

END OF SECTION

INTERIOR WINDOW SHADES

- 1. PART GENERAL
 - 1.1. GENERAL REQUIREMENTS
 - 1.1.1. Conform to Division 01, General Requirements.
 - 1.2. DESCRIPTION
 - 1.2.1. Work Included:
 - a. Provide manual chain operated interior roller shades, fabric and blackout.
 - 1.2.2. Related Work Specified Elsewhere:
 - a. Aluminum frame mounting surface: Section 08 41 50 and 10 22 39
 - b. Drywall mounting surface: Section 09 25 00
 - 1.3. SUBMITTALS
 - 1.3.1. Shop Drawings:
 - a. Submit shop drawings complete with component assembly and installation mounting details, wiring and control diagrams. Include plans, elevations, and sections.
 - b. Motor-Operated Shades: Include details of installation and diagrams for power, signal, wiring and networked motors including product schedule.
 - 1.3.2. Samples: Submit duplicate 210 mm x 280 mm samples of each specified fabric/shade/colour and texture.
 - 1.3.3. Closeout Submittal:
 - a. Operation and Maintenance Data: For roller shades, motor operators, and control systems to include in maintenance manuals.
 - 1.4. QUALITY ASSURANCE
 - 1.4.1. Inspection and Preparation:
 - a. Make accurate measurements at the site before fabrication. Verify layout of glazing framing sections, spans, and loading capabilities.
 - b. Verify that all blocking and framing necessary to carry shade assembly hardware is properly installed and secure.
 - 1.4.2. Manufacturer Qualifications: Motor operators, controls, and controllers certified by an NRTL to provide UL recognized or listed wired AC and DC powered motors.
 - a. ISO 9001 certified including in-house engineering and product design activities.
 - b. Controls manufacturer capable of supplying commissioning services for control systems.
 - c. Motor manufacturer capable of supplying a full range of wirefree (12V dc - battery and solar powered) direct voltage DC (24V dc), main or line-voltage (120V ac) motor and control products.

INTERIOR WINDOW SHADES

- 1.4.3. Installer Qualifications: Trained and certified by manufacturer of motor-operator and control system products.
- 1.4.4. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to verify operation with networked control, and to set quality standards for fabrication and installation.
 - a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - b. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.5. WARRANTY
 - 1.5.1. Warrant the work of this Section against defect as follows:
 - a. Hardware, fabrics/shade cloth, aluminum and steel coatings, chain: Ten (10) years.
 - b. Motor and Control Systems: Manufacturer agrees to repair or replace motor and control units that are not free from defects in material and workmanship under normal and proper use, not prorated: Five (5) years.
- 2. PART PRODUCTS
 - 2.1. MATERIALS
 - 2.1.1. Description: Provide chain operated and motorized interior roller window shade system for exterior windows at locations noted below with related hardware for complete operations. Fabric must be PVC free.
 - a. Type 1: 3% blind, manual. Provide blinds at the following locations – Offices A222, A225, A226, A227, A229, A232, A233, A234 and A235; Collab A224 interior storefront panes at north-west and north-east (4 units); Collab rooms A223D, E and F (3 rooms).
 - b. Type 2: 3% and blackout blinds, manual. Provide blinds at the following locations – South facing windows of Collab A223A, A223B and A223C.
 - 2.1.2. Acceptable Manufacturers:
 - a. Hunter Douglas Architectural Window Coverings, RB 500
 - b. PHIFER Inc., SheerWeave 7000 Blackout and SheerWeave 8000
 - c. Legrand Solarfective
 - d. or equal.
 - 2.1.3. Hardware:
 - 1. Shade Mounting Brackets:
 - 1. 71.5 mm x 76 mm (2.875" x 3"), 12 gauge, L shaped, coated steel mounting brackets.

INTERIOR WINDOW SHADES

2. Manual Chain Operator:
 1. Chain operator type, Nysan Sunriser™, gear reduction operating hardware, manufactured with a braking mechanism to stop shade at any desired point of travel.
 2. Drive chain to be #10 stainless steel, tested strength of 41kg (90lb.).
 3. Left hand or right hand operating system to avoid conflict with adjacent cabinets.
 4. Must be break-away type chain
 3. Roller Tube Assembly:
 1. Top roller tube of one piece extruded aluminium tube, with 10 micron thick clear anodised coating, at the manufacturers recommended engineered diameter and wall thickness for maximum allowable deflection of L/700.
 2. The spline will be an extruded vinyl profile, welded to the fabric band or panel, such that removal and re-installation of the fabric panels can occur without removing the roller tube and hardware. Fabric panels must be replaceable on site. Attachment of the fabric to the tube with double sided adhesive tapes, adhesives, staples, or rivets is not acceptable.
 4. Hembars and Hembar Pockets:
 1. Round shaped profile, 15 mm (0.625") diameter, wall thickness engineered to weight requirements, in welded hembar pocket with open ends. Finished with coloured, round end caps.
 5. Fasteners: Non-corrosive to manufacturer's recommendations.
 6. Fabric:
 1. Tested in accordance with ASHRAE Standard 74073, "Methods of Measuring Solar-Optical Properties of Materials" and flame spread to NFPA 701-1999 TM#1, Standard Methods of Fire Tests for Flame Resistant Textiles and Films 1999 edition - test method #1 (Small Scale) Toxicity: UPIIT Fungal resistance: ASTM G21 Bacterial Resistance, ASTM G22.
 2. PVC free, 12 oz/yd²
 3. Flame Resistance – 0.0 sec after flame
 4. Fuel contributed value – 0
 5. Colour: selected by Architect from manufacturer's complete range
 6. Accessories: All necessary accessories to produce a complete and functioning system.
 7. Type 1: 3% and blackout.
- 2.2. FABRICATION
- 2.2.1. Fabricate assemblies square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance. Factory applied finish shall be uniform, smooth and without blemishes.

INTERIOR WINDOW SHADES

3. PART EXECUTION

3.1. INSTALLATION

- 3.1.1. Install in strict accordance with reviewed shop drawings and manufacturer's instructions.
- 3.1.2. Install, plumb, square, rigidly coupled and adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Allowable tolerance of not more than 3 mm (0.125") in either direction within channels after installation.
- 3.1.3. Adjusting and Cleaning:
 - a. Adjust shades and operating components as required to ensure smooth and trouble free operation without binding.
 - b. Adjust shade and shade-cloth to hang flat without buckling or distortion.
 - c. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
 - d. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
 - e. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

FOOT GRILLES

- 1. PART GENERAL
 - 1.1. GENERAL REQUIREMENTS
 - 1.1.1. Conform to Division 01, General Requirements.
 - 1.2. DESCRIPTION
 - 1.2.1. Work Included:
Provide recessed and surface mounted foot grilles and floor prep for the Work.
 - 1.2.2. Related Work Specified Elsewhere:
 - a. Concrete Flooring: Section 03 30 00
 - 1.3. SUBMITTALS
 - 1.3.1. Shop Drawings: Indicate dimensions, grid profile, joints and frame installation.
 - 1.3.2. Templates: Submit templates and instructions where recessed, openings, fastenings or anchors have to be built in by others.
 - 1.4. WARRANTY
 - 1.4.1. Provide written warranty against defects in material or workmanship for a period of five years from the date of substantial completion.
- 2. PART PRODUCTS
 - 2.1. ACCEPTABLE PRODUCTS
 - 2.1.1. Recessed: Bi-directional, model BSA-4 by Grillage Bolar (Canada) Inc., KN Crowder, Richelieu or approved equal.
 - a. Tread: 9.5mm x 3mm x 25mm aluminum alloy 6061-T6 grid
 - b. Colour: Natural aluminum.
 - c. Frame: AD Level Base installation. Level with adjacent floor finish.
 - 2.1.2. Surface Mounted: Model Isomat BA-5 by Grillage Bolar (Canada) Inc., KN Crowder, Richelieu or approved equal.
 - d. Tread: 27mm x 13mm aluminum alloy 6061-T5 grid
 - e. Colour: natural aluminum, carpet from manufacturer's complete range to be selected by Architect.
 - f. Frame: SSA, bevel finished

FOOT GRILLES

3. PART EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide cement leveling bed as required at floor recess.
- 3.1.2. Install in accordance with manufacturer's written instructions to plumb, level and rigid installation.

END OF SECTION

Table of Contents - Mechanical

<u>List of Specification Sections</u>	<u>DR</u>	<u>Date Issued</u>
DIVISION 21		
21 01 01 General Requirements	M	January, 2022
21 01 05 Demolition and Renovations	M	January, 2022
21 05 00 Common Work Results	M	January, 2022
21 12 00 Standpipe & Fire Hose	M	January, 2022
21 13 13 Sprinkler Systems	M	January, 2022
DIVISION 22		
22 01 01 General Requirements	M	January, 2022
22 01 05 Demolition and Renovations	M	January, 2022
22 05 00 Common Work Results	M	January, 2022
22 05 16 Piping Expansion Control	M	January, 2022
22 05 30 Supports & Anchors	M	January, 2022
22 05 48 Vibration Controls	M	January, 2022
22 07 19 Piping Insulation	M	January, 2022
22 11 19 Plumbing Specialties	M	January, 2022
22 14 13 Plumbing Piping	M	January, 2022
22 40 00 Plumbing Fixtures & Trim	M	January, 2022
DIVISION 23		
23 01 01 General Requirements	M	January, 2022
23 01 05 Demolition and Renovations	M	January, 2022
23 05 00 Common Work Results	M	January, 2022
23 05 30 Supports & Anchors	M	January, 2022
23 05 48 Vibration Controls	M	January, 2022
23 05 93 Testing, Adjusting and Balancing	M	January, 2022
23 07 13 Duct Insulation	M	January, 2022
23 31 00 Ductwork	M	January, 2022
23 33 00 Air Duct Accessories	M	January, 2022
23 36 00 Air Terminal Units	M	January, 2022
23 37 00 Air Outlets and Inlets	M	January, 2022
23 83 00 Radiant Snow Melting System	M	January, 2022
DIVISION 25		
25 01 01 General Requirements	M	January, 2022
25 01 05 Demolition and Renovations	M	January, 2022
25 05 00 Common Work Results	M	January, 2022
25 50 01 Controls and Instrumentation	M	January, 2022

END OF SECTION

General Requirements

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and conform to:
 - .1 The Contract CCDC 2-2020, Stipulated Price Contract as amended,
 - .2 Division 1 requirements and documents referred to therein.
- .2 This Section applies to and governs the work of all Sections of Division 21.
- .3 The technical Sections of this Division are generally divided into units of work for the purpose of ready reference. The division of the work among subcontractors is not the Consultant's responsibility and the Consultant assumes no responsibility to act as an arbiter and/or to establish subcontract limits between any Sections of the work..
- .4 The specifications are integral with the drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one but implied in the other is fully and properly required.
- .5 Wherever differences occur in the tender documents, the most onerous condition governs. Base the bid on the most costly arrangement.
- .6 Ensure Sub-contractors undertaking the work of Division 21 provide a 50% performance bond and a 50% labour and materials payment bond. In addition, ensure Sub-contractors employed to undertake any part of the work of Division 21 that is \$50,000.00 or greater in contract value provide a 50% performance bond and a 50% labour and materials bond to the party they are in contract with.

1.2 WORK INCLUDED

- .1 Products and methods mentioned or shown in the Contract Documents complete with incidentals necessary for a complete operating installation. Provide all tools, equipment and services required to do the work.
- .2 Cutting and patching of new or existing work
- .3 Identification of equipment, piping, ductwork, and valves and controllers
- .4 Motors required for equipment supplied under this Division.
- .5 Take such measures and include in Bid Price for the proper protection of the existing building and its finishes at all times during alterations and construction of the new addition. Coordinate this protective work with all trades.
- .6 Refer to Mechanical/Electrical Equipment Schedule for extent of wiring and electrical characteristics.
- .7 Verify the correct operation of each equipment item provided and/or altered and each system in total and obtain the Owner's approval prior to starting and/or returning to operation.

1.3 SUBMITTALS

- .1 Approval Drawings: Prepare and submit drawings necessary for approval to any authority having jurisdiction, and obtain two (2) copies of approved drawings for retention by Consultant prior to commencement of work under this Division.
- .2 Shop Drawings: Prepare and submit two (2) copies of shop drawings of major equipment items (including those items specifically indicated under Part 1: General of each Section), to the Consultant for review. The Consultant will return one copy, marked with comments and his review stamp as he deems appropriate. Prepare the necessary number of copies of the returned set and distribute to the Owner, the Prime Consultant, the General Contractor, the site, and to subcontractors and suppliers.
 - .1 Clearly indicate manufacturer's and supplier's names, catalogue model numbers, details of construction, accurate dimensions, capacities and performance. Prior to submission check and certify as correct, shop drawings and data sheets. Do not order equipment until a copy of the shop drawings, reviewed by Consultant, has been returned to Contractor.
 - .2 Clearly indicate the weight, location, method of support and anchor point forces and locations for each piece of equipment on shop drawings.
 - .3 The Consultant will not review shop drawings that fail to bear the Contractor's stamp of approval or certification.
 - .4 Read the following in conjunction with the wording on the shop drawing review stamp applied to each and every drawing submitted:
 - .1 *"This review by the Consultant is for the sole purpose of ascertaining conformance*

General Requirements

with general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub trades."

- .3 As-Built Records: Prepare and submit complete as-built records prior to Substantial Performance of the Contract. Refer to paragraph 3.2.5 and to Division 1 for requirements.
- .4 Requests for Shut-Down: Obtain permission for systems shut-down and/or service interruption from the Owner prior to disruption of any system or service in use by the Owner. Employ the Owner's standard form of request where available. Refer to Division 1 for additional requirements.
- .5 Requests for Start-up: Obtain permission from the Owner to start-up or to return to service any item of equipment, system or service installed new or previously shut-down. Refer to Division 1 for additional requirements.
- .6 Contractor's Material and Test Certificates: Prepare and submit certificates for each system installed. Where certificates are prescribed by regulations, codes or standards ensure they conform to the requirements of those documents (eg. NFPA-standards). Include a copy of each certificate in the Operation and Maintenance manual. Certificates shall include the following:
 - .1 description of the system (description and type),
 - .2 description of the tests conducted and results observed, including re-testing, where necessary,
 - .3 description of any corrective measures undertaken,
 - .4 description of materials used (pipe and fittings),
 - .5 list of witnesses for each test conducted,
 - .6 date system left ready for service,
 - .7 signature of installing Contractor.

1.4 QUALITY ASSURANCE

- .1 Conform to minimum requirements or better of provincial and local codes, where existing, and to requirements of local inspection authorities for execution of work under this Division.
- .2 Ensure materials supplied under this Division conform to minimum requirements and recommendations or better of applicable standards of the following:
 - .1 NFPA National Fire Protection Association
 - .2 OBC Ontario Building Code
 - .3 OFC Ontario Fire Code
 - .4 OFM Ontario Fire Marshall
- .3 Use latest editions and amendments in effect on date of bid call subject to requirements of OBC.
- .4 Arrange and pay for permits and inspections by authorities having jurisdiction, required in the undertaking of this Division. Make modifications required by authorities.
- .5 All tradesmen employed on the project shall hold valid trade certificates/licenses and shall make a copy available for review by the Consultant and/or Owner when requested.

1.5 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.6 WARRANTY

- .1 Refer to General Conditions.

General Requirements

- .2 Arrange with each manufacturer/supplier to extend warranties as necessary to coincide with warranty period or those periods specified.

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Ensure materials and equipment provided under this Division are new and free from defects and bear labels of approval as required by codes referred to in this Division and/or by inspection authorities.
- .2 Ensure manufacturers and suppliers of equipment or materials under this Division determine if their products are composed of any hazardous materials. If they are, the products are suitably labeled and supplied with Material Safety Data sheets. Obtain the Owner's approval in writing to bring hazardous materials onto the site prior to doing so.
- .3 When utilizing any products that are hazardous, keep Material Safety Data sheets on file at the job site and present them to anyone requesting this information. When transferring hazardous materials from original container into other containers, provide Workplace Labels on such containers.

2.2 ACCEPTABLE PRODUCTS

- .1 First item named or specified by catalogue number meets specifications regarding performance, quality of material and workmanship, and is acceptable to the Consultant.
- .2 Items, other than first named, meeting specifications regarding quality of materials and workmanship are acceptable to the Consultant, only, if they also meet performance and/or capacities specified and can be accommodated within the space allotted.
- .3 General approval indicated by inclusion of other manufacturers named is subject to final review of shop drawings, performance data and test reports.

2.3 EQUIVALENTS AND ALTERNATIVES

- .1 Suppliers wishing approval for additional equipment items as equivalent to those specified must submit complete description, technical and performance data to Consultant at least ten (10) working days prior to Bid closing date. Such equivalent equipment, if accepted, to conform to specifications with regard to all details, accessories, modifications, features and performance. Deviations from specifications must be stated in writing at time of submission for approval.
- .2 Bid Prices shall include only products specified or approved equivalents. Contractors may propose unsolicited alternatives to the products specified. Alternative proposals shall be submitted in sealed envelope at time of general contract Bid submission and shall include full description and technical data, and a statement of the related increase or decrease in Bid Price should alternatives be accepted. All additional costs associated with unsolicited alternative proposals such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in alternative price. Prior approval by Consultant is not required for unsolicited alternative proposals.
- .3 Where the Contractor uses equipment other than that first named, on which the design is based, he shall be responsible for all details of installation including equipment size, arrangement, fit, and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by Contractor to provide such drawings will be considered indication that original arrangements and space allocations are adequate. All additional costs associated with equivalent equipment such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in Bid Price.

2.4 SUBSTITUTIONS DURING PROGRESS OF WORK

- .1 If during the progress of work, specified products are not obtainable, equivalent or similar products by other manufacturers may be permitted by Consultant.
- .2 Apply, in writing, to Consultant for substitution of any products, indicating the following:
 - .1 Manufacturer's name, model number, details of construction, accurate dimensions, capacities and performance of proposed products.

General Requirements

- .2 Reason for substitution.
 - .3 Any revisions to the contract price made necessary by substitution.
 - .4 Any revisions to the contract time made necessary by substitution.
 - .5 Any revisions to layout, arrangement or services made necessary by substitution.
- .3 No substitutions will be permitted without written authorization from the Consultant.

2.5 CONSULTANT'S REVIEW

- .1 The consultants will review and evaluate unsolicited alternatives and substitutions proposed by the Contractor. Such review and evaluation work will be undertaken by the Consultant on an additional fee basis. The Contractor shall reimburse the Owner for all costs associated with such reviews and evaluations.
- .2 The Contractor shall also reimburse the Owner for any and all costs incurred in updating Contract Documents to reflect such changes.

3 EXECUTION

3.1 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.

3.2 INSTALLATION REQUIREMENTS

- .1 The Consultant's drawings and instructions govern the location of all items. Prepare fully coordinated installation drawings prior to installation.
- .2 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise install products and services to follow building planes. Ensure installation permits free use of space and maximum headroom.
- .3 Do not use powder activated tools except as permitted by the Prime Consultant and the Owner's workplace health and safety policies.

3.3 CONTRACT DRAWINGS

- .1 The drawings of this Division are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- .2 Obtain accurate dimensions from the architectural and structural drawings, or by measurement. Location and elevation of services are approximate. Verify them before construction is undertaken.
- .3 Make changes where required to accommodate structural conditions, (beams, columns, etc.). Obtain Consultant's approval before proceeding.
- .4 Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Note that outlets and/or equipment may be relocated up to 10 feet (3 m) in any direction without a change to the contract price.
- .5 Note that the layout and orientation of the ceiling outlets on the architectural reflected ceiling drawings may differ from that shown on the mechanical drawings. Make the installation in accordance with the latest architectural ceiling drawings. Provide the equipment as specified and/or shown on the documents of this Division.
- .6 The drawings of this Division are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as shown on the mechanical documents. If there is a difference in quantity between the architectural and drawings of this Division, base the contract price on the greater quantity.
- .7 Prepare installation (construction) drawing to reflect the latest architectural ceiling layout.

3.4 EXTRAS AND CREDITS

- .1 Accompany all price submissions requested by Consultant for extra work, or work to be deleted, with a complete cost breakdown as follows:

General Requirements

- .1 Materials, quantities and unit costs including any applicable contractors trade discount clearly identified.
- .2 Labour hours and unit costs.
- .3 Total materials and labour costs.
- .4 Overhead and profit mark-ups in accordance with the General Conditions of the Contract.

3.5 INSTRUCTION

- .1 Instruct and familiarize Owner's operating personnel with the various mechanical systems. Arrange instruction for each system separately.
- .2 Provide instruction for each system on two separate occasions, coordinated with the Owner's staff operating schedule, in order that interested personnel may arrange to attend.
- .3 Ensure each instruction period includes, but is not limited to the following;
 - .1 a classroom seminar with operating manuals, product and system drawings and such other audio/visual aids as may be appropriate,
 - .2 instruction during the classroom seminar by the manufacturer's representative regarding the proper operating and maintenance procedures for each item of equipment,
 - .3 demonstration of the proper operating procedures for each item of equipment,
 - .4 explanation of the purpose and function of all safety devices provided,
 - .5 demonstration of all measures required for safe and proper access for operation and maintenance.
- .4 Provide a period of follow-up instruction (on two occasions) approximately one month after completing Owner's instruction to clarify and reinforce earlier instructions.
- .5 Submit a letter from the Owner's management staff indicating the instruction has been given satisfactorily to the Consultant prior to substantial completion of the project.

3.6 COMMISSIONING

- .1 Refer to Section 01 80 50 Commissioning.
- .2 The Contractor shall start-up and completely commission all equipment and systems installed and/or modified under this contract. Commissioning work shall be completed to the satisfaction of the Consultant prior to acceptance of the Work or any part thereof.
- .3 Commissioning shall conform to CAN/CSA Z320-11 Building Commissioning Standard
- .4 The Commissioning Team shall be comprised of;
 - .1 Representatives of the Commissioning Coordinator (Commissioning Agent)
 - .2 The individual, company or agency undertaking the work of each Section,
 - .3 Representatives of the Contractor and his sub-contractors as required,
 - .4 Representatives of equipment manufacturers,
 - .5 Representatives of the Consultants,
 - .6 Representatives of the Owner.
- .5 The Contractor and his sub-contractors shall each assign an individual representing each of the relevant trades to the commissioning team and shall ensure that representatives of the equipment manufacturers are present during the relevant commissioning tasks.
- .6 The Contractor shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, test and commission each system provided as part of the Work.
- .7 Each Section shall prepare Check Sheets in accordance with the standards listed above and shall issue them to the commissioning team for use during the commissioning process.
- .8 Three (3) copies of commissioning manuals shall be provided, bound in hard cover D-ring binders with transparent cover on front and spine personalized to indicate;
 - .1 name and logo of Brock University,
 - .2 name of the project,
 - .3 the Owner's project number,
 - .4 identification of the system commissioned,
 - .5 the date that the system was commissioned.
- .9 Commissioning manuals shall include machine printable index dividers to organize each manual by system and by commissioning stage.

General Requirements

END OF SECTION

Demolition and Renovations

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 01 22 00.

1.2 WORK INCLUDED

- .1 Identification of existing services and utility connections.
- .2 Installation, protection and maintenance of temporary services as required to support continuing operation of the facility.
- .3 Disconnection and removal of various mechanical equipment in areas to be turned over to the Owner.
- .4 Disconnection and making safe of various mechanical systems and equipment in areas to be demolished and/or renovated.
- .5 Disposal of waste materials in accordance with waste management requirements.
- .6 Re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction including requirements for marking of equipment.

1.3 REGULATORY REQUIREMENTS

- .1 Notify all authorities of intent to demolish and schedule for the work. Obtain required permits from authorities.
- .2 Conform to all codes for demolition work, dust control, products requiring disconnection and re-connection.
- .3 Do not close or obstruct egress width to any building or site exit.
- .4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.
- .5 Conform to procedures applicable when hazardous or contaminated materials are discovered.
- .6 Arrange for re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction. This includes requirements for marking of equipment under rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

1.4 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.5 INTERRUPTIONS

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

1.6 PHASING AND SCHEDULING

Demolition and Renovations

- .1 Refer to Division 1 PHASING AND SCHEDULING OF THE WORK.
- .2 Coordinate with the work of all Sections of Division 15 with other trades and assist in the development of the Phasing Strategy.

3 3 EXECUTION

3.1 PREPARATION

- .1 Prior to start of work under this Section, ensure that the General Trades;
 - .1 Provide, erect, and maintain temporary barriers at locations indicated.
 - .2 Erect and maintain weatherproof closures for exterior openings.
 - .3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
 - .4 Prevent movement of structure; provide bracing and shoring.
- .2 Install, protect and maintain temporary services as required to support continuing operation of the facility.
- .3 Protect services and equipment which are not to be demolished.
- .4 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
- .5 Notify affected utility companies before starting work and comply with their requirements.
- .6 Mark location and termination of utilities.
- .7 Provide appropriate temporary signage including signage for exit or building egress.

3.2 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Remove and dispose of built-in items such as sleeves, anchors, and inserts.
- .3 Remove and dispose of bases, supports and anchors for piping, equipment and ductwork mounted on or in walls, supported above floors and/or suspended from the structure.

3.3 PROTECTION

- .1 Protect existing and new work to remain free from damage due to execution of work under this Division with tarpaulins and other protective coverings as necessary.
- .2 Repair any and all damage to the building and components resulting from failure to provide sufficient protection, to the satisfaction of the Consultant.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.4 DEMOLITION

- .1 Notify all authorities of intent to demolish and schedule for the work.
- .2 All demolition work shall conform to all codes, regulations, standards and by-laws applicable to the work.
- .3 Isolate and drain systems as required to effect demolition. Disconnect, cap and make safe all mechanical services to the building including, but not limited to; sanitary sewer(s), storm sewer(s), water service, natural gas service, steam service, condensate return, water supply to standpipe and sprinkler systems, fire suppression systems hot water heating systems, steam and condensate

Demolition and Renovations

- systems.
- .4 Contractor to allow contingency for pipe freezing of existing services to make tie-in's for new distribution and for isolation of existing systems to perform new and demolition work. Existing facility infrastructure is aged and it was not possible to locate/investigate/assess the condition of all existing system isolation valves.
 - .5 Protect existing equipment and services to remain from debris and unwanted materials. Clean as necessary to maintain service during demolition period and on completion of the work.
 - .6 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
 - .7 Remove and dispose of all redundant mechanical services and equipment within the limits of the demolition site and where demolished systems extend beyond these limits.
 - .8 Turn over items identified for recovery by the Owner.
 - .9 All demolition work shall conform to Occupational Health & Safety and Environmental regulations. Ensure that all parties are familiar with requirements and experienced in the work to be undertaken.
 - .10 Waste disposal shall conform to the requirements of Division 1, municipal By-Laws and Ministry of the Environment regulations and standards.
 - .11 All existing air intake and exhaust openings that may be affected by dust and/or debris from the demolition work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from demolition work with new filters.
 - .12 In the event that dust and debris from demolition work does penetrate the building and/or its air distribution systems, this Section shall be responsible for cleaning the affected areas and/or systems.
 - .13 Disconnect remove, cap and identify all utilities within demolition areas.
 - .14 Demolish in an orderly and careful manner. Protect existing supporting structural members.
 - .15 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
 - .16 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
 - .17 Remove temporary Work.

3.5 RENOVATIONS

- .1 Isolate and drain systems as required to effect renovations, modifications and/or repairs. On completion of renovations, modifications and/or repairs, test entire system as if new. Report repairs or replacements required of existing equipment, piping, fittings or devices that are not included in contract to Consultant and Owner for instruction. Flush, clean and refill renovated systems as specified for new.
- .2 Relocate or remove existing items so designated unless specifically indicated to be relocated or removed under other Sections.
- .3 Existing items to be relocated shall be cleaned and repaired or altered as required to suit new location. All damaged or ineffective parts shall be replaced and the item made "as new".
- .4 Existing items to be removed remain the property of the owner and shall be delivered to a location on site designated by the owner. If the owner declares no interest in the removed items, assume ownership and remove the items from the site.
- .5 Make good all surfaces and finishes in areas from which items have been removed and in which items are relocated. Cap all existing services required to be severed to effect alterations and do all other work necessary to make good such areas to satisfaction of consultant.
- .6 Openings in existing floor assemblies and vertical fire separations necessitated by installation of equipment and systems or construction in general must be temporarily sealed with fire barrier materials such as mineral wool or other noncombustible insulation.
- .7 If during alteration work existing asbestos material, other than known asbestos, is discovered (e.g. fireproofing, acoustic or thermal insulation, tank covering), stop work in the affected area and immediately notify consultant.
- .8 Existing refrigerant indicated to be removed shall not be discharged to the atmosphere, but shall be salvaged and reclaimed or disposed of following the guidelines of the authority having jurisdiction.
- .9 All existing air intake and exhaust openings that may be affected by dust and/or debris from the

Demolition and Renovations

renovation work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from renovation work with new filters.

- .10 In the event that dust and debris from renovation work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .11 Temporary filters shall be removed on completion of the renovation work.

3.6 INSPECTION AND RE-CERTIFICATION

- .1 Where any equipment, machine or apparatus is modified, rebuilt or rewound with any change resulting in its performance or capacity rating and characteristics it shall be inspected and re-certified as required by authorities having jurisdiction.
- .2 A nameplate giving the name of the person or firm making the change and the resulting changes in performance or capacity shall be provided and affixed to the equipment, machine or apparatus adjacent to the original nameplate. Where the original nameplate is removed, the original manufacturer's name and original identifying data, such as serial numbers, shall be added to the nameplate.
- .3 Refer to rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

END OF SECTION

Common Work Results

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 21 01 01.

1.2 COMMON WORK RESULTS

- .1 Section 21 05 00 applies to and governs all work of Division 21.

1.3 REFERENCE STANDARDS

- .1 Provide all work in accordance with requirements of Regulatory Agencies and conform to:
 - .1 Local and district by-laws, regulations and published engineering standards.
 - .2 the Ontario Building Code as amended,
 - .3 Regulations for Construction Projects under The Occupational Health and Safety Act.
 - .4 Fire Code made under the Fire Marshal's Act.
- .2 Conform to following CSA Standards:
 - .1 CSA B242 Groove and Shoulder Type: Mechanical Pipe Couplings.
 - .2 CAN1-B149.1 Natural gas and propane installation code.
 - .3 CSA B64.1 Manual for the Selection and Installation of Backflow Prevention Devices
 - .4 CSA B64.1 Manual for the Maintenance and Field Testing of Backflow Prevention Devices.
- .3 Conform to following National Research Council Canada publications:
 - .1 National Building Code of Canada and Supplements to National Building Code of Canada
 - .2 National Fire Code of Canada.
- .4 Provide work where indicated in conformance with guide Specification of the Victaulic System for Building Services, G-100.
- .5 Conform to following National Fire Protection Association standards;
 - .1 NFPA 13 - Installation of Sprinkler Systems.
 - .2 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 22 00 & 21 01 01.

2 PRODUCTS

2.1 1 PIPING SPECIALTIES

- .1 Cast brass, pressure, copper to copper unions shall be used with seamless copper tubing smaller than 3" (75 mm).
- .2 Cast brass flanges shall be used with seamless copper tubing, type L for tubing 3" (75 mm) and larger.
- .3 Dart type, 125 lb. (860 kPa) black malleable iron unions shall be used with all steel pipe for piping 2-1/2" (65 mm) and smaller.
- .4 Slip-on, 150 lb. (1000 kPa) carbon steel flanges with 1/16" (4 mm) raised face shall be used with all steel pipe for piping larger than 2-1/2" (65 mm).
- .5 Gaskets for joining flanged steel pipe shall be 1/16" (4 mm) Cranite ring type gaskets.
- .6 Piping specialties including backflow preventers, strainers, valves etc. shall be line size unless indicated otherwise on drawings.

2.2 ADHESIVES, SEALANTS, PAINTS AND COATINGS

- .1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;
 - .1 Paint for Mechanical Identification: maximum VOC emission of 250g/L
 - .2 Touch-Up Paint: maximum VOC emission of 250g/L

Common Work Results

- .3 Zinc-Rich Primer: maximum VOC emission of 250g/L
- .4 Adhesives for Mechanical Identification: maximum VOC emission of 70g/L
- .5 Sealants for service penetrations: maximum VOC emission of 650g/L clear and 350 g/L pigmented
- .6 Sealants for Firestopping: max. VOC emission of 650g/L clear and 350 g/L pigmented
- .7 Acrylic Sealant for supports and anchors: maximum VOC emission of 250g/L
- .8 Insulation Vapour Barrier Lap Adhesive: maximum VOC emission of 80g/L
- .9 Insulation Joint Sealer: maximum VOC emission of 250g/L
- .10 Insulation Vapour Barrier Mastic: maximum VOC emission of 400g/L
- .11 Flame Retardent Adhesive: maximum VOC emission of 650g/L clear and 350 g/L pigmented

3 EXECUTION

3.1 INSPECTION

- .1 Inspect installed work of other trades and verify that such work is complete to point where work under this Division may properly commence.
- .2 Verify that work of this Division may be executed in accordance with pertinent codes and regulations, specifications, drawings, and referenced standards.
- .3 Review drawings and verify dimensions at the site. Report discrepancies immediately to Consultant before proceeding with any construction work or shop drawings.

3.2 PREPARATION

- .1 Existing services and equipment shall be relocated or removed to suit new construction and renovation work.
- .2 Services that are no longer required shall be removed or cut back and capped to the satisfaction of Consultant.
- .3 Obtain written authorization from Consultant for renovation work that is not specifically indicated.
- .4 Where modifications or connections to existing systems require shutdown of the system the Contractor shall submit a request for system shutdown describing the system or part to be shutdown, the duration of the shutdown, the work planned and steps to be taken to reinstate the system to full operation. The request shall be submitted in the format stipulated by the Owner.
- .5 All work required to prepare systems for shutdown and/or re-instatement, such as draining, chemical treatments, and re-filling shall be included in the Bid Price.

3.3 PIPING INSTALLATION - ABOVE GROUND

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays. Provide all materials to be built-in such as sleeves, anchors, etc., together with accurate dimensions or templates, promptly.
- .2 Layout all work accurately, installing piping parallel to lines of building.
- .3 Install piping, wherever possible, in partitions and above ceiling. Do not install piping in outside walls unless so shown on drawings. Wrap uninsulated piping in masonry walls with building paper.
- .4 Install concealed piping close to building structure to minimize furring dimensions.
- .5 Provide adequate space around piping to facilitate application of insulation.
- .6 Dissimilar metal is not allowed, hence no dielectric coupling is allowed
- .7 Where piping passes through concrete floors, or walls, sleeves shall be sized to permit the pipe to expand freely without binding or crushing pipe insulation.
- .8 Where branch pipes are welded into main without the use of "T" connections, torch cut openings must be cut true, bevelled and filed smooth. Branch pipes must not be allowed to project inside of main pipe. Openings must not be cut large enough to permit entry of welding metal and slag within the pipe.

3.4 PIPING JOINTS

- .1 Make joints in piping installed under this Division using persons familiar with the particular materials being used and in accordance with NFPA Standards, manufacturer's instructions, and as specified

Common Work Results

herein.

- .2 Use only welder and/or brazer operators, with a valid identification card, as issued under The Boiler and Pressure Vessels Act, to make joints in Registered Piping Systems.
- .3 Carefully ream joints in threaded pipe and paint with approved graphite type joint sealer on male connections only. Make connections with proper wrench to suit pipe size. Where leaks occur, the joint shall be disassembled and corrected if possible, or replaced. Over-tightening, caulking or peening will not be acceptable.
- .4 When using Victaulic Grooved Piping Method: make joints in grooved piping with couplings and gaskets in accordance with Victaulic Company of Canada Ltd, General Catalogue G-100, latest edition. Cut or roll grooves using tools specifically designed for that purpose.
- .5 Use butt welding and/or schedule 40 carbon steel welding fittings to join sections of steel piping with welding ends.

3.5 FLUSHING AND CLEANING

- .1 Refer to SUEZ documentation
- .2 Flush water mains in accordance with procedures established by NFPA 24.
- .3 Thoroughly flush all other piping installed by this Division.
- .4 Remove, clean and replace all strainers in systems after flushing.
- .5 Thoroughly clean and lubricate all equipment, and leave all items in perfect order ready for operation.

3.6 ELECTRICAL WIRING

- .1 Conform to requirements of Division 26 for all wiring included in Division 21, including pre-wired equipment provided by Sections under Division 21.
- .2 Ensure that all pre-wired electrical equipment is CSA approved. Arrange and pay for special approval where this is not possible.
- .3 Coordinate all wiring requirements with other Divisions. Line voltage wiring from power distribution panels to starters and from starters to motors will be provided under Division 26. All the field wiring for equipment shall be included under Division 21.

3.7 EQUIPMENT TESTING AND INSPECTION

- .1 Test operation of equipment installed under this Division according to instructions in appropriate articles of this Division. Make any required adjustments or replacements to ensure equipment is operating as intended. Retest equipment requiring adjustment or replacement.
- .2 Pay all fuel consumption charges for equipment under testing and during commissioning.
- .3 Arrange and pay for inspections by authorities as required by code and complete any changes or alterations required by such inspections.
- .4 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Testing and Balancing Agency.
 - .3 The Commissioning Agent.
 - .4 The Consultant.
 - .5 The Owner's Representative.
- .5 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.

3.8 PIPING SYSTEMS TESTING AND INSPECTION

- .1 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
- .2 Test all piping at the completion of roughing-in, before connecting to existing systems, and prior to concealment.
- .3 Make tests, that are required by any authority having jurisdiction, in the presence of the authority's authorized inspector and shall be certified by him.
- .4 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Commissioning Agent

Common Work Results

- .3 The Owner's Representative
- .4 The Consultant
- .5 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.
- .6 Repair all leaks exposed during testing and retest. If defects in pipe or fittings are discovered in the system, they shall be removed and replaced.
- .7 Certify tests not required by authorities having jurisdiction.

3.9 TESTING AND BALANCING

- .1 Allow sufficient time for testing and verification prior to substantial completion. Notify Testing and Balancing Agency on completion of adjusting and balancing of systems.
- .2 Adjust systems and components (drives, sheaves, belts, etc.) as required by Testing and Balancing Agency.
- .3 Maintain systems in full operation during testing and verification.
- .4 Make adjustments to control systems as required to facilitate verification. Maintain all safety controls in operation.
- .5 Check and correct alignment of drive shaft coupling, drives, etc. as required by Testing and Balancing Agency.

3.10 PROTECTION

- .1 Protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division.
- .2 Repair to satisfaction of Consultant, damage to building resulting from failure to provide such protection.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work of this Division shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.11 CUTTING AND PATCHING

- .1 Include cutting and patching as required in execution of work under respective Sections of this Division.
- .2 Holes through the structure will not be permitted without written approval of the Consultant. Any and all openings required through the completed structure must be clearly and accurately shown on a copy of the relevant structural drawing(s). Exact locations, elevations and size of the proposed opening must be identified well in advance of the need for the work.
- .3 All sleeved or formed openings through the structure must be shown on sleeving drawings and must be approved by the Structural Consultant prior to construction.
- .4 The Contractor shall conduct exploratory work including x-ray of the existing structure, shall mark the location of embedded reinforcements, anchors, conduits and piping on exposed surfaces of adjacent floors and/or walls and shall pay all associated costs.
- .5 Reinforcing shall not be cut or modified without prior approval of the Structural Consultant. Should reinforcement be cut without such prior approval, the cost of any additional reinforcement deemed necessary by the Structural Consultant shall be the responsibility of this Contractor.
- .6 Alternative imaging techniques are subject to the approval of the Structural Consultant.
- .7 Ensure that cutting and patching of roofs and reinforced concrete structures is executed by specialists familiar with the materials affected, and is performed in a manner to neither damage nor endanger the work. Coordinate and supervise such cutting and patching.
- .8 Maintain the integrity of fire rated assemblies where they are pierced by ducts and pipes.

Common Work Results

- .9 Make good surfaces affected by this work and repair finish to satisfaction of Consultant.
- .10 Stop work immediately upon discovery of any hazardous material and report discovery to the Owner and Consultant. Obtain instruction prior to proceeding with the work.

3.12 PAINTING

- .1 Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Consultant.
- .2 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

3.13 SUPPORT AND ATTACHEMENT

- .1 Support piping and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls, and do not support from or attach to steel roof deck and/or wall or ceiling finishes.

3.14 DISSIMILAR METALS

- .1 Separate dissimilar metals in order to prevent galvanic corrosion.
- .2 Provide gaskets or shims of approved materials to avoid electrolytic action.
- .3 Use bronze unions and/or flanges where piping of dissimilar metals are connected.

END OF SECTION

Standpipe & Fire Hose

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements.

1.2 SECTION INCLUDES

- .1 Standpipe network.
- .2 Fire hose cabinets.

1.3 REFERENCES

- .1 FM - Factory Mutual Approval Guide.
- .2 NFPA 10 - Portable Fire Extinguishers.
- .3 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .4 ULC - Fire Protection Equipment Directory.
- .5 ITS (Intertek Testing Services) - Certification Listings.

1.4 REGULATORY REQUIREMENTS

- .1 Conform to OBC and OFC.
- .2 Standpipe and Hose Systems: Conform to NFPA 14.
- .3 Welding Materials and Procedures: Conform to ASME Code.
- .4 Valves: Bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- .5 Equipment and Components: Bear ULC and FM label or marking.
- .6 Products Requiring Electrical Connection: CSA Listed and classified by Underwriters Laboratories of Canada Inc., as suitable for the purpose specified and indicated.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 21 01 01: Procedures for submittals.
- .2 Product Data: Provide manufacturer's catalogue sheet for equipment indicating rough-in size, finish, and accessories.
- .3 Shop Drawings: Indicate supports, components, accessories, and sizes. Submit shop drawings and product data to Owner's insurance underwriter for approval. Submit proof of approval to Consultant.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Section 21 01 01: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components.
- .3 Operation Data: Include manufacturer's data.
- .4 Maintenance Data: Include servicing requirements and test schedule.
- .5 Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.7 QUALITY ASSURANCE

- .1 Perform Work to NFPA 14. Maintain one copy on site.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

- .1 Transport, handle, store, and protect products.
 - .2 Deliver and store products in shipping packaging until installation.
-

Standpipe & Fire Hose

1.9 EXTRA MATERIALS

- .1 Provide two of hose nozzles.
- .2 Provide two of valve stem packings for each size and type of valve installed.

2 PRODUCTS

2.1 ABOVE GROUND PIPING

- .1 Steel Pipe: ASTM A53; Schedule 10.
 - .1 joined by welding or by roll grooved pipe and fittings:
 - .1 schedule 10 for sizes 5" (125mm) and smaller,
 - .2 0.134" (3.40mm) for 6" (150mm) diameter,
 - .3 0.188" (4.78mm) for 8" and 10" (200mm and 250mm) diameter.
 - .2 joined with threaded fittings or cut groove pipe and fittings:
 - .1 schedule 40 for sizes 6" (150mm) diameter and smaller,
 - .2 schedule 30 for sizes 8" (200mm) diameter and larger.
- .2 Pipe Fittings:
 - .1 Steel Fittings: ASME B16.9, wrought steel, buttwelded;.
 - .2 Cast Iron Fittings: ASME B16.1, flanges and flanged fittings;.
 - .3 Malleable Iron Fittings: ASME B16.3, threaded fittings.
 - .4 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .5 Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocket and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

2.2 PIPE HANGERS AND SUPPORTS

- .1 Conform to NFPA 14.
- .2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 40 mm): Carbon steel, adjustable swivel, split ring.
- .3 Hangers for Pipe Sizes 2" (50 mm) and Over: Carbon steel, adjustable, clevis.
- .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .5 Wall Support for Pipe Sizes to 3-1/4" (80 mm): Cast iron hook.
- .6 Wall Support for Pipe Sizes 4" (100 mm) and Over: Welded steel bracket and wrought steel clamp.
- .7 Vertical Support: Steel riser clamp.
- .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.3 VALVES - GENERAL

- .1 cUL or ULC and FM approved, listed and labelled.
 - .2 All valves controlling connections to water supplies shall be listed indicating valves.
 - .3 Conform to requirements of ANSI, ASTM, ASME, and applicable MSS standards.
 - .4 Provide valves of the same manufacturer where possible.
 - .5 Manufacturer's name and pressure rating clearly marked on body to MSS-SP-25.
 - .6 All valves supplied for this project shall have a current and valid Canadian Registration Number for the Province of Ontario with TSSA. Suppliers shall provide a copy of the Statutory Declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration. This shall be included with the shop drawing submittal package.
 - .7 Materials:
 - .1 Bronze: ASTM B62 or B61 as applicable
 - .2 Brass: ASTM B283 C3770
 - .3 Cast Iron: ASTM A126 Class B
 - .8 End Connections:
 - .1 Threaded ends: ANSI B1.20.1
 - .2 Flanged ends: ANSI B16.1 (Class 125), ANSI B16.5
-

Standpipe & Fire Hose

- .3 Face-to-face dimensions: ANSI B16.10
- .9 Design and Testing:
 - .1 Bronze Gate & Check valves: MSS-SP-80
 - .2 Cast Iron Gate Valves: MSS-SP-70
 - .3 Cast Iron Globe Valves: MSS-SP-85
 - .4 Cast Iron Check: MSS-SP-71
 - .5 Butterfly Valves: MSS-SP-67
- .10 Acceptable manufacturers:
 - .1 Kitz
 - .2 Crane, Jenkins.
 - .3 Conbraco.
 - .4 Nibco

2.4 ISOLATION VALVES

- .1 Electrically Supervised: ULC listed, FM approved, NO/NC SPDT dry contact switch suitable for electrical supervision on trouble circuit of facility fire alarm system. Valve monitoring switches shall be Potter Electric Signal and Manufacturing Limited or equivalent.
- .2 Up to 2" (50 mm):
 - .1 Construction: ULC listed, FM approved, 300 psig non-shock WOG, ASTM B62 bronze body, solid wedge disc, rising stem, bronze trim, threaded ends, Kitz #25
- .3 2-1/2" (65 mm) and Larger:
 - .1 Construction: ULC listed, FM approved, 175 psi 1210 kPa CWP, outside screw and yoke, cast iron body, stem with ACME double threads, tapered solid wedge disc, flanged ends, renewable bronze seat rings.

2.5 CHECK VALVES

- .1 2-1/2" (65 mm) and Larger:
 - .1 Construction: ULC listed, FM approved, 175psi (1210 kPa)CWP, iron body and bolted cap, bronze trim, bronze swing disc with replaceable bronze seat rings, flanged ends.
- OR**
- .2 Construction: ULC listed, FM approved, 175 psi (1210 kPa), Cast Iron body, 316 stainless steel shaft, Double Door Bronze Disc to B-62, Buna seat, 316 stainless steel spring, wafer style.

2.6 DRAIN VALVES

- .1 Construction: ULC listed and FM approved, brass ball valve with cap and chain, 3/4" (20 mm) hose thread.

2.7 HOSE VALVES

- .1 Hose Station Valve: Angle type, chrome plated finish, 1-1/2" (40 mm) nominal size with automatic ball drip.
- .2 Hose Connection Valve: Angle type; chrome plated finish; 2-1/2" (65 mm) size, thread to match fire department hardware, 2 070 kPa working pressure, with threaded cap and chain of same material and finish.
- .3 Pressure Reducing Valve: Angle type; chrome plated finish with inner hydraulic controls; 1-1/2" (40 mm) size, thread to match fire department hardware, 2 760 kPa inlet pressure, with threaded cap and chain of same material and finish.

2.8 FIRE HOSE CABINETS

- .1 Manufacturer: Nathional Fire Equipment Model Knight 200-2.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Wilson Cousins.
-

Standpipe & Fire Hose

- .2 CEB
- .3 Hose Cabinets:
 - .1 Style: Recessed mounted.
 - .2 Tub: 18 gauge steel, 30" x 30" x 8" deep, baked white enamel finish
 - .3 Door: 14-ga. steel adjustable door & trim, concealed hinge, flush stainless steel latch
 - .4 Door glass: full panel, 1/4" (6 mm) "Lexan" glass
- .4 Hose Rack: Steel; with polished chrome finish; swivel type with pins and water stop.
- .5 Hose: 40 mm 1-1/2 inch diameter, 30 m 100 feet long, of polyurethane lined synthetic hose; mildew and rot-resistant.
- .6 Nozzle: Chrome plated brass; combination fog, straight stream, and adjustable shut-off.
- .7 Fire Extinguisher: Refer to Section 15305.

3 EXECUTION

3.1 PREPARATION

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and foreign material, from inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.2 PIPING INSTALLATION

- .1 Install piping to NFPA 13 for sprinkler systems,
 - .2 Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
 - .3 Install piping to conserve building space, to not interfere with use of space and other work.
 - .4 Group piping whenever practical at common elevations.
 - .5 Sleeve pipes passing through partitions, walls, and floors.
 - .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - .7 Inserts:
 - .1 Provide inserts for placement in concrete formwork.
 - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm.
 - .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - .5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
 - .8 Pipe Hangers and Supports:
 - .1 Install to NFPA 13.
 - .2 Install hangers to provide minimum 1/2" (15 mm) space between finished covering and adjacent work.
 - .3 Place hangers within 12" (300 mm) of each horizontal elbow.
 - .4 Use hangers with 1-1/2" (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - .5 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - .6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - .7 Provide copper plated hangers and supports for copper piping.
 - .9 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
 - .10 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding, maximum VOC content of 250 g/L..
 - .11 Do not penetrate building structural members unless indicated.
 - .12 Provide sleeves when penetrating footings. Seal pipe and sleeve penetrations to achieve fire
-

Standpipe & Fire Hose

- .13 resistance equivalent to fire separation required.
- .13 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .14 Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- .15 Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- .16 Provide ball valves for shut-off or isolating service.
- .17 Provide drain valves at main shut-off valves, low points of piping and apparatus.
- .18 All control, drain and test connection valves shall be provided with permanently engraved and marked weatherproof metal or rigid plastic identification signs, secured with weather resistant chain or other approved method.

3.3 HOSE CABINETS INSTALLATION

- .1 Install to manufacturer's instructions.
- .2 Install to NFPA 14.
- .3 Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal surface) 66" (1675 mm) above finished floor.
- .4 Locate hose station valve in cabinet at 60" (1500 mm) above floor. Locate hose connection valve below hose station valve and not closer than 4" (100 mm) from side or bottom of cabinet.
- .5 Locate pump tank fire extinguisher in cabinet.
- .6 Connect standpipe system to water source ahead of domestic water connection.
- .7 Where static pressure exceeds 100 psi (690 kPa) but is less than 100 psi (690 kPa) at any hose station, provide pressure orifice disc in discharge of hose station valve to prevent pressure on hose exceeding 100 psi (690 kPa).
- .8 Where static pressure exceeds 100 psi (690 kPa) at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi (620 kPa).
- .9 Provide two way fire department outlet connection on roof.
- .10 Flush entire system of foreign matter.

3.4 FIELD QUALITY CONTROL

- .1 Test entire system to NFPA 14.
- .2 Test shall be witnessed by authority having jurisdiction.

END OF SECTION

Sprinkler Systems

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 21 01 01

1.2 SECTION INCLUDES

- .1 System design, installation, and certification.
- .2 Wet-pipe sprinkler assembly.

1.3 REFERENCES

- .1 NFPA 13 - Installation of Sprinkler Systems
- .2 NFPA 13A - Inspection, Testing and Maintenance of Sprinkler Systems
- .3 NFPA 15 - Water Spray Fixed Systems
- .4 NFPA 16 - Installation of Deluge Foam-Water Sprinkler System and Foam-Water Spray Systems
- .5 NFPA 16A - Installation of Closed-Head Foam-Water Sprinkler Systems
- .6 NFPA 25 - Water Based Fire Protection Systems
- .7 NFPA 26 - Supervision of Valves Controlling Water Supplies
- .8 NFPA 72 - Installation, Maintenance and Use of Protective Signalling Systems
- .9 NFPA 72E - Automatic Fire Detectors
- .10 NFPA 72G - Installation, Maintenance and Use of Notification Appliances for Protective Signalling Systems
- .11 NFPA 72H - Testing Procedures for Local, Auxiliary, Remote Station and Proprietary Protective Signaling Systems
- .12 NFPA 75 - Protection of Electronic Computer/Data Processing Equipment
- .13 NFPA 231 - General Storage
- .14 NFPA 231C - Rack Storage of Materials
- .15 NFPA 291 - Fire Flow Testing and Marking of Hydrants
- .16 FM - Factory Mutual Approval Guide.
- .17 ULC/ORD C263.1 Sprinkler-Protected Windows Systems
- .18 ULC - Fire Resistance Directory.
- .19 UL 199 - Automatic Sprinklers for Fire-Protection Service.

1.4 SYSTEM DESCRIPTION

- .1 System to provide coverage for entire building addition.
- .2 Provide system to Owner's Insurer's occupancy requirements.
- .3 Determine volume and pressure of incoming water supply from water flow test data.
- .4 Interface system with building fire alarm system.
- .5 Provide fire department connections where indicated.

1.5 SUBMITTALS FOR REVIEW

- .1 Product Data: Provide data on following components including manufacturers catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
 - .1 sprinkler alarm valves
 - .2 flow switches
 - .3 low pressure alarm switch
 - .4 ball drain valve
 - .5 sprinkler heads
 - .6 shut-off valves
- .2 Preliminary layout: show finished ceiling areas indicating sprinkler locations coordinated with ceiling installation.
- .3 Hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories, indicating:
 - .1 Sheet number.

Sprinkler Systems

- .2 Sprinkler description and discharge constant K.
- .3 Hydraulic reference points.
- .4 Flow l/s.
- .5 Pipe size.
- .6 Pipe lengths, centre to centre of fittings.
- .7 Equivalent pipe lengths for fitting and devices.
- .8 Friction loss in kPa at each reference point.
- .9 Total friction loss between reference points.
- .10 Elevation head in kPa at each reference point.
- .11 Required pressure in kPa at each reference point.
- .12 Velocity pressure and normal pressure if included in calculations.
- .13 Notes to indicate starting points, reference to other sheets or to clarify data shown.
- .14 Semi-logarithmic graph paper indicating water supply curves and systems requirements plus inside and outside hose requirements so as to present a graphic summary of complete hydraulic calculations.
- .4 Layout and Installation Drawings: Clearly indicate:
 - .1 Name and department or agency
 - .2 Location, including street address.
 - .3 Point of compass
 - .4 Ceiling construction.
 - .5 Full height cross section.
 - .6 Location of fire walls.
 - .7 Occupancy of each area or room.
 - .8 Location and size of blind spaces and closets.
 - .9 Any questionable small enclosures in which no sprinklers are to be installed.
 - .10 Size of city main in street, pressure and whether dead-end or circulating and if dead-end, direction and distance to nearest circulating main, with city main test results.
 - .11 Other sources of water supply, with pressure or elevation.
 - .12 Make, type and orifice size of sprinklers.
 - .13 Temperature rating and location of high temperature sprinklers.
 - .14 Number of sprinklers on each riser and on each zone by floors, and total area protected by each zone on each floor.
 - .15 Number of sprinklers on each riser and total per floor.
 - .16 Make, type, model and size of alarm valves.
 - .17 Arrangement and operation of system controls.
 - .18 Kind and location of alarm bells.
 - .19 Cutting lengths of pipe or centre to centre dimensions.
 - .20 Crosses, riser nipples and sizes.
 - .21 Type of hangers, inserts and sleeves.
 - .22 All control valves, checks, drain pipes and test pipes.
 - .23 Small hand hose and hose equipment.
 - .24 When plans include underground pipe indicate: weight or class and size of pipe pits; depth of top of pipe below grade.
 - .25 Provisions for flushing.
 - .26 Name and address of contractor
 - .27 A summary sheet, clearly indicating:
 - .1 Date.
 - .2 Location.
 - .3 Name of department of agency.
 - .4 Building number or other identification.
 - .5 Description of hazard.
 - .6 Name and address of contractor or designer.
 - .7 Name of approving agency.
 - .8 System design requirements, including design area of water application, minimum rate of application and area per sprinkler.
 - .9 Total water requirements as calculated including allowance for inside hose and outside hydrants.

Sprinkler Systems

- .10 Water supply information.
- .5 Submit shop drawings to Owner's insurance underwriter and authorities having jurisdiction for approval. Submit proof of approval to Consultant.
- .6 Samples: Submit two of each style of sprinkler specified.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- .2 Contractor's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- .3 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- .4 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

- .1 Perform Work to OBC, NFPA 13 and Owner's Insurer's requirements. Maintain one copy on site.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.
- .4 Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to OBC, OFC, ULC.
- .2 Sprinkler Systems: Conform to NFPA 13.
- .3 Valves: Bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- .4 Equipment and Components: Bear ULC and FM label or marking.
- .5 Products Requiring Electrical Connection: CSA Listed and classified by Underwriters Laboratories of Canada Inc., as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND PROTECTION

- .1 Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 EXTRA MATERIALS

- .1 Provide extra sprinklers to NFPA 13.
- .2 Provide suitable wrenches for each sprinkler type.
- .3 Provide two of valve stem packings for each size and type of valve installed.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Viking.
- .2 Reliable.
- .3 Tyco - Central.
- .4 Tyco - Grinnel (GEM).
- .5 Substitutions: Refer to Section 01 62 00.

Sprinkler Systems

2.2 SPRINKLERS

- .1 Suspended Ceiling:
 - .1 Type: Semi-recessed pendant type with matching push on escutcheon plate.
 - .2 Finish: Chrome plated.
 - .3 Escutcheon Plate Finish: Chrome plated.
 - .4 Fusible Link: Glass bulb type temperature rated for specific area hazard.
- .2 Exposed Area Type:
 - .1 Type: Standard upright type with guard.
 - .2 Finish: Brass.
 - .3 Fusible Link: Glass bulb type temperature rated for specific area hazard.
- .3 Concealed Pendant:
 - .1 Cover plate attachment with 1/2" (13mm) assembly adjustment.
 - .2 Smooth aesthetic ceiling profile.
 - .3 Factory installed protective cap.
 - .4 Factory painted (confirm colour with architect prior to ordering)

2.3 PIPING SPECIALTIES

- .1 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- .2 Supervisory Switches: As manufactured by Potter.

2.4 ABOVE GROUND PIPING

- .1 Steel Pipe: ASTM A53; Schedule 10.
 - .1 joined by welding or by roll grooved pipe and fittings:
 - .1 schedule 10 for sizes 5" (125mm) and smaller,
 - .2 0.134" (3.40mm) for 6" (150mm) diameter,
 - .3 0.188" (4.78mm) for 8" and 10" (200mm and 250mm) diameter.
 - .2 joined with threaded fittings or cut groove pipe and fittings:
 - .1 schedule 40 for sizes 6" (150mm) diameter and smaller,
 - .2 schedule 30 for sizes 8" (200mm) diameter and larger.
- .2 Pipe Fittings:
 - .1 Steel Fittings: ASME B16.9, wrought steel, buttwelded;.
 - .2 Cast Iron Fittings: ASME B16.1, flanges and flanged fittings;.
 - .3 Malleable Iron Fittings: ASME B16.3, threaded fittings.
 - .4 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .5 Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocket and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

2.5 PIPE HANGERS AND SUPPORTS – corrosion resistance

- .1 Conform to NFPA 13.
- .2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 40 mm): Carbon steel, adjustable swivel, split ring.
- .3 Hangers for Pipe Sizes 2" (50 mm) and Over: Carbon steel, adjustable, clevis.
- .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .5 Wall Support for Pipe Sizes to 3-1/4" (80 mm): Cast iron hook.
- .6 Wall Support for Pipe Sizes 4" (100 mm) and Over: Welded steel bracket and wrought steel clamp.
- .7 Vertical Support: Steel riser clamp.
- .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.6 VALVES - GENERAL

- .1 cUL or ULC and FM approved, listed and labelled.

Sprinkler Systems

- .2 All valves controlling connections to water supplies shall be listed indicating valves.
- .3 Conform to requirements of ANSI, ASTM, ASME, and applicable MSS standards.
- .4 Provide valves of the same manufacturer where possible.
- .5 Manufacturer's name and pressure rating clearly marked on body to MSS-SP-25.
- .6 All valves supplied for this project shall have a current and valid Canadian Registration Number for the Province of Ontario with TSSA. Suppliers shall provide a copy of the Statutory Declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration. This shall be included with the shop drawing submittal package.
- .7 Materials:
 - .1 Bronze: ASTM B62 or B61 as applicable
 - .2 Brass: ASTM B283 C3770
 - .3 Cast Iron: ASTM A126 Class B
 - .4 Stainless Steel – All Ball Valves
- .8 End Connections:
 - .1 Threaded ends: ANSI B1.20.1
 - .2 Flanged ends: ANSI B16.1 (Class 125), ANSI B16.5
 - .3 Face-to-face dimensions: ANSI B16.10
- .9 Design and Testing:
 - .1 Bronze Gate & Check valves: MSS-SP-80
 - .2 Cast Iron Gate Valves: MSS-SP-70
 - .3 Cast Iron Globe Valves: MSS-SP-85
 - .4 Cast Iron Check: MSS-SP-71
 - .5 Butterfly Valves: MSS-SP-67
- .10 Acceptable manufacturers:
 - .1 Kitz
 - .2 Nibco

2.7 ISOLATION VALVES

- .1 Electrically Supervised: ULC listed, FM approved, NO/NC SPDT dry contact switch suitable for electrical supervision on trouble circuit of facility fire alarm system. Valve monitoring switches shall be Potter Electric Signal and Manufacturing Limited or equivalent.
- .2 Up to 2" (50 mm):
 - .1 Construction: ULC listed, FM approved, 300 psig non-shock WOG, ASTM B62 bronze body, solid wedge disc, rising stem, bronze trim, threaded ends, Kitz #25
- .3 2-1/2" (65 mm) and Larger:
 - .1 Construction: ULC listed, FM approved, 175 psi 1210 kPa CWP, outside screw and yoke, cast iron body, stem with ACME double threads, tapered solid wedge disc, flanged ends, renewable bronze seat rings.

2.8 CHECK VALVES

- .1 2-1/2 " (65 mm) and Larger:
 - .1 Construction: ULC listed, FM approved, 175psi (1210 kPa)CWP, iron body and bolted cap, bronze trim, bronze swing disc with replaceable bronze seat rings, flanged ends.

OR

 - .2 Construction: ULC listed, FM approved, 175 psi (1210 kPa), Cast Iron body, 316 stainless steel shaft, Double Door Bronze Disc to B-62, Buna seat, 316 stainless steel spring, wafer style.

2.9 DRAIN VALVES

- .1 Construction: ULC listed and FM approved, brass ball valve with cap and chain, 3/4" (20 mm) hose thread.

3 EXECUTION

3.1 PREPARATION

Sprinkler Systems

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and foreign material, from inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.2 PIPING INSTALLATION

- .1 Install piping to NFPA 13 for sprinkler systems,
- .2 Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- .3 Install piping to conserve building space, to not interfere with use of space and other work.
- .4 Group piping whenever practical at common elevations.
- .5 Sleeve pipes passing through partitions, walls, and floors.
- .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .7 Inserts:
 - .1 Provide inserts for placement in concrete formwork.
 - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm.
 - .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - .5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- .8 Pipe Hangers and Supports: corrosion resistance
 - .1 Install to NFPA 13.
 - .2 Install hangers to provide minimum 1/2" (15 mm) space between finished covering and adjacent work.
 - .3 Place hangers within 12" (300 mm) of each horizontal elbow.
 - .4 Use hangers with 1-1/2" (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - .5 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - .6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - .7 Provide copper plated hangers and supports for copper piping.
- .9 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .10 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding, maximum VOC content of 250 g/L..
- .11 Do not penetrate building structural members unless indicated.
- .12 Provide sleeves when penetrating footings. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- .13 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .14 Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- .15 Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- .16 Provide ball valves for shut-off or isolating service.
- .17 Provide drain valves at main shut-off valves, low points of piping and apparatus.
- .18 All control, drain and test connection valves shall be provided with permanently engraved and marked weatherproof metal or rigid plastic identification signs, secured with weather resistant chain or other approved method.

3.3 SPRINKLER EQUIPMENT INSTALLATION

- .1 Install to NFPA 13.

Sprinkler Systems

- .2 Install equipment to manufacturers instructions.
- .3 Install buried shut-off valves in valve box. Provide post indicator.
- .4 Place pipe runs to minimize obstruction to other work.
- .5 Place piping in concealed spaces above finished ceilings.
- .6 Centre sprinklers in two directions in ceiling tile and provide piping offsets as required.
- .7 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- .8 Flush entire piping system of foreign matter.
- .9 Hydrostatically test entire system.
- .10 Require test be witnessed by Fire Marshall.

3.4 INTERFACE WITH OTHER PRODUCTS

- .1 Ensure required devices are installed and connected as required to fire alarm system.

3.5 OPERATING SEQUENCE FOR WET SPRINKLERS

- .1 In Normal Set Condition: The system piping is filled with water.
 - .1 All water supply control valves open and secured.
 - .2 Alarm test shut-off valve in "ALARM" position.
 - .3 Water gauge valves open.
 - .4 The water supply pressure gauge (lower gauge) equals that of the known service-line pressure. The system pressure gauge (upper gauge) reading is equal to or greater than the water supply pressure gauge reading.
 - .5 Incoming power to all alarm switches on.
 - .6 Main-drain valve, auxiliary drain valves and inspectors test valves tightly closed.
 - .7 The sprinkler head cabinet contains appropriate replacement sprinklers and wrenches.
 - .8 Temperature maintained above freezing for entire system.
 - .9 If Fire Department connection is used, make sure the automatic drip valve is free allowing accumulated water to escape.
 - .10 Sprinklers in good condition and unobstructed.
- .2 In Fire Condition:
 - .1 The heat produced operates a sprinkler allowing the water to flow.
 - .2 The alarm valve clapper is opened by the flow of water allowing pressurized water to enter the alarm port to activate the connected alarm devices.
 - .3 When using variable pressure trim the water flowing through the alarm port overcomes the retarding chamber's drain restriction, filling the retarding chamber then activating the connected alarm devices.
 - .4 The alarms will continue to sound until the flow of water is manually turned off.
- .3 In Service condition:
 - .1 The system should be placed out of service only for repairs.
 - .2 The work to be done must be completed in a manner to minimize the time that the system must be out of service.
 - .3 All hazardous activities in the effected area shall be terminated until the system is placed back in service.
 - .4 Any system impairment shall be coordinated with the Owner, local authority having jurisdiction and other related parties.
 - .5 Provide a roving fire patrol in the area covered by the system until the system is back in service.
 - .6 Prior to turning off any valves or activating any alarms, notify local security guards and/or central alarm station so that a false alarm will not be signalled and result in a local fire department response.

3.6 TESTING AND INSPECTION

- .1 Test automatic sprinkler in accordance with requirements of NFPA 13 and NFPA 25.
 - .1 hydrostatically tested at 50 psi (3.5 bar) in excess of system working pressure and minimum

Sprinkler Systems

- test pressure of 200 psi (13.8 bar) for 2-hr.
- .2 when cold weather prevents testing with water, an interim test may be conducted with air. The hydrostatic test with water must be conducted subsequently when conditions permit.
- .3 modifications affecting fewer than 20 sprinklers and modifications that can not be isolated shall not require testing in excess of system working pressure. Modifications affecting more than 20 sprinklers shall be isolated and tested at not less than 200 psi (13.8 bar) for 2-hr.
- .4 loss shall be determined by a drop in gauge pressure or by visible leakage.
- .2 Arrange and pay for all reviews and inspections required by:
 - .1 Local Inspection Authority.
 - .2 Owner's Insurance Authority.
- .3 Coordinate testing of automatic sprinkler systems with fire alarm system verification to ensure that all devices are fully tested.

END OF SECTION

General Requirements

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and conform to:
 - .1 The Contract CCDC 2-2020, Stipulated Price Contract as amended,
 - .2 Division 1 requirements and documents referred to therein.
- .2 The technical Sections of this Division are generally divided into units of work for the purpose of ready reference. The division of the work among subcontractors is not the Consultant's responsibility and the Consultant assumes no responsibility to act as an arbiter and/or to establish subcontract limits between any Sections of the work.
- .3 The specifications are integral with the drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one but implied in the other is fully and properly required.
- .4 Wherever differences occur in the tender documents, the most onerous condition governs. Base the bid on the most costly arrangement.
- .5 Ensure Sub-contractors undertaking the work of Division 22 provide a 50% performance bond and a 50% labour and materials payment bond. In addition, ensure Sub-contractors employed to undertake any part of the work of Division 22 that is \$50,000.00 or greater in contract value provide a 50% performance bond and a 50% labour and materials bond to the party they are in contract with.

1.2 DEFINITIONS

- .1 The following are definitions of words found in this specification and on associated drawings under this Division:
 - .1 "Concealed" locations hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.
 - .2 "Exposed" mechanical work normally visible to building occupants.
 - .3 "Furnish" (and its derivatives) has the same meaning as the term "Supply".
 - .4 "Install" (and its derivatives) - receive, store and handle at the site, mount and support and connect all required services. Includes adjustment and calibration, testing, commissioning, inspection by authorities having jurisdiction and documentation.
 - .5 "Provide" (and its derivatives) - supply, install in place, connect the associated required services ready for operation, adjust and calibrate, test, commission, warrant, and document. Includes inspection by authorities having jurisdiction.
 - .6 "Supply" (and its derivatives) purchase and deliver to the site for installation. Includes submittals, manufacturer's field inspection and warranty.
 - .7 "Wet" locations exposed to moisture, requiring special materials and arrangement.

1.3 WORK INCLUDED

- .1 Products and methods mentioned or shown in the Contract Documents complete with incidentals necessary for a complete operating installation. Provide all tools, equipment and services required to do the work.
- .2 Cutting and patching of new or existing work.
- .3 Identification of equipment, piping, valves and controllers.
- .4 Take such measures and include in Bid Price for the proper protection of the existing building and its finishes at all times during alterations and construction of the new addition. Coordinate this protective work with all trades.
- .5 Verify the correct operation of each equipment item provided and/or altered and each system in total and obtain the Owner's approval prior to starting and/or returning to operation.

1.4 SUBMITTALS

- .1 Shop Drawings: Prepare and submit two (2) copies of shop drawings of major equipment items

General Requirements

(including those items specifically indicated under Part 1: General of each Section), to the Consultant for review. The Consultant will return one copy, marked with comments and his review stamp as he deems appropriate. Prepare the necessary number of copies of the returned set and distribute to the Owner, the Prime Consultant, the General Contractor, the site, and to subcontractors and suppliers.

- .1 Clearly indicate manufacturer's and supplier's names, catalogue model numbers, details of construction, accurate dimensions, capacities and performance. Prior to submission check and certify as correct, shop drawings and data sheets. Do not order equipment until a copy of the shop drawings, reviewed by Consultant, has been returned to Contractor.
- .2 Clearly indicate the weight, location, method of support and anchor point forces and locations for each piece of equipment on shop drawings.
- .3 The Consultant will not review shop drawings that fail to bear the Contractor's stamp of approval or certification.
- .4 Read the following in conjunction with the wording on the shop drawing review stamp applied to each and every drawing submitted:
"This review by the Consultant is for the sole purpose of ascertaining conformance with general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub trades."
- .2 As-Built Records: Prepare and submit complete as-built records prior to Substantial Performance of the Contract. Refer to paragraph 3.2.5 and to Division 1 for requirements.
- .3 Requests for Shut-Down: Obtain permission for systems shut-down and/or service interruption from the Owner prior to disruption of any system or service in use by the Owner. Employ the Owner's standard form of request where available. Refer to Division 1 for additional requirements.
- .4 Requests for Start-up: Obtain permission from the Owner to start-up or to return to service any item of equipment, system or service installed new or previously shut-down. Refer to Division 1 for additional requirements.

1.5 QUALITY ASSURANCE

- .1 Conform to minimum requirements or better of provincial and local codes, where existing, and to requirements of local inspection authorities for execution of work under this Division.
- .2 Ensure materials supplied under this Division conform to minimum requirements and recommendations or better of applicable standards of the following:
 - .1 ASTM American Society of Testing and Materials
 - .2 AWWA American Water Works Association
 - .3 CAN2 National Standard of Canada (Published by CGSB)
 - .4 CAN3 National Standard of Canada (Published by CSA)
 - .5 CGSB Canadian General Standards Board
 - .6 CSA Canadian Standards Association
 - .7 NBC National Building Code of Canada
 - .8 OBC Ontario Building Code
 - .9 TIAC Thermal Insulation Association of Canada
 - .10 ULC Underwriter's Laboratories of Canada Ltd
 - .11 UL Underwriter's Laboratories (including cUL)
- .3 Use latest editions and amendments in effect on date of Bid call subject to requirements of OBC.
- .4 Arrange and pay for permits and inspections by authorities having jurisdiction, required in the undertaking of this Division. Make modifications required by authorities.
- .5 All tradesmen employed on the project shall hold valid trade certificates/licenses and shall make a copy available for review by the Consultant and/or Owner when requested.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

General Requirements

- .1 Immediately after letting of contract, review material and equipment requirements for this work, determine supply and delivery dates for all items, and notify Consultant of any potential delays in completion of this project in order that remedial action may be taken.
- .2 Store neatly out of the way and protected from damage and theft, materials and equipment supplied under this Division that are received at the site by this Division.

1.7 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.8 INTERRUPTIONS

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

1.9 WARRANTY

- .1 Refer to Division 01 and to Section 22 00 01 General Requirements.
- .2 Arrange with each manufacturer/supplier to extend warranties as necessary to coincide with warranty period or those periods specified.

1.10 EXTRAS AND CREDITS

- .1 Accompany all price submissions requested by Consultant for extra work, or work to be deleted, with a complete cost breakdown as follows:
 - .1 Materials, quantities and unit costs including any applicable contractor's trade discount clearly identified.
 - .2 Labour hours and unit costs.
 - .3 Total materials and labour costs.
 - .4 Overhead and profit mark-ups in accordance with the General Conditions of the Contract.

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Ensure materials and equipment provided under this Division are new and free from defects and bear labels of approval as required by codes referred to in this Division and/or by inspection authorities.
- .2 Ensure apparatus and equipment provided under this Division bears manufacturer's nameplate indicating name of manufacturer, model number or type, size, capacity, CRN, and other pertinent information. Ensure nameplates are easily read and clearly visible, with openings provided where equipment is insulated.
- .3 Ensure manufacturers and suppliers of equipment or materials under this Division determine if their products are composed of any hazardous materials. If they are, the products are suitably labeled and

General Requirements

supplied with Material Safety Data sheets. Obtain the Owner's approval in writing to bring hazardous materials onto the site prior to doing so.

- .4 When utilizing any products that are hazardous, keep Material Safety Data sheets on file at the job site and present them to anyone requesting this information. When transferring hazardous materials from original container into other containers, provide Workplace Labels on such containers.

2.2 ACCEPTABLE PRODUCTS

- .1 First item named or specified by catalogue number meets specifications regarding performance, quality of material and workmanship, and is acceptable to the Consultant.
- .2 Items, other than first named, meeting specifications regarding quality of materials and workmanship are acceptable to the Consultant, only, if they also meet performance and/or capacities specified and can be accommodated within the space allotted.
- .3 General approval indicated by inclusion of other manufacturers named is subject to final review of shop drawings, performance data and test reports.

2.3 EQUIVALENTS AND ALTERNATIVES

- .1 Suppliers wishing approval for additional equipment items as equivalent to those specified must submit complete description, technical and performance data to Consultant at least ten (10) working days prior to Bid closing date. Such equivalent equipment, if accepted, to conform to specifications with regard to all details, accessories, modifications, features and performance. Deviations from specifications must be stated in writing at time of submission for approval.
- .2 Bid Prices shall include only products specified or approved equivalents. Contractors may propose unsolicited alternatives to the products specified. Alternative proposals shall be submitted in sealed envelope at time of general contract Bid submission and shall include full description and technical data, and a statement of the related increase or decrease in Bid Price should alternatives be accepted. All additional costs associated with unsolicited alternative proposals such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in alternative price. Prior approval by Consultant is not required for unsolicited alternative proposals.
- .3 Where the Contractor uses equipment other than that first named, on which the design is based, he shall be responsible for all details of installation including equipment size, arrangement, fit, and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by Contractor to provide such drawings will be considered indication that original arrangements and space allocations are adequate. All additional costs associated with equivalent equipment such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in Bid Price.

2.4 SUBSTITUTIONS DURING PROGRESS OF WORK

- .1 If during the progress of work, specified products are not obtainable, equivalent or similar products by other manufacturers may be permitted by Consultant.
- .2 Apply, in writing, to Consultant for substitution of any products, indicating the following:
 - .1 Manufacturer's name, model number, details of construction, accurate dimensions, capacities and performance of proposed products.
 - .2 Reason for substitution.
 - .3 Any revisions to the contract price made necessary by substitution.
 - .4 Any revisions to the contract time made necessary by substitution.
 - .5 Any revisions to layout, arrangement or services made necessary by substitution.
- .3 No substitutions will be permitted without written authorization from the Consultant.

2.5 CONSULTANT'S REVIEW

- .1 The consultants will review and evaluate unsolicited alternatives and substitutions proposed by the Contractor. Such review and evaluation work will be undertaken by the Consultant on an additional

General Requirements

fee basis. The Contractor shall reimburse the Owner for all costs associated with such reviews and evaluations.

- .2 The Contractor shall also reimburse the Owner for any and all costs incurred in updating Contract Documents to reflect such changes.

3 EXECUTION

3.1 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Provide materials to be built-in, such as sleeves, anchors, and inserts, together with templates and/or measurements, promptly when required by other trades.
- .3 Provide structural supports for equipment to be mounted on or in walls, supported above floors and/or suspended from the structure.

3.2 INSTALLATION REQUIREMENTS

- .1 The Consultant's drawings and instructions govern the location of all items. Prepare fully coordinated installation drawings prior to installation.
- .2 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise install products and services to follow building planes. Ensure installation permits free use of space and maximum headroom.
- .3 Confirm the exact location of outlets, fixtures and connections. Confirm location of outlets for equipment supplied under other Divisions.
- .4 Install equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
- .5 Provide suitable shielding and physical protection for devices.
- .6 Install products and services in accordance with the manufacturer's requirements and/or recommendations.
- .7 Provide bases, supports, hangers and fasteners. Secure products and services so as not to impose undue stresses on the structure and systems.
- .8 Do not use power activated tools without written permission of the Consultant. Use them in accordance with the Owner's health and safety policies.
- .9 Ensure that the load onto structures does not exceed the maximum loading per square metre indicated on the structural drawings or as directed by the Consultant.

3.3 CONTRACT DRAWINGS

- .1 The drawings of this Division are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- .2 Obtain accurate dimensions from the architectural and structural drawings, or by measurement. Location and elevation of services are approximate. Verify them before construction is undertaken.
- .3 Make changes where required to accommodate structural conditions, (beams, columns, etc.). Obtain Consultant's approval before proceeding.
- .4 Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Note that outlets and/or equipment may be relocated up to 10 feet (3 m) in any direction without a change to the contract price.
- .5 The drawings of this Division are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as shown on the mechanical documents. If there is a difference in quantity between the architectural and drawings of this Division, base the contract price on the greater quantity.

3.4 RECORD DRAWINGS

- .1 Maintain project "as-built" record drawings. Obtain white prints from the Consultant for this purpose

General Requirements

- and pay printing costs. Identify each set as "Project Record Copy".
- .2 Record deviations from contract documents caused by site conditions or by changes ordered by the Consultant. Record deviations in red ink clearly and accurately, using industry standard drafting procedures consistent with quality and standards of Consultants documents.
- .3 Record deviations as work progresses throughout the execution of this contract. Maintain record drawings on site in clean, dry, legible condition, making them available for periodic review by the Consultant.
- .4 Record location of concealed services, particularly underground services. Before commencing any backfilling, obtain accurate measurements and information concerning correct location and depth of services.
- .5 Transfer records from the "Project Record Copy" to a DVD in Autocad format matching the Consultant's documents. Arrange computer file in layers to exactly match the layering system of the Consultant.
- .6 Submit the "Project Record Copy" on one or more DVD with white prints of each drawing to the Consultant at the time of Substantial Performance.

3.5 COMMISSIONING

- .1 Refer to Section 01 80 50 Commissioning.
- .2 The Contractor shall start-up and completely commission all equipment and systems installed and/or modified under this contract. Commissioning work shall be completed to the satisfaction of the Consultant prior to acceptance of the Work or any part thereof.
- .3 The Commissioning Team shall be comprised of;
 - .1 Representatives of the Commissioning Coordinator (Commissioning Agent)
 - .2 The individual, company or agency undertaking the work of each Section,
 - .3 Representatives of the Contractor and his sub-contractors as required,
 - .4 Representatives of equipment manufacturers,
 - .5 Representatives of the Consultants,
 - .6 Representatives of the Owner.
- .4 The Contractor and his sub-contractors shall each assign an individual representing each of the relevant trades to the commissioning team and shall ensure that representatives of the equipment manufacturers are present during the relevant commissioning tasks.
- .5 The Contractor shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, test and commission each system provided as part of the Work.
- .6 Each Section shall prepare Check Sheets in accordance with the standards listed above and shall issue them to the commissioning team for use during the commissioning process.
- .7 Three (3) copies of commissioning manuals shall be provided, bound in hard cover D-ring binders with transparent cover on front and spine personalized to indicate;
 - .1 name and logo of Facility,
 - .2 name of the project,
 - .3 the Owner's project number,
 - .4 identification of the system commissioned,
 - .5 the date that the system was commissioned.
- .8 Commissioning manuals shall include machine printable index dividers to organize each manual by system and by commissioning stage.

END OF SECTION

Demolition & Renovations

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 WORK INCLUDED

- .1 Identification of existing services and utility connections.
- .2 Installation, protection and maintenance of temporary services as required to support continuing operation of the facility.
- .3 Disconnection and removal of various mechanical equipment in areas to be turned over to the Owner.
- .4 Disconnection and making safe of various mechanical systems and equipment in areas to be demolished and/or renovated.
- .5 Disposal of waste materials in accordance with waste management requirements.
- .6 Re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction including requirements for marking of equipment.

1.3 REGULATORY REQUIREMENTS

- .1 Notify all authorities of intent to demolish and schedule for the work. Obtain required permits from authorities.
- .2 Conform to all codes for demolition work, dust control, products requiring disconnection and re-connection.
- .3 Do not close or obstruct egress width to any building or site exit.
- .4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.
- .5 Conform to procedures applicable when hazardous or contaminated materials are discovered.
- .6 Arrange for re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction. This includes requirements for marking of equipment under rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

1.4 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.5 INTERRUPTIONS

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

Demolition & Renovations

1.6 PHASING AND SCHEDULING (NOT APPLICABLE)

- .1 Refer to Division 1 PHASING AND SCHEDULING OF THE WORK.
- .2 Coordinate with the work of all Sections of Division 15 with other trades and assist in the development of the Phasing Strategy.

3 EXECUTION

3.1 PREPARATION

- .1 Prior to start of work under this Section, ensure that the General Trades;
 - .1 Provide, erect, and maintain temporary barriers at locations indicated.
 - .2 Erect and maintain weatherproof closures for exterior openings.
 - .3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
 - .4 Prevent movement of structure; provide bracing and shoring.
- .2 Install, protect and maintain temporary services as required to support continuing operation of the facility.
- .3 Protect services and equipment which are not to be demolished.
- .4 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
- .5 Notify affected utility companies before starting work and comply with their requirements.
- .6 Mark location and termination of utilities.
- .7 Provide appropriate temporary signage including signage for exit or building egress.

3.2 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Remove and dispose of built-in items such as sleeves, anchors, and inserts.
- .3 Remove and dispose of bases, supports and anchors for piping, equipment and ductwork mounted on or in walls, supported above floors and/or suspended from the structure.

3.3 PROTECTION

- .1 Protect existing and new work to remain free from damage due to execution of work under this Division with tarpaulins and other protective coverings as necessary.
- .2 Repair any and all damage to the building and components resulting from failure to provide sufficient protection, to the satisfaction of the Consultant.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.4 DEMOLITION

- .1 Notify all authorities of intent to demolish and schedule for the work.
- .2 All demolition work shall conform to all codes, regulations, standards and by-laws applicable to the work.
- .3 Isolate and drain systems as required to effect demolition. Disconnect, cap and make safe all

Demolition & Renovations

- mechanical services to the building including, but not limited to; sanitary sewer(s), storm sewer(s), water service, natural gas service, steam service, condensate return, water supply to standpipe and sprinkler systems, fire suppression systems hot water heating systems, steam and condensate systems.
- .4 Protect existing equipment and services to remain from debris and unwanted materials. Clean as necessary to maintain service during demolition period and on completion of the work.
 - .5 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
 - .6 Remove and dispose of all redundant mechanical services and equipment within the limits of the demolition site and where demolished systems extend beyond these limits.
 - .7 Turn over items identified for recovery by the Owner.
 - .8 All demolition work shall conform to Occupational Health & Safety and Environmental regulations. Ensure that all parties are familiar with requirements and experienced in the work to be undertaken.
 - .9 Waste disposal shall conform to the requirements of Division 1, municipal By-Laws and Ministry of the Environment regulations and standards.
 - .10 All existing air intake and exhaust openings that may be affected by dust and/or debris from the demolition work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from demolition work with new filters.
 - .11 In the event that dust and debris from demolition work does penetrate the building and/or its air distribution systems, this Section shall be responsible for cleaning the affected areas and/or systems.
 - .12 Disconnect remove, cap and identify all utilities within demolition areas.
 - .13 Demolish in an orderly and careful manner. Protect existing supporting structural members.
 - .14 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
 - .15 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
 - .16 Remove temporary Work.

3.5 RENOVATIONS

- .1 Isolate and drain systems as required to effect renovations, modifications and/or repairs. On completion of renovations, modifications and/or repairs, test entire system as if new. Report repairs or replacements required of existing equipment, piping, fittings or devices that are not included in contract to Consultant and Owner for instruction. Flush, clean and refill renovated systems as specified for new.
- .2 Relocate or remove existing items so designated unless specifically indicated to be relocated or removed under other Sections.
- .3 Existing items to be relocated shall be cleaned and repaired or altered as required to suit new location. All damaged or ineffective parts shall be replaced and the item made "as new".
- .4 Existing items to be removed remain the property of the owner and shall be delivered to a location on site designated by the owner. If the owner declares no interest in the removed items, assume ownership and remove the items from the site.
- .5 Make good all surfaces and finishes in areas from which items have been removed and in which items are relocated. Cap all existing services required to be severed to effect alterations and do all other work necessary to make good such areas to satisfaction of consultant.
- .6 Openings in existing floor assemblies and vertical fire separations necessitated by installation of equipment and systems or construction in general must be temporarily sealed with fire barrier materials such as mineral wool or other noncombustible insulation.
- .7 If during alteration work existing asbestos material, other than known asbestos, is discovered (e.g. fireproofing, acoustic or thermal insulation, tank covering), stop work in the affected area and immediately notify consultant.

3.6 INSPECTION AND RE-CERTIFICATION

- .1 Where any equipment, machine or apparatus is modified, rebuilt or rewound with any change resulting in its performance or capacity rating and characteristics it shall be inspected and re-certified as required by authorities having jurisdiction.

Demolition & Renovations

- .2 A nameplate giving the name of the person or firm making the change and the resulting changes in performance or capacity shall be provided and affixed to the equipment, machine or apparatus adjacent to the original nameplate. Where the original nameplate is removed, the original manufacturer's name and original identifying data, such as serial numbers, shall be added to the nameplate.
- .3 Refer to rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

END OF SECTION

Common Work Results

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 COMMON WORK RESULTS

- .1 Section 22 05 00 applies to and governs all work of Division 22.

1.3 REFERENCE STANDARDS

- .1 Provide all work in accordance with requirements of Regulatory Agencies and conform to:
 - .1 Local and district by-laws, regulations and published engineering standards.
 - .2 the Ontario Building Code as amended,
 - .3 the Ontario Gas Utilization Code as amended
 - .4 Regulations for Construction Projects under the Occupational Health and Safety Act.
- .2 Conform to following CSA Standards:
 - .1 CSA B242 Groove and Shoulder Type: Mechanical Pipe Couplings.
 - .2 CAN1-B149.1 Natural gas and propane installation code.
 - .3 CSA B64.1 Manual for the Selection and Installation of Backflow Prevention Devices
 - .4 CSA B64.1 Manual for the Maintenance and Field Testing of Backflow Prevention Devices.
- .3 Conform to following National Research Council Canada publications:
 - .1 National Building Code of Canada and Supplements to National Building Code of Canada
 - .2 National Fire Code of Canada.
 - .3 Canadian Plumbing Code.
- .4 Provide work where indicated in conformance with guide Specification of the Victaulic System for Building Services, G-100.
- .5 The above documents or portions thereof are referenced within the work of Division 22 and shall be considered part of the requirements of this document as though fully repeated herein.

1.4 QUALIFICATIONS

- .1 Motor manufacturer: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- .2 Firestop Sealant Manufacturer: Company specializing in manufacture of sealants with minimum three years documented product development, testing, and manufacturing experience.
- .3 Firestop components and assemblies shall be ULC listed and tested in accordance with ULC S115 Standard Method of Fire Test for Firestop Systems.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 22 01 01 & 01 22 00.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products. Refer to Division 1 requirements as well.
- .2 Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WASTE MANAGEMENT & DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 1 Waste Management and Disposal, and with the Contractor's Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Common Work Results

1.8 WARRANTY

- .1 Provide extended coverage five year warranty for motors larger than 20 HP (15 kW).

2 PRODUCTS

2.1 PIPING SPECIALTIES

- .1 Cast brass, pressure, copper to copper unions shall be used with seamless copper tubing smaller than 3" (75 mm).
- .2 Cast brass flanges shall be used with seamless copper tubing, type L for tubing 3" (75 mm) and larger.
- .3 Dart type, 125 lb. (860 kPa) black malleable iron unions shall be used with all steel pipe for piping 2-1/2" (65 mm) and smaller.
- .4 Slip-on, 150 lb. (1000 kPa) carbon steel flanges with 1/16" (4 mm) raised face shall be used with all steel pipe for piping larger than 2-1/2" (65 mm).
- .5 Gaskets for joining flanged steel pipe shall be 1/16" (4 mm) Cranite ring type gaskets.
- .6 Piping specialties including backflow preventers, strainers, valves etc. shall be line size unless indicated otherwise on drawings.
- .7 Strainers
 - .1 Manufacturers:
 - .1 Sarco SB
 - .2 S. A. Armstrong
 - .3 Crane
 - .4 Conbraco
 - .5 Colton
 - .2 In copper tubing: Class 250, wye type, bronze, screwed connection, with blind caps, and 1/32" (0.8 mm) perforated stainless steel screen.
 - .3 In Steel Piping: 2" (50mm) and smaller
 - .1 Body and cover: screwed, line size Y type strainer, semi-steel conforming to ASTM A278-85, Class 30, complete with screwed blind cap. Primary service rating of 125 psi @ 350 F (860 kPa @ 178 C). Body shall have side drain connection.
 - .2 Screen: perforated type 304 stainless steel service:
 - .1 Water 1/32" (0.8 mm)
 - .2 Glycol 1/32" (0.8 mm)
 - .3 Water @ Pump Suction 1/8" (3.2 mm)
 - .4 In Steel Piping: 2-1/2" (65mm) and larger
 - .1 Body and cover: flanged, line size Y type strainer, cast steel, class 150, complete with flanged blow down cover. Primary service rating of 150 psi @ 500 F (1 MPa @ 260 C).
 - .2 Screen: perforated type 304 stainless steel service:
 - .1 Water 1/16" (1.6 mm)
 - .2 Glycol 1/16" (1.6 mm)
 - .3 Water @ Pump Suction 1/4" (6.4 mm)
 - .5 In grooved piping:
 - .1 Victaulic Style 730 grooved end tee-type strainer for piping 2 1/2" (65 mm) and larger or approved equivalent.
 - .2 Victaulic Style 731 suction diffuser, or approved equivalent

2.2 ADHESIVES, SEALANTS, PAINTS AND COATINGS

- .1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;
 - .1 Paint for Mechanical Identification: maximum VOC emission of 250g/L
 - .2 Touch-Up Paint: maximum VOC emission of 250g/L
 - .3 Zinc-Rich Primer: maximum VOC emission of 250g/L
 - .4 Adhesives for Mechanical Identification: maximum VOC emission of 70g/L

Common Work Results

- .5 Sealants for service penetrations: maximum VOC emission of 650g/L clear and 350 g/L pigmented
- .6 Sealants for Firestopping: max. VOC emission of 650g/L clear and 350 g/L pigmented
- .7 Acrylic Sealant for supports and anchors: maximum VOC emission of 250g/L
- .8 Insulation Vapour Barrier Lap Adhesive: maximum VOC emission of 80g/L
- .9 Insulation Joint Sealer: maximum VOC emission of 250g/L
- .10 Insulation Vapour Barrier Mastic: maximum VOC emission of 400g/L
- .11 Flame Retardent Adhesive: maximum VOC emission of 650g/L clear and 350 g/L pigmented

2.3 FIRESTOPPING COMPOUNDS

- .1 Manufacturer: 3M products indicated.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Dow Corning
 - .2 John Manville
 - .3 Hilti Firestop Systems
- .3 Fire Rated Sealants: intumescent material, synthetic elastomers, capable of expanding up to 8 to 10 times when exposed to temperatures of 250°F (121°C) or higher. ULC listed and labelled.

2.4 NAMEPLATES

- .1 Provide laminated plastic plates with black face and white centre of minimum size 3-1/2" x 1-1/2" x 3/32" (90 x 40 x 2 mm) nominal thickness, engraved with 1/4" (6 mm) high lettering. Use 1" (25 mm) lettering for major equipment.
- .2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- .3 Identify equipment type and number and service of areas or zone of building served.
- .4 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-1/2" x 9" (65 x 230 mm), reading: "WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME."

2.5 TAGS

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 1-1/2" (40 mm) diameter. OR
- .2 Metal Tags: Brass, aluminum or stainless steel with stamped letters; tag size minimum 1-1/2" (40 mm) diameter with smooth edges.
- .3 Chart: Typewritten letter size list in anodized aluminum frame.

2.6 STENCILS

- .1 Stencils: With clean cut symbols and letters of following size:
 - .1 3/4"-1-1/4" (20-30 mm) Outside Diameter of Insulation or Pipe: 8" (200 mm) long colour field, 1/2" (15 mm) high letters.
 - .2 1-1/2"-2" (40-50 mm) Outside Diameter of Insulation or Pipe: 8" (200 mm) long colour field, 3/4" (20 mm) high letters.
 - .3 2-1/2"-6" (65-150 mm) Outside Diameter of Insulation or Pipe: 12" (300 mm) long colour field, 1-1/4" (30 mm) high letters.
 - .4 8" - 10" (200-250 mm) Outside Diameter of Insulation or Pipe: 24" (600 mm) long colour field, 2-1/2" (65 mm) high letters.
 - .5 Over 10" (250 mm) Outside Diameter of Insulation or Pipe: 32" (800 mm) long colour field, 3-1/2" (90 mm) high letters.
 - .6 Ductwork and Equipment: 2-1/2" (65 mm) high letters.

2.7 TEST PLUGS

- .1 Manufacturer: Pete's Plug.

Common Work Results

- .2 Other acceptable manufacturers offering equivalent products.
 - .1 WATTS TP
- .3 Test Plug: 1/4" or 1/2" (6 mm or 15 mm) brass fitting and cap for receiving 1/8" (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 93°C (200°F).
- .4 Test Kit: Carrying case, internally padded and fitted containing one diameter pressure gauges, one gauge adapters with 1/8" (3 mm) probes, two 1" (25 mm) dial thermometers.

2.8 ACCESS DOORS

- .1 Standard:
 - .1 Minimum 12ga.
 - .2 steel, prime coat painted
 - .3 heavy duty fully concealed hinges
 - .4 screwdriver operated, cam latch
- .2 Concealed (Recessed):
 - .1 Minimum 12ga.
 - .2 steel, prime coat painted
 - .3 heavy duty fully concealed hinges
 - .4 screwdriver operated, cam latch
- .3 Fire Rated:
 - .1 Access doors in fire separations or fire rated assemblies: ULC labelled.
 - .2 Refer to architectural drawings for ratings of fire separations and assemblies.
 - .3 Minimum 16ga.
 - .4 steel, prime coat painted
 - .5 heavy duty fully concealed hinges
 - .6 screwdriver operated, cam latch
- .4 Air Seal Flush Mount:
 - .1 Minimum 16ga.
 - .2 304 stainless steel, #7 satin finish
 - .3 1/2" (13 mm) wide, heavy duty, fully concealed frame and concealed hinges
 - .4 1/8" x 3/8" (3.2 x 9.6 mm) closed-cell neoprene gasket
 - .5 screwdriver operated, stainless steel cam latch

2.9 SLEEVES

- .1 Materials: minimum schedule 20 galvanized steel or cast iron.

2.10 ESCUTCHEONS

- .1 Finish: Polished chrome

2.11 FLASHINGS AND COUNTER FLASHINGS

- .1 Thaler or equivalent mechanical/electrical flashings as recommended for specific purpose.
- .2 Stainless steel flashing sleeve, integral deck flange and EPDM seal.

2.12 PENETRATION SEALS

- .1 Manufacturer: Link-Seal
- .2 Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.

3 EXECUTION

3.1 INSPECTION

- .1 Inspect installed work of other trades and verify that such work is complete to point where work under this Division may properly commence.

Common Work Results

- .2 Verify that work of this Division may be executed in accordance with pertinent codes and regulations, specifications, drawings, and referenced standards.
- .3 Review drawings and verify dimensions at the site. Report discrepancies immediately to Consultant before proceeding with any construction work or shop drawings.

3.2 PREPARATION

- .1 Existing services and equipment shall be relocated or removed to suit new construction and renovation work.
- .2 Services that are no longer required shall be removed or cut back and capped to the satisfaction of Consultant.
- .3 Obtain written authorization from Consultant for renovation work that is not specifically indicated.
- .4 Where modifications or connections to existing systems require shutdown of the system the Contractor shall submit a request for system shutdown describing the system or part to be shutdown, the duration of the shutdown, the work planned and steps to be taken to reinstate the system to full operation. The request shall be submitted in the format stipulated by the Owner.
- .5 All work required to prepare systems for shutdown and/or re-instatement, such as draining, chemical treatments, and re-filling shall be included in this Bid Price.

3.3 PIPING INSTALLATION - ABOVE GROUND

- .1 Cooperate with other trades whose work affects or is affected by work of this Section, to ensure satisfactory installation and to avoid delays. Provide all materials to be built-in such as sleeves, anchors, etc., together with accurate dimensions or templates, promptly.
- .2 Layout all work accurately, installing piping parallel to lines of building.
- .3 Install piping, wherever possible, in partitions and above ceiling. Do not install piping in outside walls unless so shown on drawings. Wrap un-insulated piping in masonry walls with building paper.
- .4 Install concealed piping close to building structure to minimize furring dimensions.
- .5 Provide adequate space around piping to facilitate application of insulation.
- .6 Use dielectric couplings where piping of dissimilar metals connect.
- .7 Where piping passes through concrete floors, or walls, sleeves shall be sized to permit the pipe to expand freely without binding or crushing pipe insulation.
- .8 When using PVC-DWV pipe, provide for expansion and contraction of risers by using ProSet E-Z Flex Coupling in accordance with good engineering practices.
- .9 Install automatic control valves and wells supplied under other Sections.

3.4 PIPING JOINTS

- .1 Make joints in piping installed under this Division using persons familiar with the particular materials being used and in accordance with Canadian Plumbing Code, manufacturer's instructions, and as specified herein.
- .2 Use only welder and/or brazer operators, with a valid identification card, as issued under The Boiler and Pressure Vessels Act, to make joints in Registered Piping Systems, as indicated under Section 22 01 01, paragraph 1.11.
- .3 Use 95/5 Sb.Sn (tin-antimony) solder for joining copper drainage tubing smaller than 4" (100 mm), and for joining copper water tubing installed above grade, and smaller than 4" (100 mm).
- .4 Use silver solder or Silfos for joining copper water tubing installed below grade, and all copper tubing 4" (100 mm) and larger in size.
- .5 Carefully ream joints in threaded pipe and paint with approved graphite type joint sealer on male connections only. Make connections with proper wrench to suit pipe size. Where leaks occur, the joint shall be disassembled and corrected if possible, or replaced. Over-tightening, caulking or peening will not be acceptable.
- .6 Make joints in cast iron pipe with standard M-J joints in accordance with manufacturer's recommendations and CSA B70.
- .7 When using Victaulic Grooved Piping Method:
 - .1 Make joints in grooved piping with couplings and gaskets in accordance with Victaulic Company of Canada Ltd, General Catalogue G-100, latest edition. Cut or roll grooves using

Common Work Results

- tools specifically designed for that purpose.
- .2 Use Zero-flex or rigidlok couplings in locations where rigidity is required, in particular in mechanical rooms on coils, headers and pumps.
- .3 Vic-Boltless couplings may be used.
- .8 Install unions or welding flanges at connections to valves, etc. to facilitate removal.
- .9 Use butt welding and/or schedule 40 carbon steel welding fittings to join sections of steel piping with welding ends.

3.5 FLUSHING AND CLEANING

- .1 Flush and sterilize domestic water mains in accordance with procedures established by AWWA Specification C601.
- .2 Flush new domestic water piping in accordance with Local and Provincial Codes.
- .3 Thoroughly flush all other piping installed by this Division.
- .4 Remove, clean and replace all strainers in systems after flushing.
- .5 Thoroughly clean all equipment and fixtures, lubricate mechanical equipment, and leave all items in perfect order ready for operation.

3.6 ELECTRICAL COMPONENTS AND WIRING

- .1 Conform to requirements of Division 26 for all wiring included in Division 22. Includes pre-wired equipment provided by Sections under Division 22.
- .2 Ensure that all pre-wired electrical equipment is CSA approved. Arrange and pay for special approval where this is not possible.
- .3 Coordinate all wiring requirements with other Divisions. Line voltage wiring from power distribution panels to starters and from starters to motors will be provided under Division 26. All other field wiring for equipment shall be included under Division 22, unless specifically called for under Division 25.

3.7 EQUIPMENT TESTING AND INSPECTION

- .1 Test operation of equipment installed under this Division according to instructions in appropriate articles of this Division. Make any required adjustments or replacements to ensure equipment is operating as intended. Retest equipment requiring adjustment or replacement.
- .2 Pay all fuel consumption charges for equipment under testing and during commissioning.
- .3 Conduct tests before application of external insulation and before concealment of piping or ductwork.
- .4 Arrange and pay for inspections by authorities as required by code and complete any changes or alterations required by such inspections.
- .5 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Commissioning Agent.
 - .3 The Consultant.
 - .4 The Owner's Representative.
- .6 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.

3.8 PIPING SYSTEMS TESTING AND INSPECTION

- .1 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
- .2 Test all piping at the completion of roughing-in, before connecting to existing systems, and prior to concealment, insulation or covering of piping.
- .3 Make tests, that are required by any authority having jurisdiction, in the presence of the authority's authorized inspector and shall be certified by him.
- .4 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Commissioning Agent.
 - .3 The Owner's Representative
 - .4 The Consultant

Common Work Results

- .5 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.
- .6 Repair all leaks exposed during testing and retest. If defects in pipe or fittings are discovered in the system, they shall be removed and replaced.
- .7 Certify tests not required by authorities having jurisdiction.

3.9 TESTING AND BALANCING

- .1 Allow sufficient time for testing and verification prior to substantial completion. Notify Testing and Balancing Agency on completion of adjusting and balancing of systems.
- .2 Adjust systems and components (drives, sheaves, belts, etc.) as required by Testing and Balancing Agency.
- .3 Maintain systems in full operation during testing and verification.
- .4 Make adjustments to control systems as required to facilitate verification. Maintain all safety controls in operation.
- .5 Check and correct alignment of drive shaft coupling, drives, etc. as required by Testing and Balancing Agency.
- .6 Provide pitot tube test fittings at all main branches of sheet metal work and at intake and discharge locations of air handling systems as required by Testing and Balancing Agency.

3.10 PROTECTION

- .1 Protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division.
- .2 Repair to satisfaction of Consultant, damage to building resulting from failure to provide such protection.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work of this Division shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.11 CUTTING AND PATCHING

- .1 Include cutting and patching as required in execution of work under respective Sections of this Division.
- .2 Holes through the structure will not be permitted without written approval of the Consultant. Any and all openings required through the completed structure must be clearly and accurately shown on a copy of the relevant structural drawing(s). Exact locations, elevations and size of the proposed opening must be identified well in advance of the need for the work.
- .3 All sleeved or formed openings through the structure must be shown on sleeving drawings and must be approved by the Structural Consultant prior to construction.
- .4 The Contractor shall conduct exploratory work including x-ray of the existing structure, shall mark the location of embedded reinforcements, anchors, conduits and piping on exposed surfaces of adjacent floors and/or walls and shall pay all associated costs.
- .5 Reinforcing shall not be cut or modified without prior approval of the Structural Consultant. Should reinforcement be cut without such prior approval, the cost of any additional reinforcement deemed necessary by the Structural Consultant shall be the responsibility of this Contractor.
- .6 Alternative imaging techniques are subject to the approval of the Structural Consultant.
- .7 Ensure that cutting and patching of roofs and reinforced concrete structures is executed by specialists familiar with the materials affected, and is performed in a manner to neither damage nor endanger the work. Coordinate and supervise such cutting and patching.
- .8 Maintain the integrity of fire rated assemblies where they are pierced by ducts and pipes.

Common Work Results

- .9 Make good surfaces affected by this work and repair finish to satisfaction of Consultant. Finish painting, where required, will be provided under Division 9.
- .10 Stop work immediately upon discovery of any hazardous material and report discovery to the Owner and Consultant. Obtain instruction prior to proceeding with the work.

3.12 SEALANTS & CAULKING

- .1 Fill voids around pipes:
 - .1 Seal between sleeve and pipe in foundation walls and below grade floors with penetration seals (link-seal)). Install as per manufacturer's installation instructions.
 - .2 Where sleeves pass through non-fire rated walls or floors, caulk space between pipe and sleeve with fibreglass. Seal space at each end with waterproof, fire retardant, non-hardening mastic.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with easily removable filler.
 - .5 Coat exposed exterior surfaces or ferrous sleeves with heavy application of zinc rich paint (VOC content not to exceed 250 g/L).
- .2 Temporarily plug all openings during construction.

3.13 FIRESTOPPING

- .1 All openings in fire separations and fire rated assemblies for service penetrations shall be protected with ULC listed service penetration firestop systems (SP).
- .2 The service penetration firestop system shall have F and FT ratings equal to or greater than ratings specified by the Architect for the fire separation (F) and firewall (FT) joint firestop systems (JF).
- .3 All components employed in the service penetration firestop system shall conform to the ULC listing.
- .4 Contractor shall prepare and submit a schedule of service penetration firestop systems to be employed indicating the ULC listing designation, services involved, location of opening through fire separation and the components of the fire separation assembly.
- .5 Refer to architectural drawings for ratings of fire separations and assemblies.

3.14 SLEEVES AND CURBS

- .1 Provide pipe sleeves at points where pipes pass through masonry or concrete.
- .2 Provide sleeves of minimum schedule 20 galvanized steel or cast iron.
- .3 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint:
 - .1 through foundation walls, with penetration seals.
 - .2 through floors of mechanical rooms and equipment rooms.
- .4 Provide 1/4" (6 mm) clearance all around, between sleeve and pipes or between sleeve and insulation.
- .5 Where piping passes below footings, provide minimum clearance of 2" (50 mm) between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing with concrete of same strength as footing.
- .6 Terminate sleeves flush with surface of concrete and masonry and 2" (50 mm) above floors. Not applicable to concrete floors on grade.
- .7 Provide watertight concrete curb 4" (100 mm) high around mechanical services (pipes, ducts, conduits) which rise through mechanical (service) room floors. Provide minimum 4" (100 mm) clearance between openings for services within curbs.
- .8 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction, caulk between sleeve recess and pipe, fasten roof flashing to clamp device, make water-tight durable joint. Co-ordinate with roofing Section.

3.15 FLASHINGS

- .1 Provide all flashing at each point where piping passes through the roof.
- .2 Coordinate this work with the roofing Trades to ensure a satisfactory installation and to avoid delays.

Common Work Results

3.16 ESCUTCHEONS AND PLATES

- .1 Provide on pipes passing through finished walls, partitions, floors and ceilings.
- .2 Use chrome or nickel plated brass, solid type with set screws for ceiling or wall mounting.
- .3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.
- .4 Where sleeve extends above finished floor, escutcheon or plates shall clear sleeve extension.
- .5 Secure to pipe or finished surface, but not insulation.

3.17 PAINTING

- .1 Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Consultant.
- .2 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

3.18 SUPPORT AND ATTACHEMENT

- .1 Support and attach piping, ductwork fixtures and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls, and do not support from or attach to steel roof deck and/or wall or ceiling finishes.

3.19 DISSIMILAR METALS

- .1 Separate dissimilar metals in order to prevent galvanic corrosion.
- .2 Provide gaskets or shims of approved materials to avoid electrolytic action.
- .3 Use dielectric unions and/or flanges where piping of dissimilar metals are connected.

3.20 MOCK-UP

- .1 Refer to Division 01 for requirements for mock-up.
- .2 Each Section shall provide related components for mock-up.
- .3 Mock-up may not remain as part of the Work.

3.21 FIELD QUALITY CONTROL

- .1 Temporary and Trial Usage
 - .1 Allow the Owner the privilege of temporary and trial usage of installed equipment, as soon as work is complete, for a period of time required to conduct a thorough test.
 - .2 Do not construe such usage as evidence of acceptance of work by Owner.
 - .3 Repair damage to work tested, resulting from such trial usage, by this Contractor at no cost to Owner.
- .2 Systems Verification:
 - .1 Verify the correct installation and proper operation of equipment and systems installed. Adjust and balance each system as necessary to achieve optimum operation of each system.
 - .2 Co-operate with the TAB agency as follows:
 - .1 provide assistance when and as requested,
 - .2 co-ordinate completion of work systematically to permit orderly verification and adherence to schedules,
 - .3 provide additional necessary flow balancing devices as directed by agency,
 - .4 notify TAB Agency of tests being conducted.

3.22 ADJUST AND CLEAN

- .1 Clean equipment and fixtures, lubricate mechanical equipment installed under this Division and leave items in perfect order ready for operation.
- .2 Test and adjust control devices, instrumentation, relief valves, dampers, etc., installed in this Division after cleaning of systems and leave in perfect order ready for operation.

Common Work Results

- .3 Remove from the premises upon completion of work of this division, debris, surplus, and waste materials resulting from operations.

3.23 MECHANICAL IDENTIFICATION INSTALLATION

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces for stencil painting.
- .3 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer (VOC content not to exceed 680 g/L).
- .4 Install tags with corrosion resistant chain.
- .5 Comply with standard detail drawing plate, "Detail of Piping Identification".
- .6 Apply stencil markings on all covered piping.
- .7 Install plastic tape pipe markers complete around bare pipe to manufacturer's instructions.
- .8 Label piping that is heat traced or equipped with heating cable "HEAT TRACED" in addition to other identification. Locate such labels adjacent to other identifications.
- .9 Clearly identify abandoned services left in place as "ABANDONED".
- .10 Install underground plastic pipe markers 6"-8" (150-200 mm) below finished grade, directly above buried pipe.
- .11 Identify pumps, water heating equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .12 Identify control panels and major control components outside panels with plastic nameplates.
- .13 Identify valves in main and branch piping with tags. Consecutively number valves in each system.
- .14 Identify piping, concealed or exposed, with stencilled painting and plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- .15 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-3/8" x 9" (60 x 230 mm), reading:

"WARNING. THIS EQUIPMENT IS AUTOMATICALLY
CONTROLLED. IT MAY START AT ANY TIME."
- .16 Provide colour coded self-adhesive dots to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.24 MANUFACTURER'S NAMEPLATES

- .1 Provide metal nameplates on each piece of equipment, mechanically fastened with raised or recessed letters.
- .2 Include registration plates, Underwriters' Laboratories and CSA approval, as required by respective agency and as specified. Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors, all factory supplied.
- .3 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.25 INSTALLATION OF ACCESS DOORS

- .1 Supply access doors for access to equipment requiring service, lubrication or adjustment and all concealed valves, cleanouts, trap primers, control and volume dampers, and other such equipment.
- .2 Turn over access doors to the appropriate general trade for installation under other Sections.
- .3 Refer to architectural drawings for ratings of fire separations and assemblies. install fire rated access doors in fire rated partitions, walls, and ceilings.
- .4 Access doors in ceilings shall be minimum 24" x 24" (600mm x 600mm), unless otherwise approved by the Consultant.
- .5 Provide concealed access doors in GWB ceilings and coordinate in-fill with general trades.
- .6 Provide Air Seal Flush Mount access doors in All Clean Rooms, Laboratories and Health Care Facility Class 1 rooms [e.g. operating rooms, procedure rooms, ICU, CCU, PACU, and all sterile

Common Work Results

environments].

END OF SECTION

Piping Expansion Control

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 21 01 01.

1.2 SECTION INCLUDES

- .1 Flexible pipe connectors.
- .2 Expansion joints and compensators.
- .3 Pipe loops, offsets, and swing joints.
- .4 Anchors and guides

1.3 REFERENCES

- .1 CSA B51 Boiler, Pressure Vessel and Pressure Piping Code
- .2 ASME B31.1 Code for Power Piping
- .3 ASME B31.3 Process piping
- .4 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed.

1.4 PERFORMANCE REQUIREMENTS

- .1 Provide structural work and equipment required to control expansion and contraction of piping.
- .2 Verify that anchors, guides, and expansion joints provided, adequately protect system.
- .3 Arrange all piping so that expansion and contraction of any piping may take place without placing undue strain on the piping or connections to the equipment. Use swing joints and suitable expansion joints wherever necessary due to field conditions and where indicated on the drawings.
- .4 This Section shall analyze each section of pipe installed between constraints and shall determine the potential for expansion of the pipe based on pipe temperature at installation and pipe temperatures throughout the pipe's operating range. Where potential expansion exceeds 1" (25 mm) over the length of the pipe section, expansion compensators shall be installed. Pipe sections are constrained where they penetrate walls, partitions, floors, ceilings, roofs and movement of the pipe is restricted and where the pipe is anchored to the building structure.
- .5 Expansion Calculations:
 - .1 Safety Factor: 30 percent.
 - .2 Installation Temperature: 50°F (10°C).
 - .3 Hot Water Heating: 210°F (99°C).
 - .4 Domestic Hot Water: 140°F (60°C).

1.5 SUBMITTALS

- .1 Refer to section 01 33 00 & 21 01 01
- .2 Product Data:
 - .1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per metre and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - .2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- .3 Design Data: Submit detailed construction drawings for expansion compensation and piping anchors, signed and sealed by a professional engineer licenced in Ontario. Provide selection criteria used.
- .4 Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- .2 Design expansion compensating system under direct supervision of a Professional Engineer

Piping Expansion Control

experienced in design of this work and licenced in the Province of Ontario.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products.
- .2 Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- .3 Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.8 WARRANTY

- .1 Warranty: 5-year replacement warranty.

1.9 EXTRA MATERIALS

- .1 Section 21 01 01: Submittals for project closeout.
- .2 Provide two 340 gm containers of packing lubricant and cartridge style grease gun.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturers must be certified by the Expansion Joint Manufacturers Association (EJMA)
- .2 Flexible Pipe Connectors
 - .1 Flex-Pression Ltd.
 - .2 Sr. Flexonics
 - .3 Ontario Hose
 - .4 Colton Industries
- .3 Expansion Joints
 - .1 Flex-Pression Ltd.
 - .2 Hyspan Precision Products, Inc.
 - .3 Sr. Flexonics
- .4 Pipe Alignment Guides
 - .1 Flex-Pression Ltd.
 - .2 Hyspan Precision Products, Inc.
 - .3 Sr. Flexonics

2.2 PIPE ALIGNMENT GUIDES

- .1 Steel Pipe:
 - .1 radial "spider" type, minimizing piping motions in non-axial planes.
 - .2 constructed of carbon steel with a 360-degree two-piece bolted housing, and 360-degree two-piece bolted clamps with spider type legs.
 - .3 provide an insulation clearance of 1.5" on sizes 6" IPS and under, and 2.0" on sizes 8" IPS and over.
 - .4 axial travel shall be 3" for sizes 2" IPS and under, and 6" for sizes 2-1/2" IPS and over.
 - .5 refer to piping and expansion joint schedules for specific insulation and motion requirements.
 - .6 Basis of design: Hyspan Series 9500.
- .2 Copper Pipe:
 - .1 radial "spider" type, minimizing piping motions in non-axial planes.
 - .2 constructed of carbon steel with non-metallic coating on the tube clamps, and a 360-degree two-piece bolted housing, and 360-degree two-piece bolted clamps with spider type legs.
 - .3 provide an insulation clearance of 1.5".
 - .4 axial travel shall be 3" for sizes 2-1/2" and under, or 6" for sizes 3" and 4".
 - .5 refer to piping and expansion joint schedules for specific insulation and motion requirements.
 - .6 Basis of design: Hyspan Series 9500.

Piping Expansion Control

2.3 FLEXIBLE PIPE CONNECTORS

- .1 Copper Piping:
 - .1 Inner Hose: Bronze
 - .2 Exterior Sleeve: Braided bronze.
 - .3 Pressure Rating: 125 psi (862 kPa) WSP and 450°F (232°C).
 - .4 Joint: As specified for pipe joints.
 - .5 Size: Use pipe sized units
 - .6 Maximum offset: 3/4" (20 mm) on each side of installed centre line.
- .2 Steel Piping, 2" (50 mm) diameter and smaller:
 - .1 Inner Hose: braided bronze.
 - .2 Exterior Sleeve: None.
 - .3 Pressure Rating: 125 psi (862 kPa) WSP and 450°F (232°C).
 - .4 Joint: Threaded.
 - .5 Size: Use pipe sized units.
 - .6 Maximum offset: 3/4" (20 mm) on each side of installed centre line.
- .3 Steel Piping, 2-1/2" to 3-1/2" (65mm to 90mm) diameter :
 - .1 Inner Hose: braided bronze.
 - .2 Exterior Sleeve: None.
 - .3 Pressure Rating: 125 psi (862 kPa) WSP and 450°F (232°C).
 - .4 Joint: Flanged.
 - .5 Size: Use pipe sized units.
 - .6 Maximum offset: 3/4" (20 mm) on each side of installed centre line.
- .4 Steel Piping, 4" (100mm) diameter and larger:
 - .1 Inner Hose: braided 321 stainless steel.
 - .2 Exterior Sleeve: None.
 - .3 Pressure Rating: 125 psi (862 kPa) WSP and 450°F (232°C).
 - .4 Joint: Flanged.
 - .5 Size: Use pipe sized units.
 - .6 Maximum offset: 3/4" (20 mm) on each side of installed centre line.

2.4 EXPANSION JOINTS - COPPER PIPING

- .1 Bronze Bellows Type:
 - .1 Construction: 2-ply bronze with anti-torque device, limit stops, internal guides.
 - .2 Pressure Rating: 125 psi (862 kPa) WSP and 400°F (204°C).
 - .3 Maximum Compression: 1-3/4" (45 mm).
 - .4 Maximum Extension: 1/4" (6 mm).
 - .5 Joint: Soldered.
 - .6 Size: Use pipe line sized units
 - .7 Application: Copper piping.

2.5 EXPANSION JOINTS - DESIGN 150 PSIG / 500°F

- .1 Ratings
 - .1 Design Pressure: 150 psig (1035 kPa)
 - .2 Test Pressure: 225 psig (1552 kPa)
 - .3 Design Temperature: 500 °F (260°C)
- .2 Stainless Steel Bellows Type:
 - .1 Construction multi-ply ASTM A240 type 321 stainless steel bellows, ASME A53, Gr. B carbon steel housing,
 - .2 Pressure Rating: 150 psi (1035 kPa) WSP and 500°F (260°C).
 - .3 Maximum Compression: 1-3/4" (45 mm).
 - .4 Maximum Extension: 1/4" (6 mm).
 - .5 Joint: Flanged.
 - .6 Size: Use pipe line sized units
 - .7 Application: Steel piping 2-1/2" (65 mm) and smaller.

Piping Expansion Control

- .3 Externally Pressurized:
 - .1 Construction: Self-equalizing type with three or four ply ASTM A240 type 321 stainless steel bellows; ASME A53, Grade B carbon steel housing and pipe nipples; ASME-A36 steel plate guide rings and flanges; ASME A105, 3000-lb thread-o-let drain port & plug.
 - .2 Pressure Rating: 300 psi (2070 kPa) WOG and 500°F (260°C).
 - .3 Maximum Compression: 8" (200 mm).
 - .4 Maximum Extension: 2" (50 mm).
 - .5 Joints: Flanged.
 - .6 Size: Use pipe line sized units
 - .7 Application: Steel piping 3" (75 mm) and larger.

2.6 LAMINATED, ULTRA-LOW PRESSURE FORCE SERIES 1501-1506

- .1 Ratings:
 - .1 Design Pressure: 150 PSIG
 - .2 Test Pressure: 225 PSIG
 - .3 Maximum Temperature: 500 F.
- .2 Basis of design: Hyspan series 1501-1506.
- .3 Expansion joints shall be low area, three-ply, internally pressurized designs, single or dual configurations as scheduled.
- .4 Integral pipe attachments must have a radius where the bellows neck is received.
- .5 Expansion joints with larger effective area, welded to the pipe OD, not of three plies, or attached to a pipe without a radius will not be accepted.
- .6 Bellows shall be three ply, type 304 or 321 stainless steel, with the effective areas listed below, and attached to the pipe ID. Alloy 625 bellows shall be provided when chloride-ion, stress-corrosion cracking is a concern.

Pipe Size	Effective Area (in ²)	Pipe Size	Effective Area (in ²)
1-1/2"	2.3	6"	33.3
2"	4.1	8"	56.8
2-1/2"	5.8	10"	87.2
3"	8.8	12"	122.0
4"	15.4	14"	152.0

- .7 Internal liners of stainless steel shall remain within the joint over all dimensions under design motions.
- .8 Bellows receivers of A53 Gr. B (or A106 Gr. B) standard weight pipe, with internal radii.
- .9 Flanges shall be A36 carbon steel plate, or A105 forged, with ANSI B16.5 drilling and outside diameter. Flanges may be fixed or lap joint stub end as specified.
- .10 Butt weld ends of schedule standard A53 Gr. B (or A106 Gr. B).
- .11 Dual joints must include an intermediate anchor base.

2.7 LAMINATED, ULTRA-LOW PRESSURE FORCE, SERIES 1501-1502 HYRISER

- .1 Ratings:
 - .1 Design Pressure: 150 PSIG
 - .2 Test Pressure: 225 PSIG
 - .3 Maximum Temperature: 500 F.
- .2 Basis of design: Hyspan series 1501/1502 HYRISER.
- .3 Expansion joints shall be low area, three-ply, internally pressurized designs, single configuration incorporating an internal guide liner.
- .4 Integral pipe attachments must have a radius where the bellows neck is received.
- .5 Expansion joints with larger effective area or axial spring rate welded to the pipe OD, not of three

Piping Expansion Control

- plies, or attached to a pipe without a radius will not be accepted.
- .6 Bellows shall be three ply, type 304 or 321 stainless steel, with the effective areas listed below, and attached to the pipe ID. Alloy 625 bellows shall be provided when chloride-ion, stress-corrosion cracking is a concern.

Pipe Size	Effective Area (in ²)	Axial Spring Rate (lbs/in)
4"	15.4	155
5"	23.5	190
6"	33.3	348
8"	56.8	325
10"	87.2	411
12"	122.0	614

- .7 Internal liners of stainless steel shall remain within the joint over all dimensions under design motions and self-drain.
- .8 Bellows receivers of A53 Gr. B (or A106 Gr. B) standard weight pipe, with internal radii.
- .9 Flanges shall be A36 carbon steel plate, or A105 forged, with ANSI B16.5 drilling and outside diameter. Flanges may be fixed or lap joint stub end.
- .10 Butt weld ends of schedule standard A53 Gr. B (or A106 Gr. B).
- .11 Dual joints must include an intermediate anchor base.
- .12 Warranty required: 5-Year limited.

2.8 TIED UNIVERSAL EXPANSION JOINTS, SERIES 1511R-1512R

- .1 Ratings:
- .1 Design Pressure: 50, 150, or 300 PSIG
 - .2 Test Pressure: 75, 225, or 450 PSIG
 - .3 Lateral Motions: 2", 3", 4"
 - .4 Maximum Temperature 500 F.
- .2 Expansion Joints shall be the tied universal configuration incorporating two independent bellows. The expansion joint shall be installed perpendicular to the piping run inducing lateral motion. The expansion joint induces only spring forces to the piping when only lateral motions are absorbed.
- .3 Bellows shall be one-to-four plies as required of austenitic stainless steel.
- .4 Flanges shall be A36 carbon steel plate, with ANSI B16.5 drilling and outside diameter. Flanges may be fixed, or vanstoned as indicated on the schedule. Carbon steel vanstone flanges allow slight rotation for misalignment and/or to allow *stainless steel wetted surfaces for corrosion resistance.
- .5 Butt weld-ends, shall be schedule standard A53 Gr. B, or the schedule and material grade otherwise indicated.
- .6 Tie/Limit rods are required to absorb pressure thrust forces and provide safety limits for design motions.
- .7 Internal liners shall be provided for;
- .1 liquid flows at 10 feet per second or higher in pipes 6" IPS and over,
 - .2 flows exceeding 2 feet per second per inch of diameter in pipes under 6" diameter,
 - .3 flow rates exceeding 100 feet per second
 - .4 steam service,
 - .5 abrasive flows.
- .8 Tied Universal expansion joints shall be Hyspan series 1511R flanged or 1512R weld end.

2.9 EXTERNALLY-PRESSURIZED & LAMINATED EXPANSION JOINT SERIES 3501-3506

- .1 Ratings:
- .1 Design Pressure 150 300 PSIG
 - .2 Test Pressure 225 450 PSIG

Piping Expansion Control

- .3 Maximum Temperature 500 F.
- .2 Expansion joints shall be externally pressurized, with internal and external guides.
- .3 Bellows must be three plies with the specified effective areas and attached via independent collars.
- .4 Materials of construction are A-53 Gr.B (or A-106 Gr.B) standard weight liner and housing, carbon steel guide rings, and type 304 stainless steel bellows with the effective areas listed below. Attach the bellows to internal and external guide rings via 304 S.S. collars. Use Alloy 625 bellows when chloride-ion, stress-corrosion cracking is a concern.
- .5 Bellows welded to guide rings at the root or crest radii are not acceptable.
- .6 Vent internal guide rings to reduce the effects of sudden pressure changes.
- .7 Include a lifting lug and drain port.
- .8 Flanges shall be A36 carbon steel plate, or A105 forged, with ANSI B16.5 drilling and outside diameter. Flanges may be fixed or lap joint stub end.
- .9 Butt weld ends of schedule standard A53 Gr. B (or A106 Gr. B).
- .10 Dual joints must include an intermediate anchor base.
- .11 Design basis: Hyspan series 3500.

Pipe Size	Effective Area (in ²)	Pipe Size	Effective Area (in ²)
1-1/2"	8.2	6"	50.3
2"	8.2	8"	80.5
2-1/2"	10.6	10"	115
3"	13.7	12"	164
4"	22.7	14"	206
5"	35.3	16"	258
		18"	318

2.10 PRESSURE BALANCED, EXTERNALLY-PRESSURIZED, LAMINATED SERIES 3500PB

- .1 Ratings:
 - .1 Design Pressure 150 PSIG
 - .2 Test Pressure 225 PSIG
 - .3 Maximum Temperature 500 F.
- .2 Expansion joints pressure balanced, externally pressurized, laminated bellows type, with internal and external guides
- .3 Bellows shall be three plies with specified spring rates per Hyspan catalog 574H and attached via independent collars.
- .4 Materials of construction are A-53 Gr.B (or A-106 Gr.B) standard weight liner and housing, carbon steel guide rings, and type 304 stainless steel bellows with three plies. Attach the bellows to internal and external guide rings via 304 S.S. collars. Use Alloy 625 bellows when chloride-ion, stress-corrosion cracking is a concern.
- .5 Bellows welded to guide rings at the root or crest radii are not acceptable.
- .6 Vent internal guide rings to reduce the effects of sudden pressure changes.
- .7 Include a lifting lug and drain port.
- .8 Flanges shall be A36 carbon steel plate, or A105 forged, with ANSI B16.5 drilling and outside diameter. Flanges may be fixed or lap joint stub end.
- .9 Butt weld ends of schedule standard A53 Gr. B (or A106 Gr. B).
- .10 Dual joints must include an intermediate anchor base.
- .11 Design basis: Hyspan series 3500PB.

2.11 SLIP EXPANSION JOINT, SERIES 6500 PERMA-PAX

- .1 Expansion joints shall be packed-slip type containing injectable flaked graphite packing and graphite seals. Packing ports allowing packing under full line pressure are required. Non-injectable packing

Piping Expansion Control

- designs are not acceptable. Non-graphite packing and seals are not acceptable.
- .2 Internal and external line-bore machined guides of ASTM SB169-C614. Non-ASME rated bearing materials are not acceptable. Joint Seal Force is 850 pounds per inch of diameter or less in published catalog.
 - .3 A stainless steel extension limit stop ring covering approximately 360 degrees will be included on each slip tube. Limit-stop pins are not acceptable.
 - .4 The slip tube will be made from A53-Gr.B pipe, schedule 80 from 1-1/4" through 16" IPS and schedule 60 from 18" through 24" IPS sizes. The slip tube will be hard-chromed-plated .002" thick according to ASTM B650.
 - .5 One-piece body required.
 - .6 Include a drain port on each joint.
 - .7 See the expansion joint schedule for required weld end fittings of schedule standard, schedule 40 or schedule 80, or flanges.
 - .8 Joint design and manufacturing in compliance with ASTM F1007 and MIL-E-17814F.
 - .9 Expansion joints will be Hyspan Series 6500 Perma-Pax .

Nominal Size (NPS)	Effective Area (square inches)	Joint Seal Force (lbs)
2	4	1700
2-1/2	5.9	2125
3	8.9	2550
4	15	3400
5	23.2	4250
6	32.5	5100
8	55.9	6800
10	86.6	8500
12	123	10,200
14	148	11,900
16	195	13,600
18	247	15,300
20	306	17,000
24	443	20,400

2.12 BALL JOINTS, TYPE N, SERIES 6500

- .1 Hyspan-Barco Type N Series I Ball Joints
 - .1 Angular motion of plus and minus 7.5 degrees and torsional motion of 360 degrees
 - .2 Ball, Case and Bolting Retainer of carbon steel - stronger than schedule standard pipe of equivalent size
 - .3 Bolted Retainer Ball Joints allowing field tightening/adjustment of bearing/seals and unbolting replacement of bearing/seals via bolt removal. Cutting and rewelding of ball joint case for bearing/seal removal and replacement will not be accepted
 - .4 Ball hard-chromed-plated .002" thick according to ASTM B650.
 - .5 Bearing seals of composite phenolic material not requiring field lubrication
 - .6 Design basis: Hyspan series 6500
- .2 Hyspan-Barco Type N Series II Ball Joints
 - .1 Angular motion of plus and minus 7.5 degrees and torsional motion of 360 degrees
 - .2 Ball, Case and Bolting Retainer of carbon steel - stronger than schedule standard pipe of

Piping Expansion Control

- equivalent size.
- .3 Bolted Retainer Ball Joints allowing field tightening/adjustment of bearing/seals and unbolting replacement of bearing/seals via bolt removal. Cutting and rewelding of ball joint case for bearing/seal removal and replacement will not be accepted. Injectable graphite secondary seal shall be included.
- .4 Flake graphite packing injected, plugged and tested at the factory.
- .5 Ball hard-chromed-plated .002" thick according to ASTM B650.
- .6 Bearing seals of ductile iron, composite phenolic, Inconel or other factory clarified material
- .7 Design basis: Hyspan series 6500

2.13 HIGH PERFORMANCE TYPE N BALL JOINTS

- .1 Design Conditions;
 - .1 Design Pressure: 150 psig
 - .2 Test Pressure: 225 psig
 - .3 Design Temperature: 500 °F
- .2 Description: flanged, bolted retainer type with integral recharge cylinders designed for injection of asbestos-free pure flaked graphite sealant and shall be capable of sealing without the use of additional bypass containment seals. Injectors shall include an integral stainless steel shut off valve for injection of sealant under full continuous operating conditions of the system. Ball joints shall provide 360° of rotation and 15° total angular flex.
- .3 Materials and Construction;
 - .1 All pressure containing parts and bolting shall be designed and manufactured from materials conforming to code requirements of ASME Section II and ANSI/ASME B31.1
 - .2 Carbon steel ball spheres shall be plated with 2 mils of chrome consisting of 1 mil hard chrome over 1 mil of crack-free chrome. the chrome plating shall be protected by a baked-on molybdenum disulfide coating.
 - .3 Ball joint pipe connection ends shall be beveled for welding to standard wall pipe (unless otherwise specified) or with ANSI forged steel weld neck flanges.
- .4 Acceptance Testing:
 - .1 All flexible ball joints shall be hydrostatically tested at one-and-one half times design pressure.
 - .2 Each ball joint shall be pressurized with 50 psig saturated steam, or thermal equivalent, inspected for leakage and have bolts properly torqued prior to shipment
 - .3 Ball joints shall be capable of certification to Mil-Std 167 vibration test and Mil-S-901 shock test.
- .5 Design basis: Hyspan-BarcoStyle III High Performance Type N ball joints or Hyspan-BarcoStyle III High Performance Type N ball joints with Type V Injectors

3 EXECUTION

3.1 INSTALLATION

- .1 Install flexible pipe connectors and expansion joints to manufacturer's instructions.
- .2 Ratings and bolt patterns for flanges shall suit design pressure and design temperature of piping system and match those of installed components.
- .3 Construct spool pieces to exact size of flexible connection for future insertion.
- .4 Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- .5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- .6 Pipe anchors shall be installed securing the piping system to the building structure in order to control the direction and the amount of pipe movement. In addition, pipe anchors shall be installed to prevent separation of pipe due to hydraulic pressures. Pipe anchors shall be designed by the Contractor to accommodate all forces experienced. Prepare calculations for each anchor and submit to Consultant for review and approval. Provide pipe guides so movement is directed along axis of pipe only. Not less than two guides shall be provided on each side of an expansion joint. Erect piping such that strain and weight is not on cast connections or apparatus.

Piping Expansion Control

- .7 Provide support and equipment required to control expansion and contraction of piping. Provide pipe offsets, and swing joints, or expansion joints where required. The Contractor may elect to install expansion loops in place of expansion compensators where there is adequate space to do so; subject to the approval of the Consultant. The Contractor shall prepare and submit detailed design calculations for each expansion loop proposed to the Consultant for review and approval prior to installation.

3.2 MANUFACTURER'S FIELD SERVICES

- .1 Prepare and start systems to Section 21 01 01.
- .2 Provide inspection services by manufacturer's representative for final installing and certify installation is to manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

Supports and Anchors

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 21 01 01.

1.2 SECTION INCLUDES

- .1 Pipe and equipment hangers and supports.
- .2 Sleeves and seals.

1.3 REFERENCES

- .1 ASME B31.1 - Power Piping.
- .2 ASME B31.2 - Fuel Gas Piping.
- .3 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .4 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .5 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .6 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .7 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- .8 NFPA 13 - Installation of Sprinkler Systems.
- .9 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .10 UL 203 - Pipe Hanger Equipment for Fire protection Service.

1.4 SUBMITTALS

- .1 Section 21 01 01: Procedures for submittals.
- .2 Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- .3 Product Data: Provide manufacturers catalogue data including load capacity.
- .4 Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- .5 Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

- .1 Conform to CSA B-51 for support of piping.

2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- .1 Manufacturers:
 - .1 Anvil
 - .2 Myat
 - .3 Hunt

2.2 ACCESSORIES

- .1 Hanger Rods: galvanized, carbon steel continuous threaded.
- .2 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's instructions and best trade practises.

Supports and Anchors

3.2 INSERTS

- .1 Provide inserts for placement in concrete formwork.
- .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100 mm).
- .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.3 PIPE HANGERS AND SUPPORTS

- .1 Support horizontal piping as scheduled.
- .2 Install hangers to provide minimum 1/2" (13 mm) space between finished covering and adjacent work.
- .3 Place hangers within 12" (300 mm) of each horizontal elbow.
- .4 Use hangers with 1-1/2" (38 mm) minimum vertical adjustment.
- .5 Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- .6 Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.
- .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .8 Support riser piping independently of connected horizontal piping.
- .9 Provide copper plated hangers and supports for copper piping.
- .10 Design hangers for pipe movement without disengagement of supported pipe.
- .11 Prime coat exposed steel hangers and supports. Refer to Section 09 91 10. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 FLASHING

- .1 Flash floor drains in floors with topping over finished areas with lead, 10" (250 mm) clear on sides with minimum 36" x 36" (910 x 910 mm) sheet size. Fasten flashing to drain clamp device.
- .2 Seal roof, floor, shower and mop sink drains watertight to adjacent materials.

3.5 SLEEVES

- .1 Set sleeves in position in formwork. Provide reinforcing around sleeves.
- .2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- .3 Extend sleeves through floors 1" (25 mm) above finished floor level. Caulk sleeves.
- .4 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk. air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- .5 Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

- .1 Imperial Measure (IP)

Pipe Size (in)	Rod Diameter (in)	Support Spacing (Ft)	
		Steel Pipe	Copper Tube
1/2	3/8	7	6
3/4	3/8	7	6
1	3/8	7	6

Supports and Anchors

1-1/4	3/8	7	6
1-1/2	3/8	9	8
2	3/8	10	9
2-1/2	3/8	12	10
3	3/8	12	10
4	5/8	14	12
6	7/8	17	
8	7/8	19	
10	7/8	21	
12	7/8	23	
14	1	25	
16	1	27	
18	1	28	

.2 Metric Measure (SI)

Pipe Size (mm)	Rod Diameter (mm)	Support Spacing (m)	
		Steel Pipe	Copper Tube
13	10	2.1	1.8
20	10	2.1	1.8
25	10	2.1	1.8
32	10	2.1	1.8
38	10	2.7	2.4
50	10	3	2.7
65	10	3.6	3
75	10	3.6	3
100	16	4.2	3.6
150	22	17	
200	22	5.7	
250	22	6.4	
300	22	7	

END OF SECTION

Vibration Controls

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 SECTION INCLUDES

- .1 Vibration control of piping, ductwork and equipment.
- .2 Coordination with Section 22 05 30 Supports and Anchors

1.3 REFERENCES

- .1 Ontario Building Code.
- .2 SMACNA "HVAC Duct Construction Standards"

1.4 PERFORMANCE REQUIREMENTS

- .1 Provide vibration isolation on motor driven equipment over 1/2 HP (0.35 kW), plus connected piping and ductwork.
- .2 Provide minimum static deflection of isolators for equipment as indicated.
 - .1 Upper Floors, Normal
 - .1 Under 400 rpm: 1-1/2" (40 mm)
 - .2 400 - 600 rpm: 3-1/2" (90 mm)
 - .3 600 - 800 rpm: 2" (50 mm)
 - .4 800 - 900 rpm: 1" (25 mm)
 - .5 1100 - 1500 rpm: 1/2" (12 mm)
 - .6 Over 1500 rpm: 1/4" (5 mm)

1.5 SUBMITTALS

- .1 Shop Drawings: Indicate vibration isolators, with static and dynamic load on each.
- .2 Product Data: Provide schedule of vibration isolator type with location and load on each.
- .3 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.
- .4 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturer shall be a member of VISCMA.
- .2 Acceptable manufacturers;
 - .1 Kinetics
 - .2 Vibroacoustics
 - .3 VAW Systems.
 - .4 Korfund
 - .5 Masdom

2.2 VIBRATION ISOLATORS

- .1 Isolators and bases shall be as tabulated on the equipment schedule.
- .2 Type 2 Hangers: Model SFH Combination Spring and Fiberglass Hangers, incorporating pre-compressed moulded fiberglass noise and vibration isolation pads, coated with a moisture impervious elastomeric membrane in series with springs, all encased in welded steel brackets. Springs shall be as specified above. Isolators shall be designed to accommodate rod misalignment over a 30 degree arc. Brackets shall be designed to carry 500% overload without failure.

Vibration Controls

- .3 Type 3 Isolators: Model FLS, Free-Standing, Laterally Stable, Spring Isolators, similar to Type FDS, but incorporating vertical limit stops to assure a constant operating height if the supported weight is removed, and to reduce movement due to wind loads. Limit stops shall be isolated from the housing to prevent short-circuiting.
- .4 Piping: All piping 1 in. (25 mm) diameter and over in the mechanical equipment room, and all piping three supports away from other mechanical equipment shall be isolated from the structure by means of vibration and noise control isolators. Suspended piping shall be isolated with Type 2 Hangers as described above. Floor-mounted piping shall be isolated with Type 2 Spring Isolators as described above.
- .5 Flexible members shall be incorporated in the ductwork adjacent to all reciprocating equipment, and shall be approved construction.
- .6 Flexible connections shall be incorporated in the ductwork adjacent to all air-moving units. The connections shall be neoprene or canvas of approved construction. High pressure ductwork, for a distance of 50 feet (1270 mm) from high pressure fans shall be isolated from the ductwork by means of Type 2 Hangers as described above.

3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's instructions.
- .2 Install isolation for motor driven equipment.
- .3 Install spring hangers without binding.
- .4 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- .5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- .6 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa static pressure, and on hanger supported, horizontally mounted axial fans.
- .7 Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.06" (1.5 mm) maximum clearance. Provide other snubbers with clearance between 1/8" and 1/4" (4 mm and 7 mm).
- .8 Support piping connections to isolated equipment resiliently as follows:
 - .1 Up to 4" (100 mm) Diameter: First three points of support.
 - .2 5" to 8" (125 to 200 mm) Diameter: First four points of support.
 - .3 10" (250 mm) Diameter and Over: First six points of support.
 - .4 Select three hangers closest to vibration source for minimum 1" (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1" (25 mm) static deflection or 1/2 static deflection of isolated equipment.
- .9 Connect wiring to isolated equipment with flexible hanging loop.

END OF SECTION

Piping Insulation

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 SECTION INCLUDES

- .1 Piping insulation.
- .2 Jackets and accessories.

1.3 REFERENCES

- .1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .3 ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .4 ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- .5 ASTM C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.
- .6 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .7 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .8 ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .9 ASTM C547 - Mineral Fibre Pipe Insulation.
- .10 ASTM C552 - Cellular Glass Thermal Insulation.
- .11 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.
- .12 ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- .13 ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.
- .14 ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.
- .15 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .16 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- .17 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- .18 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- .19 ASTM E84 - Surface Burning Characteristics of Building Materials.
- .20 ASTM E96 - Water Vapour Transmission of Materials.
- .21 NFPA 255 - Surface Burning Characteristics of Building Materials.
- .22 UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- .1 Product Data: Provide product description, list of materials and thickness for each service, and locations.
- .2 Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

- .1 Materials: Flame spread/smoke developed rating of 25/50 or less to ULC S102 and ASTM E84.

1.6 QUALIFICATIONS

- .1 Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

Piping Insulation

- .1 Transport, handle, store, and protect products.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Store insulation in original wrapping and protect from weather and construction traffic.
- .4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .2 Maintain temperature during and after installation for minimum period of 24 hours.

2 PRODUCTS

2.1 GLASS FIBRE

- .1 Manufacturers:
 - .1 Manufacturer: Owens Corning Fiberglas
- .2 Other acceptable manufacturers offering equivalent products:
 - .1 Manson
 - .2 Knauf Fiber Glass
 - .3 Johns Manville
- .3 Insulation: ASTM C547; rigid moulded, noncombustible.
 - .1 'ksi' value : ASTM C335, 0.035 at 75°F (24°C).
 - .2 Minimum Service Temperature: -20°F (-28.9°C).
 - .3 Maximum Service Temperature: 302°F (150°C).
 - .4 Maximum Moisture Absorption: 0.2 percent by volume.
- .4 Vapour Barrier Jacket
 - .1 ASTM C921, White kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture Vapour Transmission: ASTM E96; 0.02 perm.
 - .3 Secure with self sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .5 Tie Wire: 1.3 mm stainless steel with twisted ends on maximum 12" (300 mm) centres.
- .6 Vapour Barrier Lap Adhesive
 - .1 Compatible with insulation.
- .7 Insulating Cement/Mastic
 - .1 ASTM C195; hydraulic setting on mineral wool, VOC content not to exceed 80 g/L.
- .8 Fibrous Glass Fabric
 - .1 Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
 - .2 Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
- .9 Indoor Vapour Barrier Finish
 - .1 Vinyl emulsion type acrylic, compatible with insulation, white colour, VOC content not to exceed 250 g/L.
- .10 Outdoor Vapour Barrier Mastic
 - .1 Vinyl emulsion type acrylic, compatible with insulation, white colour.
- .11 Insulating Cement
 - .1 ASTM C449, VOC content not to exceed 80 g/L.

2.2 PHENOLIC INSULATION

- .1 .1 Manufacturers:
 - .1 .1 Manufacturer: Resolco International by "Insul-Phen"
 - .2 .2 Other Manufacturers: in accordance with 15010.2.3
- .2 .2 Insulation: ASTM C-1126 Phenolic Foam Thermal Insulation, CFC and HCFC free, rigid moulded, noncombustible insulation fabricated in required shapes by Resolco International approved fabricators to ASTM C-450 and C-585.
 - .1 .1 Density: 2.5-lb/ft³ (40-kg/m³)

Piping Insulation

- .2 .2 Temperature range: -290°F to +250°F (-129°C to +107°C)
- .3 .3 Closed cell content: 92%
- .4 .4 Compressive strength: 29 psi (2 bar)
- .5 .5 Thermal conductivity: 0.13 BTU-in/hr-ft²-°F (18.72 W-mm/m²-°C)
- .6 .6 Fire resistance rating: 25/50 to ASTM E84 on plain and faced product up to 3" (75mm) thick
- .3 .3 Joint Sealer:
 - .1 .1 vapour barrier type, moisture and water resistant, 97% solids by weight, non-hardening, flexible in temperature range from -5°F to +200°F (-20.5°C to +93.3°C), Daxcel 161D, Fosters 30-45, Childers CP-76.

2.3 ELASTOMERIC INSULATION

- .1 Acceptable Manufacturers:
 - .1 Armacell APArmaflex, APArmaflex W, APArmaflex SS, or APArmaflex SA.
- .2 Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form to ASTM C 534, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form."
- .3 Insulation materials shall have a closed-cell structure to prevent moisture from wicking.
- .4 Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's, formaldehyde free, low VOC's, fiber free, dust free and shall resist mold and mildew.
- .5 Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ULC S102, ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.
- .6 Materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
- .7 Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.
- .8 The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.
- .9 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 15100.2.2. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.

2.4 HYDROUS CALCIUM SILICATE

- .1 Manufacturers:
 - .1 Industrial Insulation Group Model Thermo-12
- .2 Insulation: ASTM C533, Type 1; rigid, moulded, white, asbestos free, corrosion inhibiting.
 - .1 Thermal conductivity (k) value: ASTM C177,C335 and C518;

Mean Temperature (°F)	200	300	400	500	600	700
BTU-in/(Hr-Ft ² -F°)	0.41	0.45	0.5	0.55	0.6	0.65
Mean Temperature (°C)	93	149	204	260	316	371
W/(m-C°)	0.059	0.065	0.072	0.079	0.086	0.094

- .2 Maximum Service Temperature: 1200°F (649°C).
- .3 Density: 14.5 lb/ft³ (232 kg/m³) to ASTM C302
- .4 Flexural strength: 65 psi (448 kPa)
- .5 Compressive strength: >100 psi (690 kPa), 5% compression, to ASTM C165
- .6 Mould Growth: Does not support (ASTM C1338)
- .7 Surface burning characteristics: Flame spread:0, Smoke developed: 0. (ULC S102)
- .3 Tie Wire: stainless steel with twisted ends on 12" (300mm) centres maximum.
- .4 Insulating Cement: to ASTM C449.

Piping Insulation

2.5 JACKETS

- .1 PVC Plastic
 - .1 Jacket: ASTM C921, One piece moulded type fitting covers and sheet material.
 - .1 Minimum Service Temperature: -31°F (-35°C).
 - .2 Maximum Service Temperature: 151°F (66°C).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.03 perm inches.
 - .4 Maximum Flame Spread: ASTM E84; 25 or less.
 - .5 Maximum Smoke Developed: ASTM E84; 50 or less.
 - .6 Thickness: 20 mil (0.4 mm) minimum.
 - .2 Colour: standard off-white
 - .3 Covering Adhesive Mastic
 - .1 Compatible with insulation, maximum VOC content of 50 g/L.
 - .4 Manufacturer;
 - .1 Ceel-Co 300 series
 - .2 Speedline *Smoke Safe*
- .2 Aluminum Jacket: ASTM B209.
 - .1 Thickness: 0.02" (0.40 mm) sheet.
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal slip joints and 2" (50 mm) laps.
 - .4 Fittings: 0.02" (0.40 mm) thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Bands: 3/8" (10 mm) wide; 0.01" (0.38 mm) thick aluminum.

2.6 REMOVABLE / REUSABLE INSULATION COVERS

- .1 Material: Teflon coated, woven fibreglass fabric
- .2 Weight: 16.5 oz/sq.yd. (± 10%)
- .3 Thickness: 0.015" (± 10%)
- .4 Colour: Gray
- .5 Tensile Strength: 400 x 330 lb. (W x F)
- .6 Tarp Tear strength: 60 x 40 lb. (W x F)
- .7 Mullen Burst Pressure: 650 psi
- .8 Insulation thickness: Match connecting piping
- .9 Temperature Range: -67°F to 500°F
- .10 Lacing Hooks: Stainless Steel
- .11 Tie Wire: 16-ga stainless steel

2.7 ACCESSORIES

- .1 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 15100.2.2. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.
- .2 Vapor retarder lap adhesive shall be water based, fire retardant
- .3 Tapes shall be of cloth reinforced aluminum, soft adhesive with minimum 2" (50 mm) width.
- .4 Tie wire shall be of 1/16" (1.5 mm) Ø stainless steel.
- .5 Fasteners shall be of 1/8" (4 mm) Ø pins, with 35 mm square clips. Clip length to suit insulation thickness.
- .6 Bands shall be 1/2" (12 mm) wide 1/4" (6mm) thick galvanized steel.
- .7 Facing shall be of 1" (25 mm) galvanized steel hexagonal wire mesh attached on both faces of insulation.

3 EXECUTION

3.1 EXAMINATION

- .1 Verify that piping has been tested before applying insulation materials.
- .2 Verify that surfaces are clean, foreign material removed, and dry.

Piping Insulation

3.2 INSTALLATION

- .1 Install piping insulations to TIAC National Installation Standards.
- .2 Apply insulation materials, accessories, jackets and finishes in accordance with manufacturer' written instructions and as specified.
- .3 On exposed piping locate insulation and cover seams in least visible locations.
- .4 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - .1 Provide vapour barrier jackets, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with moulded insulation of like material and thickness as adjacent pipe.
 - .3 Finish with glass cloth and vapour barrier adhesive.
 - .4 PVC fitting covers may be used.
 - .5 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - .6 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- .5 For insulated pipes conveying fluids above ambient temperature:
 - .1 Provide standard jackets, with or without vapour barrier, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - .3 Finish with glass cloth and adhesive.
 - .4 PVC fitting covers may be used.
 - .5 For hot piping conveying fluids 140°F (60°C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - .6 For hot piping conveying fluids over 140°F (60°C), insulate flanges and unions at equipment.
- .6 Inserts and Shields:
 - .1 Application: Piping 1-1/2" (40 mm) diameter or larger.
 - .2 Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - .3 Insert Location: Between support shield and piping and under the finish jacket.
 - .4 Insert Configuration: Minimum 6" (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - .5 Insert Material: hydrous calcium silicate insulation.
- .7 Finish insulation at supports, protrusions, and interruptions.
- .8 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement.
- .9 Provide integral vapour barrier jacket on insulation on pipe and fittings for exterior applications.
- .10 Provide PVC jacket and fitting covers for pipe in mechanical equipment rooms and where exposed in finished spaces.
- .11 Provide aluminum jacket and fitting covers with seams located on bottom side of horizontal piping for exterior applications, in boiler rooms and where subject to temperatures > 200°F (93°C).
- .12 For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- .13 For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 PIPE INSULATION

- .1 Insulate new or altered piping with rigid pipe insulation and re-insulate existing piping where insulation has been removed or damaged as follows:

RIGID PIPE INSULATION			
Service	Operating Temperature Range °F	Pipe Diameter in.	Insulation Thickness in.

Piping Insulation

Domestic cold water	0 to 850	All sizes	1
Domestic hot water & hot water recirculation	105 to higher	2 and smaller	1
		2-1/2 and larger	1-1/2
Sanitary drainage	40 to 55	All sizes	1
Storm drainage	40 to 55	All sizes	1
FLEXIBLE INSULATION			
Service			Insulation Thickness
Horizontal storm and sanitary drainage			1"

RIGID PIPE INSULATION (SI)			
Service	Operating Temperature Range °C	Pipe Diameter (mm)	Insulation Thickness (mm)
Domestic cold water	-18 to 454	All sizes	25
Domestic hot water & hot water recirculation	41 and higher	50 and smaller	25
		65 and larger	40
Sanitary drainage	4 to 13	All sizes	25
Storm drainage	4 to 13	All sizes	25

- .2 Phenolic insulation may be used in place of rigid fiberglass pipe insulation, thickness to provide equivalent thermal resistance.
- .3 Insulate valves, flanges and pipe connections with removable / reusable insulation covers.
- .4 Wrap butt joints with a 4" (100 mm) strip of fire resistant vapour barrier jacket cemented with lagging adhesive.
- .5 Where the pipe hanger is around the insulation, provide an insulation protection shield within the pipe saddle. Coordinate with installation of hangers.
- .6 Insulate all fittings, flanges and valves on pipes to provide equivalent insulation to that on adjoining pipe.
- .7 Continue insulation through sleeves including specified finish.
- .8 Cut back covering on strainers and finish off to expose removable head insulation.
- .9 Cover expansion joints first with 24 gauge (0.7 mm) galvanized metal sleeve and then insulate to provide equivalent thickness to that on adjoining pipe.
- .10 Protect insulation with protection saddles where insulated pipe is supported by rollers.
- .11 Insulate pipe hangers supporting new piping carrying water at 70°F (21°C) or less to prevent condensation. Extend insulating material along hanger rod to height 4 times thickness of insulation. Seal insulation with vapour-proof sealant.
- .12 Extend pipe insulation and covering through walls, floors, ceilings, and concrete beams, unless indicated otherwise on drawings. protect exposed insulation extending through floors with 4" (100 mm) wide strip of 18 gauge (1.3 mm) galvanized iron.
- .13 Pack annular space between pipe sleeves and piping or pipe covering with glass fibre insulation or rockwool insulation. In fire rated assemblies use Dow Silicon RTV or other ULC listed materials. Seal exposed insulation with mastic.
- .14 Recover exposed surfaces of insulated piping installed in exposed areas, mechanical rooms, and equipment rooms with PVC jacketing and PVC fitting covers installed in accordance with manufacturers instructions.
- .15 Insulate and cover exposed surfaces of waste connections, traps, hot and cold supply risers and

Piping Insulation

valves at each lavatory and sink designated for "handicapped" or "barrier free" use with: PVC insulated fitting covers specifically designed for this application. Vinyl material is not to exceed flame spread rating of 150, and if intended to be used in high buildings, its smoke developed classification does not exceed 300. Zeston or other equivalent material. or foamed plastic type insulation finished with two coats of Armstrong Armflex or other equivalent material.

- .16 Provide aluminum metal cladding over the insulation on the following services;
 - .1 All exposed piping located outdoors.
- .17 Insulate sprinkler and standpipe main 6 feet (1800 mm) from take-off from domestic water.
- .18 Oversize insulation of Domestic hot water piping complete with heating cable for pipe sizes 1-1/4" (35 mm) dia. and smaller by 1/4" (6 mm) in inside diameter to allow for installation over heating cable.

END OF SECTION

Plumbing Specialities

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 SECTION INCLUDES

- .1 Cleanouts.
- .2 Water hammer arrestors.
- .3 Thermostatic mixing valves.

1.3 REFERENCES

- .1 ASME A112.26.1 - Water Hammer Arrestors.
- .2 ASSE 1011 - Hose Connection Vacuum Breakers.
- .3 PDI WH-201 - Water Hammer Arrestors.

1.4 SUBMITTALS FOR REVIEW

- .1 Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- .2 Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

1.5 SUBMITTALS FOR INFORMATION

- .1 Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors
- .2 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

- .1 Accept specialties on site in original factory packaging. Inspect for damage.

2 PRODUCTS

2.1 GENERAL

- .1 Manufacturer: Watts Drainage model indicated or equivalent by;
 - .1 Zurn
 - .2 Jay R. Smith

2.2 CLEANOUTS

- .1 Interior Finished Floor Areas:
 - .1 Watts Drainage model CO-200-R, CO-200-U
 - .2 Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

Plumbing Specialities

- .2 Interior Finished Wall Areas:
 - .1 Watts Drainage model WUCO
 - .2 Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- .3 Caulking for cleanouts: VOC content not to exceed 250g/L.

2.3 WATER HAMMER ARRESTORS

- .1 Watts Drainage Series 05
- .2 ANSI A112.26.1; copper construction, piston type sized to PDI WH-201, precharged suitable for operation in temperature range 33°F to 100°F (0.5°C to 82°C) and maximum 150 psi (1000 kPa) working pressure.

3 EXECUTION

3.1 GENERAL

- .1 Install all products in accordance with the plumbing code and with manufacturer's instructions.

3.2 CLEANOUTS

- .1 Cleanouts shall be the same size as the pipe up to 4" (100mm) and not less than 4" (100mm) for larger pipes.
- .2 Provide cleanouts at the end of mains and branches, at changes in direction, in long straight runs and at the base of all soil stacks and rainwater leaders and where required by code.
- .3 Extend cleanouts to finished floor or wall surface.
- .4 Encase exterior cleanouts in concrete flush with grade.
- .5 Install floor cleanouts at elevation to accommodate finished floor.
- .6 Cleanouts in floors with surface membranes shall be installed with a membrane clamp and anchoring flange.
- .7 Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
- .8 Ensure clearance at cleanout for rodding of drainage system.

3.3 WATER HAMMER ARRESTORS

- .1 Install water hammer arrestors complete with an accessible isolation valve on hot and cold water supply piping to:
 - .1 plumbing fixtures and fixture groups,
 - .2 downstream of each backflow preventor,
 - .3 HVAC equipment with solenoid valves or other quick closing valves,
 - .4 Owner's equipment and appliances with flush valves, solenoid valves or other quick closing valves,
 - .5 wherever necessary to prevent water hammer.

END OF SECTION

Plumbing Piping

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 22 01 01.

1.2 SECTION INCLUDES

- .1 Pipe, pipe fittings, valves, and connections for piping systems.
 - .1 Sanitary Sewer
 - .2 Sanitary Vent
 - .3 Domestic (Potable) Water.
- .2 Disinfection of potable water distribution system.
- .3 Testing and reporting results.

1.3 REFERENCES

- .1 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .3 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- .4 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.
- .5 ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- .6 ASME B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.
- .7 ASTM A74 - Cast Iron Soil Pipe and Fittings.
- .8 ASTM B32 - Solder Metal.
- .9 ASTM B42 - Seamless Copper Pipe, Standard Sizes.
- .10 ASTM B68 - Seamless Copper Tube, Bright Annealed.
- .11 ASTM B75 - Seamless Copper Tube.
- .12 ASTM B88 - Seamless Copper Water Tube.
- .13 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .14 ASTM B302 - Threadless Copper Pipe, Standard Sizes.
- .15 ASTM B306 - Copper Drainage Tube (DWV).
- .16 ASTM C1053 - Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
- .17 ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
- .18 ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- .19 ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- .20 ASTM D2447 - Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- .21 ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- .22 ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- .23 ASTM D2661 - Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
- .24 ASTM D2665 - Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .25 ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .26 ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer, Pipe, and Fittings.
- .27 ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.
- .28 ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- .29 ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .30 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- .31 ASTM F679 - Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- .32 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .33 AWWA C110 - Ductile - Iron and Gray - Iron Fittings, 3" - 48" (76 mm - 1219 mm), for Water.
- .34 AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .35 AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water.
- .36 AWWA C651 - Disinfecting Water Mains.
- .37 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe (and Fabricated Fittings), 4" - 12" (100 mm - 300 mm), for Water Distribution.

Plumbing Piping

- .38 AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2" - 3" (13 mm - 76 mm) for Water Service.
- .39 AWWA C902 - Polybutylene (PB) Pressure Pipe and Tubing, 1/2" - 3" (13 mm - 76 mm) for Water.
- .40 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14" - 48" (350 mm - 1200mm).
- .41 CISPI 301 - Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
- .42 CISPI 310 - Joints with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- .43 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .44 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .45 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SUBMITTALS FOR REVIEW

- .1 Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Project Record Documents: Record actual locations of valves.

1.6 QUALITY ASSURANCE

- .1 Perform Work to Province of Ontario standards. Maintain one copy on site.
- .2 Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.7 REGULATORY REQUIREMENTS

- .1 Perform Work to Province of Ontario plumbing code.
- .2 Conform to applicable code for installation of backflow prevention devices.
- .3 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.8 DELIVERY, STORAGE, AND PROTECTION

- .1 Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- .2 Provide temporary protective coating on cast iron and steel valves.
- .3 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .4 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install underground piping when bedding is wet or frozen.

1.10 EXTRA MATERIALS

- .1 Provide two repacking kits for each size valve.

2 PRODUCTS

2.1 SANITARY SEWER PIPING, ABOVE GRADE

- .1 Cast Iron Pipe: ASTM A74, service weight.
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564, neoprene gasket system

Plumbing Piping

- .2 Cast Iron Pipe: CISPI 301, hubless, service weight.
 - .1 Fittings: Cast iron.
 - .2 Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- .3 Copper Tube: ASTM B306, DWV.
 - .1 Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper, or ASME B16.32, sovent.
 - .2 Joints: ASTM B32, solder, Grade 50B.

2.2 WATER PIPING, ABOVE GRADE

- .1 Copper Tubing: ASTM B88M, Type L, hard drawn.
 - .1 Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - .2 Joints: ASTM B32, solder, Grade 95TA.
- .2 Copper Tubing: ASTM B88M, Type L, hard drawn.
- .3 Ductile Iron Pipe: AWWA C151.
 - .1 Fittings: Ductile iron, standard thickness.
 - .2 Lining: cement
 - .3 Joints: AWWA C111, rubber gasket with 3/4" (19 mm) diameter rods.

2.3 FLANGES, UNIONS, AND COUPLINGS

- .1 Pipe Size 3-1/4" (80 mm) and Under:
 - .1 Ferrous pipe: Class 150 malleable iron threaded unions.
 - .2 Copper tube and pipe: Class 150 bronze unions with soldered joints.
- .2 Pipe Size Over 1" (25 mm):
 - .1 Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - .2 Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- .3 Grooved and Shouldered Pipe End Couplings:
 - .1 Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .2 Sealing gasket: "C" shape composition sealing gasket.
- .4 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 PIPE HANGERS AND SUPPORTS

- .1 Plumbing Piping - Drain, Waste, and Vent:
 - .1 Conform to ASME B31.9.
 - .2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
 - .3 Hangers for Pipe Sizes 2" (50 mm) and Over: Carbon steel, adjustable, clevis.
 - .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .5 Wall Support for Pipe Sizes to 3-1/4" (80 mm): Cast iron hook.
 - .6 Wall Support for Pipe Sizes 4" (100 mm) and Over: Welded steel bracket and wrought steel clamp.
 - .7 Vertical Support: Steel riser clamp.
 - .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .9 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .2 Plumbing Piping - Water:
 - .1 Conform to ASME B31.9.
 - .2 Hangers for Pipe Sizes 1/2" to 1-1/2" (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
 - .3 Hangers for Cold Pipe Sizes 2" (50 mm) and Over: Carbon steel, adjustable, clevis.
 - .4 Hangers for Hot Pipe Sizes 2" to 4" (50 to 100 mm): Carbon steel, adjustable, clevis.

Plumbing Piping

- .5 Hangers for Hot Pipe Sizes 6" (150 mm) and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
- .6 Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
- .7 Multiple or Trapeze Hangers for Hot Pipe Sizes 6" (150 mm) and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
- .8 Wall Support for Pipe Sizes to 3-1/4" (80 mm): Cast iron hook.
- .9 Wall Support for Pipe Sizes 4" (100 mm) and Over: Welded steel bracket and wrought steel clamp.
- .10 Wall Support for Hot Pipe Sizes 6" (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
- .11 Vertical Support: Steel riser clamp.
- .12 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- .13 Floor Support for Hot Pipe Sizes to 4" (100 mm): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
- .14 Floor Support for Hot Pipe Sizes 6" (150 mm) and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
- .15 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.5 VALVES - GENERAL

- .1 Conform to requirements of ANSI, ASTM, ASME, and applicable MSS standards.
- .2 Provide valves of the same manufacturer where possible.
- .3 Manufacturer's name and pressure rating clearly marked on body to MSS-SP-25.
- .4 Valid CRN (Canadian Registration Number) issued by Province of Ontario required for each valve.
- .5 Materials:
 - .1 Bronze: ASTM B62 or B61 as applicable
 - .2 Brass: ASTM B283 C3770
 - .3 Cast Iron: ASTM A126 Class B
- .6 End Connections:
 - .1 Flanged ends: ANSI B16.1 (Class 125), ANSI B16.5
 - .2 Face-to-face dimensions: ANSI B16.10
- .7 Design and Testing:
 - .1 Bronze Gate & Check valves: MSS-SP-80
 - .2 Ball Valves: MSS-SP-110
 - .3 Cast Iron Gate Valves: MSS-SP-70
 - .4 Cast Iron Globe Valves: MSS-SP-85
 - .5 Cast Iron Check: MSS-SP-71
 - .6 Butterfly Valves: MSS-SP-67
- .8 First named product as indicated in paragraphs below; other acceptable manufacturers, subject to equivalent products listed on spread sheet attached.

2.6 ISOLATION VALVES

- .1 Up To and including 2" (50mm) - Ball type
 - .1 Manufacturer: Kitz #69AMLL
 - .2 Construction: MSS SP-110, Class 150, 600 psi (4140 kPa) CWP, forged brass, two piece body, stainless steel ball and stem, full port, virgin PTFE seats and stem packing, blow-out proof stem, lever handle with balancing stops, stem extensions for insulated piping, solder ends.
- .2 2-1/2" (65 mm) and Larger - Butterfly type:
 - .1 Manufacturer: Kitz 6122EL
 - .2 Construction: MSS-SP-67, MSS-SP-25 and API-609; lug type having bi-directional "Dead End Service" pressure rating of 1380 kPa (200 psi) with the downstream flange removed; stainless steel stem with top and bottom bushings of dissimilar materials and with positive

Plumbing Piping

stem retention mechanism, aluminum bronze disc and molded or bonded style EPDM seat; suitable for both chilled water and hot water operation; supplied with 10 position locking lever handle 2" extended neck to allow for insulation. Provide gear operators for valves 150 mm and larger, and chain-wheel operators for valves mounted over 8-Ft (2400 mm) above floor.

2.7 DISINFECTION CHEMICALS

- .1 Chemicals: AWWA B300, Hypochlorite,

3 EXECUTION

3.1 EXAMINATION

- .1 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and dirt, on inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- .1 Install to manufacturer's instructions.
- .2 Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- .3 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- .4 Install piping to maintain headroom, conserve space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.
- .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .7 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- .8 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with general trades.
- .9 Establish elevations of buried piping outside the building to ensure not less than 5'6" (1.6 m) of cover.
- .10 Install vent piping penetrating roofed areas to maintain integrity of roof assembly; coordinate with Division 07.
- .11 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer (maximum VOC content of 80 g/L) to welding.
- .12 Provide support for utility meters to requirements of utility companies.
- .13 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting where required. Coordinate with general trades.
- .14 Excavate and backfill as required for work of this Section.
- .15 Install bell and spigot pipe with bell end upstream.
- .16 Install valves with stems upright or horizontal, not inverted.
- .17 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- .18 Sleeve pipes passing through partitions, walls and floors.
- .19 Inserts:
 - .1 Provide inserts for placement in concrete formwork.
 - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100 mm).
 - .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - .5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- .20 Pipe Hangers and Supports:

Plumbing Piping

- .1 Install to OBC (Plumbing Code)
- .2 Support horizontal piping as scheduled.
- .3 Install hangers to provide minimum 1/2" (15 mm) space between finished covering and adjacent work.
- .4 Place hangers within 12" (300 mm) of each horizontal elbow.
- .5 Use hangers with 1-1/2" (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- .6 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .8 Provide copper plated hangers and supports for copper piping.
- .9 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- .10 Provide hangers adjacent to motor driven equipment with vibration isolation.
- .11 Support cast iron drainage piping at every joint.

3.4 APPLICATION

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.
- .2 Install unions downstream of valves and at equipment or apparatus connections.
- .3 Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- .4 Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .5 Install globe valves for throttling, bypass, or manual flow control services.
- .6 Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
- .7 Provide spring loaded check valves on discharge of water pumps.
- .8 Provide plug valves in natural gas systems for shut-off service.
- .9 Provide flow controls in water recirculating systems where indicated.

3.5 ERECTION TOLERANCES

- .1 Establish invert elevations, slopes for drainage to 2 percent minimum. Maintain gradients.
- .2 Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- .1 Disinfect all new and altered water distribution piping.
- .2 Verify that piping system is complete and has been flushed, cleaned, inspected, and pressure tested.
- .3 Isolate existing piping to full extent possible. Ensure that all fixtures, existing and new that are served from piping being disinfected, are taken out of service and signs are placed at each fixture prohibiting use during the disinfection period.
- .4 Schedule and perform disinfecting activities with start-up, testing, adjusting, balancing, and demonstration procedures. Coordinate with related systems.
- .5 Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- .6 Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- .7 Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- .8 Maintain disinfectant in system for 24 hours.
- .9 If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- .10 Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- .11 Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze to AWWA C651.

3.7 SCHEDULES

Plumbing Piping

- .1 Pipe Hanger Schedule:
 - .1 Metal Piping:
 - .1 Pipe size: 1/2" to 1-1/4" (15 to 32 mm):
 - .1 Maximum hanger spacing: 6.5' (2 m).
 - .2 Hanger rod diameter: 3/8" (9 mm).
 - .2 Pipe size: 1-1/2" to 2" (40 to 50 mm):
 - .1 Maximum hanger spacing: 10' (3 m).
 - .2 Hanger rod diameter: 3/8" (9 mm).
 - .3 Pipe size: 2-1/2" to 3" (65 to 75 mm):
 - .1 Maximum hanger spacing: 10' (3 m).
 - .2 Hanger rod diameter: 1/2" (13 mm).
 - .4 Pipe size: 4" to 6" (100 to 150 mm):
 - .1 Maximum hanger spacing: 10' (3 m).
 - .2 Hanger rod diameter: 1/2" (15 mm).
 - .5 Pipe size: 8" to 12" (200 to 300 mm):
 - .1 Maximum hanger spacing: 14' (4.25 m).
 - .2 Hanger rod diameter: 3/4" (22 mm).
 - .6 Pipe size: 14" (350 mm) and Over:
 - .1 Maximum hanger spacing: 20' (6 m).
 - .2 Hanger rod diameter: 1" (25 mm).

END OF SECTION

Plumbing Fixtures and Trim

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 21 01 01.

1.2 SECTION INCLUDES

- .1 Sinks, faucets, spouts, waste

1.3 REFERENCES

- .1 ASME A112.18.1 - Plumbing Fixture Fittings.
- .2 ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- .3 CAN/CSA-B45.0 General Requirements for Plumbing Fixtures
- .4 CAN/CSA-B45.4 Stainless Steel Plumbing Fixtures
- .5 CAN/CSA-B125.1 Plumbing Supply Fittings
- .6 CAN/CSA-B125.2 Plumbing Waste Fittings
- .7 CAN/CSA-B125.3 Plumbing Fittings
- .8 CAN/CSA-B125.6 Flexible Water Connectors

1.4 SUBMITTALS FOR REVIEW

- .1 Product Data:
 - .1 Provide catalogue illustrations of fixtures,
 - .2 sizes,
 - .3 rough-in dimensions,
 - .4 service sizes (capacities)
 - .5 trim,
 - .6 finishes.

1.5 SUBMITTALS FOR INFORMATION

- .1 Manufacturer's Instructions: Indicate installation methods and procedures.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- .2 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum five years documented experience.
- .2 Installer Qualifications: trades licence with minimum five years documented experience.

1.8 REGULATORY REQUIREMENTS

- .1 Products Requiring Electrical Connection: Listed and classified by CSA, ULC, cUL or Special Inspection as suitable for the purpose specified and indicated.

1.9 MOCK-UP

- .1 Refer to Division 01: Requirements for mock-up.
- .2 Provide mock-up of typical bathroom group.
- .3 Mock-up may remain as part of the Work, if approved by Consultant.

Plumbing Fixtures and Trim

1.10 DELIVERY, STORAGE, AND PROTECTION

- .1 Transport, handle, store, and protect products.
- .2 Accept fixtures on site in factory packaging. Inspect for damage.
- .3 Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.11 WATER EFFICIENCY

- .1 The flow rates of fittings that supply water to a fixture shall not exceed the maximum flow rates at the test pressures listed in the table as follows:

Fittings Pressure	Maximum Flow		Test	
	l.gpm	L/min	Psi	kPa
Sink Faucet	1.84	8.35	60	413

2 PRODUCTS

2.1 MANUFACTURERS

- .1 All plumbing fixtures, fixture trim and accessories shall be provided as per Plumbing Fixture Schedule on the Mechanical Drawings.

3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- .1 Section 22 01 01: Verification of existing conditions before starting work.
- .2 Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- .3 Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

- .1 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- .1 Install each fixture with trap, easily removable for servicing and cleaning.
- .2 Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- .3 Install components level and plumb.
- .4 Install and secure floor mounted fixtures in place with bolts.
- .5 Install and secure wall hung fixtures in place with wall carriers and bolts.
- .6 Seal fixtures to wall and floor surfaces with sealant having VOC content not exceeding 250 g/L, colour to match fixture.
- .7 Solidly attach water closets to floor with lag screws.

3.4 ADJUSTING

- .1 Section 01 78 10 - Execution Requirements: Adjusting installed work.
- .2 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

Plumbing Fixtures and Trim

- .1 Section 01 78 10 - Execution Requirements: Cleaning installed work.
- .2 Clean plumbing fixtures and equipment.

3.6 PROTECTION OF FINISHED WORK

- .1 Section 01 78 10 - Execution Requirements: Protecting installed work.
- .2 Do not permit use of fixtures.

END OF SECTION

General Requirements

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and conform to:
 - .1 The Contract CCDC 2-2020, Stipulated Price Contract as amended,
 - .2 Division 1 requirements and documents referred to therein.
- .2 Section 23 01 01 applies to and governs the work of all Sections of Division 23.
- .3 The technical Sections of this Division are generally divided into units of work for the purpose of ready reference. The division of the work among subcontractors is not the Consultant's responsibility and the Consultant assumes no responsibility to act as an arbiter and/or to establish subcontract limits between any Sections of the work.
- .4 The specifications are integral with the drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one but implied in the other is fully and properly required.
- .5 Wherever differences occur in the tender documents, the most onerous condition governs. Base the bid on the most costly arrangement.
- .6 Ensure Sub-contractors undertaking the work of Division 23 provide a 50% performance bond and a 50% labour and materials payment bond. In addition, ensure Sub-contractors employed to undertake any part of the work of Division 23 that is \$50,000.00 or greater in contract value provide a 50% performance bond and a 50% labour and materials bond to the party they are in contract with.

1.2 WORK INCLUDED

- .1 Products and methods mentioned or shown in the Contract Documents complete with incidentals necessary for a complete operating installation. Provide all tools, equipment and services required to do the work.
- .2 Cutting and patching of new or existing work
- .3 Identification of equipment, piping, ductwork, and valves and controllers
- .4 Motors required for equipment supplied under this Division.
- .5 Variable frequency drives for motors and equipment supplied under this Division.
- .6 Internal wiring, relays, contactors, switches, transformers, motor starters, and all controls necessary for the intended operation, furnished with terminals and external controls suitable for connection to power source at a single easily accessed location for equipment items that are supplied with motors and/or electrical or electronic components under this Division.
- .7 Take such measures and include in Bid Price for the proper protection of the existing building and its finishes at all times during alterations and construction of the new addition. Coordinate this protective work with all trades.
- .8 Refer to Mechanical/Electrical Equipment Schedule for extent of wiring and electrical characteristics.
- .9 Verify the correct operation of each equipment item provided and/or altered and each system in total and obtain the Owner's approval prior to starting and/or returning to operation.

1.3 RELATED WORK

- .1 Power wiring, conduit and connections for motors under this Division will be by Division 26.
- .2 Power wiring, conduit and connections to variable frequency drives for motors under this Division will be by Division 26. Wiring and connections from VFD to motors under this Division will be by Division 26 unless specified otherwise.
- .3 Flashings for mechanical equipment and services located on or passing through roofs will be provided under Division 7. Supply counter flashings, and integral flashing collars on equipment and piping under this Division.
- .4 Painting of exposed piping and ductwork other than for identification will be supplied under Division 9.
- .5 Concrete equipment bases, housekeeping pads, sump pits and trenches will be provided under Division 3.

1.4 SUBMITTALS

- .1 Approval Drawings: Prepare and submit drawings necessary for approval to any authority having

General Requirements

- jurisdiction, and obtain two (2) copies of approved drawings for retention by Consultant prior to commencement of work under this Division.
- .2 Shop Drawings: Prepare and submit two (2) hard copies and one (1) electronic copy of shop drawings of major equipment items (including those items specifically indicated under Part 1: General of each Section), to the Consultant for review. The Consultant will return one copy, marked with comments and his review stamp as he deems appropriate. Prepare the necessary number of copies of the returned set and distribute to the Owner, the Prime Consultant, the General Contractor, the site, and to subcontractors and suppliers.
- .1 Clearly indicate manufacturer's and supplier's names, catalogue model numbers, details of construction, accurate dimensions, capacities and performance. Prior to submission check and certify as correct, shop drawings and data sheets. Do not order equipment until a copy of the shop drawings, reviewed by Consultant, has been returned to Contractor.
- .2 Clearly indicate the weight, location, method of support and anchor point forces and locations for each piece of equipment on shop drawings.
- .3 The Consultant will not review shop drawings that fail to bear the Contractor's stamp of approval or certification.
- .4 Read the following in conjunction with the wording on the shop drawing review stamp applied to each and every drawing submitted:
"This review by the Consultant is for the sole purpose of ascertaining conformance with general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub trades."
- .3 Sleeving Drawings: Prepare and submit 4 copies of sleeving drawings to clearly and accurately indicate the exact location, elevation and size of any and all formed holes, recesses and sleeving required in the work of Division 23. Obtain Consultant's approval in writing prior to sleeving, forming or cutting any such opening. Provide a copy of approved sleeving drawings to the reinforcement detailer well in advance of planned pours.
- .4 Composite Wiring Diagrams: Prepare and submit three (3) copies of complete composite wiring diagrams of each specific mechanical system. Indicate all electrical equipment and wiring, both internal and external, for review and coordination of trades.
- .5 Contractor's Material and Test Certificates: Prepare and submit certificates for each system installed. Where certificates are prescribed by regulations, codes or standards ensure they conform to the requirements of those documents (eg. NFPA-standards). Include a copy of each certificate in the Operation and Maintenance manual. Certificates shall include the following:
- .1 description of the system (description and type),
- .2 description of the tests conducted and results observed, including re-testing, where necessary,
- .3 description of any corrective measures undertaken,
- .4 description of materials used (pipe and fittings),
- .5 list of witnesses for each test conducted,
- .6 date system left ready for service,
- .7 signature of installing Contractor.
- .6 Directories & Schematics
- .1 Submit five (5) copies of a neat typewritten directory indicating the valve number, related service, and location of each valve under this Division.
- .2 Submit five (5) copies of system control schematics for each mechanical system indicating relative locations of equipment and control devices.
- .3 Enclose one (1) copy of each directory/schematic under glass in a neat polished 18" x24" (460 mm x 610 mm) metal frame, complete with mounting clips.
- .7 Maintenance Data and Operating Instructions
- .1 Submit three (3) copies of Operation and Maintenance Manual individually bound in hard backed three-ring binders.

General Requirements

- .2 Ensure the binder spines have typewritten lettering as follows:
OPERATION & MAINTENANCE MANUAL
for

[Insert name of project]
[Insert date of submission]
[Insert Division Title]
- .3 Provide a list of names, addresses and telephone numbers of equipment suppliers, installing contractors, general contractors, architect and Consultant. Include special telephone numbers for service departments on normal and emergency call basis.
- .4 Provide descriptive literature (shop drawings) of each manufactured item. Include a bill of material with purchase order numbers and vendor's identification of equipment orders for each item.
- .5 Include copies of start-up reports and checklists and all certificates issued with respect to this contract.
- .6 Ensure operating instructions include the following:
 - .1 General description of each mechanical system.
 - .2 Step by step procedure to follow in putting each piece of equipment into service.
 - .3 Schematic control diagrams for each separate mechanical system, control thermometers, freezestats, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control device on these diagrams.
 - .4 Diagram of the electrical control system indicating the wiring of all related electrical components such as PE and EP switches, firestats, freezestats, fuses, interlocks, electrical switches and relays.
 - .5 Drawings of each control panel including temperature control and electrical panels, completely identifying all components on the panels and their function.
- .7 Ensure maintenance instructions include the following:
 - .1 Manufacturer's maintenance instructions for each item of mechanical equipment installed under this Division. Instructions shall include installation instructions, parts numbers and lists, name of supplier and maintenance and lubrication instructions.
 - .2 Summary list of each item of mechanical equipment requiring lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication.
 - .3 Equipment directory indicating name, model, serial number and nameplate data of each item of equipment supplied, and system with which it is associated.
 - .4 Balancing and testing reports.
 - .5 Copy of valve directory.
- .8 As-Built Records: Prepare and submit complete as-built records prior to Substantial Performance of the Contract. Refer to Division 1 for requirements.
- .9 Requests for Shut-Down: Obtain permission for systems shut-down and/or service interruption from the Owner prior to disruption of any system or service in use by the Owner. Employ the Owner's standard form of request where available. Refer to Division 1 for additional requirements.
- .10 Requests for Start-up: Obtain permission from the Owner to start-up or to return to service any item of equipment, system or service installed new or previously shut-down. Refer to Division 1 for additional requirements.

1.5 QUALITY ASSURANCE

- .1 Conform to minimum requirements or better of provincial and local codes, where existing, and to requirements of local inspection authorities for execution of work under this Division.
- .2 Ensure materials supplied under this Division conform to minimum requirements and recommendations or better of applicable standards of the following:
- .3 Use latest editions and amendments in effect on date of Bid call subject to requirements of OBC.
- .4 Arrange and pay for permits and inspections by authorities having jurisdiction, required in the

General Requirements

- undertaking of this Division. Make modifications required by authorities.
- .5 All tradesmen employed on the project shall hold valid trade certificates/licenses and shall make a copy available for review by the Consultant and/or Owner when requested.
 - .6 All welding and brazing shall be executed by certified welders in accordance with registered procedures.
 - .7 All refrigeration work shall be executed only by mechanics with valid ODP cards.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

- .1 Immediately after letting of contract, review material and equipment requirements for this work, determine supply and delivery dates for all items, and notify Consultant of any potential delays in completion of this project in order that remedial action may be taken.
- .2 Store neatly out of the way and protected from damage and theft, materials and equipment supplied under this Division that are received at the site by this Division.

1.7 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.8 WARRANTY

- .1 Refer to General Conditions. Arrange with each manufacturer/supplier to extend warranties as necessary to coincide with warranty period or those periods specified.
- .2 Make submissions necessary to register product warranties to the benefit of the Owner.
- .3 Submit to Consultant, prior to Substantial Performance of the Contract, manufacturer's written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Owner's name.

1.9 DEFINITIONS

- .1 The following are definitions of words found in this specification and on associated drawings under this Division:
 - .1 "Concealed" - locations hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.
 - .2 "Exposed" - mechanical work normally visible to building occupants.
 - .3 "Furnish" - (and its derivatives) has the same meaning as the term "Supply".
 - .4 "Install" - (and its derivatives) - receive, store and handle at the site, mount and support and connect all required services. Includes adjustment and calibration, testing, commissioning, inspection by authorities having jurisdiction and documentation.
 - .5 "Provide" - (and its derivatives) - supply, install in place, connect the associated required services ready for operation, adjust and calibrate, test, commission, warrant, and document. Includes inspection by authorities having jurisdiction.
 - .6 "Supply" - (and its derivatives) purchase and deliver to the site for installation. Includes submittals, manufacturer's field inspection and warranty.
 - .7 "Wet" - locations exposed to moisture, requiring special materials and arrangement.

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

General Requirements

- .1 Ensure materials and equipment provided under this Division are new and free from defects and bear labels of approval as required by codes referred to in this Division and/or by inspection authorities.
- .2 Ensure apparatus and equipment provided under this Division bears manufacturer's nameplate indicating name of manufacturer, model number or type, size, capacity, CRN, and other pertinent information. Ensure nameplates are easily read and clearly visible, with openings provided where equipment is insulated.
- .3 Ensure manufacturers and suppliers of equipment or materials under this Division determine if their products are composed of any hazardous materials. If they are, the products are suitably labeled and supplied with Material Safety Data sheets. Obtain the Owner's approval in writing to bring hazardous materials onto the site prior to doing so.
- .4 When utilizing any products that are hazardous, keep Material Safety Data sheets on file at the job site and present them to anyone requesting this information. When transferring hazardous materials from original container into other containers, provide Workplace Labels on such containers.

2.2 ACCEPTABLE PRODUCTS

- .1 First item named or specified by catalogue number meets specifications regarding performance, quality of material and workmanship, and is acceptable to the Consultant.
- .2 Items, other than first named, meeting specifications regarding quality of materials and workmanship are acceptable to the Consultant, only, if they also meet performance and/or capacities specified and can be accommodated within the space allotted.
- .3 General approval indicated by inclusion of other manufacturers named is subject to final review of shop drawings, performance data and test reports.

2.3 EQUIVALENTS AND ALTERNATIVES

- .1 Suppliers wishing approval for additional equipment items as equivalent to those specified must submit complete description, technical and performance data to Consultant at least ten (10) working days prior to Bid closing date. Such equivalent equipment, if accepted, to conform to specifications with regard to all details, accessories, modifications, features and performance. Deviations from specifications must be stated in writing at time of submission for approval.
- .2 Bid Prices shall include only products specified or approved equivalents. Contractors may propose unsolicited alternatives to the products specified. Alternative proposals shall be submitted in sealed envelope at time of general contract Bid submission and shall include full description and technical data, and a statement of the related increase or decrease in Bid Price should alternatives be accepted. All additional costs associated with unsolicited alternative proposals such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in alternative price. Prior approval by Consultant is not required for unsolicited alternative proposals.
- .3 Where the Contractor uses equipment other than that first named, on which the design is based, he shall be responsible for all details of installation including equipment size, arrangement, fit, and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by Contractor to provide such drawings will be considered indication that original arrangements and space allocations are adequate. All additional costs associated with equivalent equipment such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in Bid Price.

2.4 SUBSTITUTIONS DURING PROGRESS OF WORK

- .1 If during the progress of work, specified products are not obtainable, equivalent or similar products by other manufacturers may be permitted by Consultant.
- .2 Apply, in writing, to Consultant for substitution of any products, indicating the following:
 - .1 Manufacturer's name, model number, details of construction, accurate dimensions, capacities and performance of proposed products.
 - .2 Reason for substitution.
 - .3 Any revisions to the contract price made necessary by substitution.

General Requirements

- .4 Any revisions to the contract time made necessary by substitution.
- .5 Any revisions to layout, arrangement or services made necessary by substitution.
- .3 No substitutions will be permitted without written authorization from the Consultant.

2.5 CONSULTANT'S REVIEW

- .1 The consultants will review and evaluate unsolicited alternatives and substitutions proposed by the Contractor. Such review and evaluation work will be undertaken by the Consultant on an additional fee basis. The Contractor shall reimburse the Owner for all costs associated with such reviews and evaluations.
- .2 The Contractor shall also reimburse the Owner for any and all costs incurred in updating Contract Documents to reflect such changes.

3 EXECUTION

3.1 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Provide materials to be built-in, such as sleeves, anchors, and inserts, together with templates and/or measurements, promptly when required by other trades.
- .3 Provide structural supports for equipment to be mounted on or in walls, supported above floors and/or suspended from the structure.

3.2 INSTALLATION REQUIREMENTS

- .1 The Consultant's drawings and instructions govern the location of all items. Prepare fully coordinated installation drawings prior to installation.
- .2 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise install products and services to follow building planes. Ensure installation permits free use of space and maximum headroom.
- .3 Confirm the exact location of outlets, fixtures and connections. Confirm location of outlets for equipment supplied under other Divisions.
- .4 Install equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
- .5 Install metering and/or sensing devices to provide proper and reliable sampling of quantities being measured. Install instruments to permit easy observation.
- .6 Provide suitable shielding and physical protection for devices.
- .7 Install products and services in accordance with the manufacturer's requirements and/or recommendations.
- .8 Provide bases, supports, hangers and fasteners. Secure products and services so as not to impose undue stresses on the structure and systems.
- .9 Do not use power activated tools without written permission of the Consultant. Use them in accordance with the Owner's health and safety policies.
- .10 Ensure that the load onto structures does not exceed the maximum loading per square metre indicated on the structural drawings or as directed by the Consultant.

3.3 CONTRACT DRAWINGS

- .1 The drawings of this Division are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- .2 Obtain accurate dimensions from the architectural and structural drawings, or by measurement. Location and elevation of services are approximate. Verify them before construction is undertaken.
- .3 Make changes where required to accommodate structural conditions, (beams, columns, etc.). Obtain Consultant's approval before proceeding.
- .4 Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Note

General Requirements

that outlets and/or equipment may be relocated up to 10 feet (3 m) in any direction without a change to the contract price.

- .5 Note that the layout and orientation of the ceiling outlets on the architectural reflected ceiling drawings may differ from that shown on the mechanical drawings. Make the installation in accordance with the latest architectural ceiling drawings. Provide the equipment as specified and/or shown on the documents of this Division.
- .6 The drawings of this Division are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as shown on the mechanical documents. If there is a difference in quantity between the architectural and drawings of this Division, base the contract price on the greater quantity.
- .7 Prepare installation (construction) drawing to reflect the latest architectural ceiling layout.

3.4 CONSTRUCTION DRAWINGS

- .1 Prepare fully dimensioned drawings showing devices, fixtures, equipment, outlets, sleeves and openings through structure. Indicate locations and weights on load points.
- .2 Prepare fully dimensioned construction drawings of products and services suitably interfaced with work of the sub-trades, in mechanical rooms, service and ceiling spaces, and other critical locations. Coordinate the work with other divisions. Base drawings on reviewed shop drawings and latest architectural drawings. Indicate details pertaining to the following: access, clearances, cleanouts, sleeves, electrical connections, drain locations and elevation of pipes, ducts, conduits.
- .3 Prepare drawings of pits, curbs, sills, equipment bases, anchors, inertia slabs, etc.
- .4 Submit construction drawings to other Divisions. Provide one (1) transparency and four (4) print copies of construction drawings to the Consultant for record purposes.
- .5 Submit construction drawings prior to commencement of work.

3.5 RECORD DRAWINGS

- .1 Maintain project "as-built" record drawings. Obtain white prints from the Consultant for this purpose and pay printing costs. Identify each set as "Project Record Copy".
- .2 Record deviations from contract documents caused by site conditions or by changes ordered by the Consultant. Record deviations in red ink clearly and accurately, using industry standard drafting procedures consistent with quality and standards of Consultants documents.
- .3 Record deviations as work progresses throughout the execution of this contract. Maintain record drawings on site in clean, dry, legible condition, making them available for periodic review by the Consultant.
- .4 Record location of concealed services, particularly underground services. Before commencing any backfilling, obtain accurate measurements and information concerning correct location and depth of services.
- .5 Transfer records from the "Project Record Copy" to a DVD in Autocad format matching the Consultant's documents. Arrange computer file in layers to exactly match the layering system of the Consultant.
- .6 Submit the "Project Record Copy" on one or more DVD with white prints of each drawing to the Consultant at the time of Substantial Performance.

3.6 USE OF EQUIPMENT

- .1 For the duration of this contract, do not use any piece of equipment provided under this contract for the purposes of heating, ventilation or air conditioning without the specific authorization of the Owner and Consultant. Ensure the building is "broom clean" and painting is finished before asking permission for testing to commence.
- .2 Where specific written authorization is given for the use of equipment while work is still in progress, seal off ductwork, grilles, diffusers, and registers or other openings to the air distribution systems or air handling equipment that is not in use. Provide filters over openings in ductwork, over grilles, diffusers and registers and in or at any air handling equipment that is in use. Ensure that the edges are sealed so that the filters are not bypassed. Change the filters frequently, to the satisfaction of the Consultant, until the building is turned over the Owner.

General Requirements

3.7 SPECIAL TOOLS AND SPARE PARTS

- .1 Within 30 days of award of contract, prepare a complete itemized list of special tools and spare parts and submit to Consultant for review. List will be used as a checklist and should include provision for sign off by the Owner on receipt.
- .2 On completion of the project furnish spare parts to the Owner as follows:
 - .1 One set of mechanical seals for each pump.
 - .2 One casing joint gasket for each pump.
 - .3 One head gasket for each heat exchanger.
 - .4 One glass for each gauge glass installed.
 - .5 One set of v-belts for each piece of machinery.
 - .6 One set of new filters for each filter bank installed.
- .3 Identify spare parts containers as to contents and replacement parts number.
- .4 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .5 Furnish one grease gun and adaptors to suit different types of grease and fittings.

3.8 EXTRAS AND CREDITS

- .1 Accompany all price submissions requested by Consultant for extra work, or work to be deleted, with a complete cost breakdown as follows:
 - .1 Materials, quantities and unit costs including any applicable contractors trade discount clearly identified.
 - .2 Labour hours and unit costs.
 - .3 Total materials and labour costs.
 - .4 Overhead and profit mark-ups in accordance with the General Conditions of the Contract.

3.9 INSTRUCTION

- .1 Instruct and familiarize Owner's operating personnel with the various mechanical systems. Arrange instruction for each system separately.
- .2 Provide instruction for each system on two separate occasions, coordinated with the Owner's staff operating schedule, in order that interested personnel may arrange to attend.
- .3 Ensure each instruction period includes, but is not limited to the following;
 - .1 a classroom seminar with operating manuals, product and system drawings and such other audio/visual aids as may be appropriate,
 - .2 instruction during the classroom seminar by the manufacturer's representative regarding the proper operating and maintenance procedures for each item of equipment,
 - .3 demonstration of the proper operating procedures for each item of equipment,
 - .4 explanation of the purpose and function of all safety devices provided,
 - .5 demonstration of all measures required for safe and proper access for operation and maintenance.
- .4 Provide a period of follow-up instruction (on two occasions) approximately one month after completing Owner's instruction to clarify and reinforce earlier instructions.
- .5 Submit a letter from the Owner's management staff indicating the instruction has been given satisfactorily to the Consultant prior to substantial completion of the project.

3.10 COMMISSIONING

- .1 Refer to Section 01 80 50 Commissioning.
- .2 The Contractor shall start-up and completely commission all equipment and systems installed and/or modified under this contract. Commissioning work shall be completed to the satisfaction of the Consultant prior to acceptance of the Work or any part thereof.
- .3 The Commissioning Team shall be comprised of;
 - .1 Representatives of the Commissioning Coordinator (Commissioning Agent)
 - .2 The individual, company or agency undertaking the work of each Section,
 - .3 Representatives of the Contractor and his sub-contractors as required,
 - .4 Representatives of equipment manufacturers,

General Requirements

- .5 Representatives of the Consultants,
- .6 Representatives of the Owner.
- .4 The Contractor and his sub-contractors shall each assign an individual representing each of the relevant trades to the commissioning team and shall ensure that representatives of the equipment manufacturers are present during the relevant commissioning tasks.
- .5 The Contractor shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, test and commission each system provided as part of the Work.
- .6 Each Section shall prepare Check Sheets in accordance with the standards listed above and shall issue them to the commissioning team for use during the commissioning process.
- .7 Three (3) copies of commissioning manuals shall be provided, bound in hard cover D-ring binders with transparent cover on front and spine personalized to indicate;
 - .1 name of Facility,
 - .2 name of the project,
 - .3 the Owner's project number,
 - .4 identification of the system commissioned,
 - .5 the date that the system was commissioned.
- .8 Commissioning manuals shall include machine printable index dividers to organize each manual by system and by commissioning stage.

END OF SECTION

Demolition & Renovation

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 WORK INCLUDED

- .1 Identification of existing services and utility connections.
- .2 Installation, protection and maintenance of temporary services as required to support continuing operation of the facility.
- .3 Disconnection and removal of various mechanical equipment in areas to be turned over to the Owner.
- .4 Disconnection and making safe of various mechanical systems and equipment in areas to be demolished and/or renovated.
- .5 Disposal of waste materials in accordance with waste management requirements.
- .6 Re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction including requirements for marking of equipment.

1.3 REGULATORY REQUIREMENTS

- .1 Notify all authorities of intent to demolish and schedule for the work. Obtain required permits from authorities.
- .2 Conform to all codes for demolition work, dust control, products requiring disconnection and re-connection.
- .3 Do not close or obstruct egress width to any building or site exit.
- .4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.
- .5 Conform to procedures applicable when hazardous or contaminated materials are discovered.
- .6 Arrange for re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction. This includes requirements for marking of equipment under rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

1.4 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.5 INTERRUPTIONS

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

Demolition & Renovation

2 PRODUCTS N/A

3 EXECUTION

3.1 PREPARATION

- .1 Prior to start of work under this Section, ensure that the General Trades;
 - .1 Provide, erect, and maintain temporary barriers at locations indicated.
 - .2 Erect and maintain weatherproof closures for exterior openings.
 - .3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
 - .4 Prevent movement of structure; provide bracing and shoring.
- .2 Install, protect and maintain temporary services as required to support continuing operation of the facility.
- .3 Protect services and equipment which are not to be demolished.
- .4 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
- .5 Notify affected utility companies before starting work and comply with their requirements.
- .6 Mark location and termination of utilities.
- .7 Provide appropriate temporary signage including signage for exit or building egress.

3.2 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Remove and dispose of built-in items such as sleeves, anchors, and inserts.
- .3 Remove and dispose of bases, supports and anchors for piping, equipment and ductwork mounted on or in walls, supported above floors and/or suspended from the structure.

3.3 PROTECTION

- .1 Protect existing and new work to remain free from damage due to execution of work under this Division with tarpaulins and other protective coverings as necessary.
- .2 Repair any and all damage to the building and components resulting from failure to provide sufficient protection, to the satisfaction of the Consultant.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.4 DEMOLITION

- .1 Notify all authorities of intent to demolish and schedule for the work.
- .2 All demolition work shall conform to all codes, regulations, standards and by-laws applicable to the work.
- .3 Isolate and drain systems as required to effect demolition. Disconnect, cap and make safe all mechanical services to the building including, but not limited to; sanitary sewer(s), storm sewer(s), water service, natural gas service, steam service, condensate return, water supply to standpipe and sprinkler systems, fire suppression systems hot water heating systems, steam and condensate systems.

Demolition & Renovation

- .4 Protect existing equipment and services to remain from debris and unwanted materials. Clean as necessary to maintain service during demolition period and on completion of the work.
- .5 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
- .6 Remove and dispose of all redundant mechanical services and equipment within the limits of the demolition site and where demolished systems extend beyond these limits.
- .7 Turn over items identified for recovery by the Owner.
- .8 All demolition work shall conform to Occupational Health & Safety and Environmental regulations. Ensure that all parties are familiar with requirements and experienced in the work to be undertaken.
- .9 Waste disposal shall conform to the requirements of Division 1, municipal By-Laws and Ministry of the Environment regulations and standards.
- .10 All existing air intake and exhaust openings that may be affected by dust and/or debris from the demolition work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from demolition work with new filters.
- .11 In the event that dust and debris from demolition work does penetrate the building and/or its air distribution systems, this Section shall be responsible for cleaning the affected areas and/or systems.
- .12 Disconnect remove, cap and identify all utilities within demolition areas.
- .13 Demolish in an orderly and careful manner. Protect existing supporting structural members.
- .14 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- .15 Remove materials as work progresses. Upon completion of work, leave areas in clean condition.
- .16 Remove temporary Work.

3.5 RENOVATIONS

- .1 Isolate and drain systems as required to effect renovations, modifications and/or repairs. On completion of renovations, modifications and/or repairs, test entire system as if new. Report repairs or replacements required of existing equipment, piping, fittings or devices that are not included in contract to Consultant and Owner for instruction. Flush, clean and refill renovated systems as specified for new.
- .2 Relocate or remove existing items so designated unless specifically indicated to be relocated or removed under other Sections.
- .3 Existing items to be relocated shall be cleaned and repaired or altered as required to suit new location. All damaged or ineffective parts shall be replaced and the item made "as new".
- .4 Existing items to be removed remain the property of the owner and shall be delivered to a location on site designated by the owner. If the owner declares no interest in the removed items, assume ownership and remove the items from the site.
- .5 Make good all surfaces and finishes in areas from which items have been removed and in which items are relocated. Cap all existing services required to be severed to effect alterations and do all other work necessary to make good such areas to satisfaction of consultant.
- .6 Openings in existing floor assemblies and vertical fire separations necessitated by installation of equipment and systems or construction in general must be temporarily sealed with fire barrier materials such as mineral wool or other noncombustible insulation.
- .7 If during alteration work existing asbestos material, other than known asbestos, is discovered (e.g. fireproofing, acoustic or thermal insulation, tank covering), stop work in the affected area and immediately notify consultant.
- .8 Existing refrigerant indicated to be removed shall not be discharged to the atmosphere, but shall be salvaged and reclaimed or disposed of following the guidelines of the authority having jurisdiction.
- .9 All existing air intake and exhaust openings that may be affected by dust and/or debris from the renovation work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from renovation work with new filters.
- .10 In the event that dust and debris from renovation work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or

Demolition & Renovation

- systems.
.11 Temporary filters shall be removed on completion of the renovation work.

3.6 INSPECTION AND RE-CERTIFICATION

- .1 Where any equipment, machine or apparatus is modified, rebuilt or rewound with any change resulting in its performance or capacity rating and characteristics it shall be inspected and re-certified as required by authorities having jurisdiction.
- .2 A nameplate giving the name of the person or firm making the change and the resulting changes in performance or capacity shall be provided and affixed to the equipment, machine or apparatus adjacent to the original nameplate. Where the original nameplate is removed, the original manufacturer's name and original identifying data, such as serial numbers, shall be added to the nameplate.
- .3 Refer to rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

END OF SECTION

Common Work Results

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 COMMON WORK RESULTS

- .1 Section 23 05 00 applies to and governs all work of Division 23.

1.3 REFERENCE STANDARDS

- .1 Provide all work in accordance with requirements of Regulatory Agencies and conform to:
 - .1 Local and district by-laws, regulations and published engineering standards.
 - .2 the Ontario Building Code as amended,
 - .3 the Ontario Gas Utilization Code as amended
 - .4 Regulations for Construction Projects under The Occupational Health and Safety Act.
 - .5 Fire Code made under the Fire Marshal's Act.
- .2 Conform to following CSA Standards:
 - .1 CSA B242 Groove and Shoulder Type: Mechanical Pipe Couplings.
 - .2 CSA W48 series Electrodes.
 - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CAN/CSA-W117.2, Safety in Welding, Cutting and Allied Processes
- .3 Conform to following National Research Council Canada publications:
 - .1 National Building Code of Canada and Supplements to National Building Code of Canada
 - .2 National Fire Code of Canada.
 - .3 Canadian Plumbing Code.
 - .4 Model National Energy Code for Buildings
- .4 Conform to following American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) Standards:
 - .1 ANSI/ASME B31.1 Power Piping.
 - .2 ANSI/ASME B31.3, Process Piping.
 - .3 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 Section 1: Power Boilers.
 - .2 Section V: Nondestructive Examination.
 - .3 Section IX: Welding and Brazing Qualifications.
 - .4 ASME A13.1 - Scheme for the Identification of Piping Systems.
 - .5 ASME B40.100 - Pressure Gauges and Gauge Attachments.
- .5 Conform to following American Welding Society (AWS) Standards:
 - .1 AWS C1.1, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1, Welding Inspection.
- .6 Conform to following American Society for Testing and Materials (ASTM) Standards:
 - .1 ASTM E1 - Specification for ASTM Thermometers.
 - .2 ASTM E77 - Inspection and Verification of Thermometers.
- .7 Conform to following Underwriters Laboratories (UL) Standards:
 - .1 UL 393 - Indicating Pressure Gauges for Fire-Protection Services.
 - .2 UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.
 - .3 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .8 Conform to AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .9 Conform to IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- .10 Conform to NEMA MG 1 - Motors and Generators.
- .11 Provide work where indicated in conformance with guide Specification of the Victaulic System for Building Services, G-100.
- .12 The above documents or portions thereof are referenced within the work of Division 23 and shall be considered part of the requirements of this document as though fully repeated herein.

Common Work Results

1.4 1.4 QUALIFICATIONS

- .1 Motor manufacturer: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- .2 Firestop Sealant Manufacturer: Company specializing in manufacture of sealants with minimum three years documented product development, testing, and manufacturing experience.
- .3 Firestop components and assemblies shall be ULC listed and tested in accordance with ULC S115 Standard Method of Fire Test for Firestop Systems.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with refer to section 01 33 00 & 23 01 01

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products. Refer to Division 1 requirements as well.
- .2 Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WASTE MANAGEMENT & DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 1 Waste Management and Disposal, and with the Contractor's Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.8 WARRANTY

- .1 Provide extended coverage five year warranty for motors larger than 20 HP (15 kW).

2 PRODUCTS

2.1 PIPING SPECIALTIES

- .1 Cast brass, pressure, copper to copper unions shall be used with seamless copper tubing smaller than 3" (75 mm).
- .2 Cast brass flanges shall be used with seamless copper tubing, type L for tubing 3" (75 mm) and larger.
- .3 Dart type, 125 lb. (860 kPa) black malleable iron unions shall be used with all steel pipe for piping 2-1/2" (65 mm) and smaller.
- .4 Slip-on, 150 lb. (1000 kPa) carbon steel flanges with 1/16" (4 mm) raised face shall be used with all steel pipe for piping larger than 2-1/2" (65 mm).
- .5 Gaskets for joining flanged steel pipe shall be 1/16" (4 mm) Cranite ring type gaskets.
- .6 Piping specialties including backflow preventers, strainers, valves etc. shall be line size unless indicated otherwise on drawings.

2.2 ADHESIVES, SEALANTS, PAINTS AND COATINGS

- .1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;
 - .1 Paint for Mechanical Identification: maximum VOC emission of 250g/L
 - .2 Touch-Up Paint: maximum VOC emission of 250g/L
 - .3 Zinc-Rich Primer: maximum VOC emission of 250g/L
 - .4 Adhesives for Mechanical Identification: maximum VOC emission of 70g/L
 - .5 Sealants for service penetrations: maximum VOC emission of 650g/L clear and 350 g/L pigmented

Common Work Results

- .6 Sealants for Firestopping: max. VOC emission of 650g/L clear and 350 g/L pigmented
- .7 Acrylic Sealant for supports and anchors: maximum VOC emission of 250g/L
- .8 Insulation Vapour Barrier Lap Adhesive: maximum VOC emission of 80g/L
- .9 Insulation Joint Sealer: maximum VOC emission of 250g/L
- .10 Insulation Vapour Barrier Mastic: maximum VOC emission of 400g/L
- .11 Flame Retardent Adhesive: maximum VOC emission of 650g/L clear and 350 g/L pigmented

2.3 WELDING ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

2.4 NAMEPLATES

- .1 Provide laminated plastic plates with black face and white centre of minimum size 3-1/2" x 1-1/2" x 3/32" (90 x 40 x 2 mm) nominal thickness, engraved with 1/4" (6 mm) high lettering. Use 1" (25 mm) lettering for major equipment.
- .2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- .3 Identify equipment type and number and service of areas or zone of building served.
- .4 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-1/2" x 9" (65 x 230 mm), reading: "WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME."

2.5 TAGS

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 1-1/2" (40 mm) diameter. **OR**
- .2 Metal Tags: Brass, aluminum or stainless steel with stamped letters; tag size minimum 1-1/2" (40 mm) diameter with smooth edges.
- .3 Chart: Typewritten letter size list in anodized aluminum frame.

2.6 STENCILS

- .1 Stencils: With clean cut symbols and letters of following size:
 - .1 3/4"-1-1/4" (20-30 mm) Outside Diameter of Insulation or Pipe: 8" (200 mm) long colour field, 1/2" (15 mm) high letters.
 - .2 1-1/2"-2" (40-50 mm) Outside Diameter of Insulation or Pipe: 8" (200 mm) long colour field, 3/4" (20 mm) high letters.
 - .3 2-1/2"-6" (65-150 mm) Outside Diameter of Insulation or Pipe: 12" (300 mm) long colour field, 1-1/4" (30 mm) high letters.
 - .4 8" - 10" (200-250 mm) Outside Diameter of Insulation or Pipe: 24" (600 mm) long colour field, 2-1/2" (65 mm) high letters.
 - .5 Over 10" (250 mm) Outside Diameter of Insulation or Pipe: 32" (800 mm) long colour field, 3-1/2" (90 mm) high letters.
 - .6 Ductwork and Equipment: 2-1/2" (65 mm) high letters.

2.7 TEST PLUGS

- .1 Manufacturer: Pete's Plug.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Watts TP.
- .3 Test Plug: 1/4" or 1/2" (6 mm or 15 mm) brass fitting and cap for receiving 1/8" (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 93°C (200°F).
- .4 Test Kit: Carrying case, internally padded and fitted containing one diameter pressure gauges, one gauge adapters with 1/8" (3 mm) probes, two 1" (25 mm) dial thermometers.

2.8 ACCESS DOORS

Common Work Results

- .1 Standard Universal Flush
 - .1 Material: Upt to 16" x 16" (400x400) 16 Gauge mounting frame, over 16" x 16" (400x400) 14 gauge door, 16 gauge mounting frame.
 - .2 Hinge: Continuous, concealed.
 - .3 Latch: Stainless steel screwdriver operated cam latch
 - .4 Finish: Steel: 5-stage iron phosphate preparation with prime coat of white, Alkyd Baking Enamel or stainless steel type 304, No. 4 satin polish.
 - .5 Manufacturers:
 - .1 Acudoor UF-500
 - .2 CEB
 - .3 MIFAB
 - .4 Cendrex Contour
- .2 Recessed Access Door
 - .1 Material: Steel or stainless steel, 22 gauge door, 22 gauge mounting frame. Door -recessed 5/8"
 - .2 Hinge: Continuous, concealed.
 - .3 Latch: Stainless steel screwdriver operated cam latch
 - .4 Finish: Satin coat steel
 - .5 Manufacturers:
 - .1 Acudoor UF-5015
 - .2 CEB
 - .3 MIFAB
 - .4 Cendrex Contour
- .3 Fire Rated
 - .1 Access doors in fire separations or fire rated assemblies: ULC labelled. Refer to Architectural drawings for ratings of fire separations and assemblies. Minimum 12 gauge.
 - .2 Hinge: Continuous, concealed.
 - .3 Latch: Stainless steel screwdriver operated cam latch
 - .4 Finish: Steel: 5-stage iron phosphate preparation with prime coat of white, Alkyd Baking Enamel or stainless steel type 304, No. 4 satin polish.
 - .5 Manufacturers:
 - .1 Acudoor
 - .2 CEB
 - .3 MIFAB
 - .4 Cendrex Contour

2.9 ADHESIVES, SEALANTS, PAINTS & COATINGS

- .1 Adhesives, Sealants, Paints and Coatings: Use only low VOC emitting materials meeting following criteria;
 - .1 Sealants for Service Penetrations: maximum VOC emission of 650g/L clear and 350 g/L pigmented
 - .2 Sealants for Firestopping: max. VOC emission of 650g/L clear and 350 g/L pigmented

2.10 FIRESTOPPING COMPOUNDS

- .1 Manufacturer: 3M products indicated.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Dow Corning
 - .2 John Manville
 - .3 Hilti Firestop Systems
- .3 Fire Rated Sealants: intumescent material, synthetic elasomers, capable of expanding up to 8 to 10 times when exposed to temperatures of 250°F (121°C) or higher. ULC listed and labelled.

2.11 SLEEVES

- .1 Materials: minimum schedule 20 galvanized steel or cast iron.

Common Work Results

2.12 ESCUTCHEONS

- .1 Finish: Polished chrome

2.13 FLASHINGS AND COUNTERFLASHINGS

- .1 Thaler or equivalent mechanical/electrical flashings as recommended for specific purpose.
- .2 Stainless steel flashing sleeve, integral deck flange and EPDM seal.

2.14 PENETRATION SEALS

- .1 Manufacturer: Link-Seal
- .2 Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.

3 EXECUTION

3.1 INSPECTION

- .1 Inspect installed work of other trades and verify that such work is complete to point where work under this Division may properly commence.
- .2 Verify that work of this Division may be executed in accordance with pertinent codes and regulations, specifications, drawings, and referenced standards.
- .3 Review drawings and verify dimensions at the site. Report discrepancies immediately to Consultant before proceeding with any construction work or shop drawings.

3.2 PREPARATION

- .1 Existing services and equipment shall be relocated or removed to suit new construction and renovation work.
- .2 Services that are no longer required shall be removed or cut back and capped to the satisfaction of Consultant.
- .3 Obtain written authorization from Consultant for renovation work that is not specifically indicated.
- .4 All work required to prepare systems for shutdown and/or re-instatement, such as draining, chemical treatments, and re-filling shall be included in this Bid Price.

3.3 PIPING INSTALLATION - ABOVE GROUND

- .1 Cooperate with other trades whose work affects or is affected by work of this Section, to ensure satisfactory installation and to avoid delays. Provide all materials to be built-in such as sleeves, anchors, etc., together with accurate dimensions or templates, promptly.
- .2 Layout all work accurately, installing piping parallel to lines of building.
- .3 Install piping, wherever possible, in partitions and above ceiling. Do not install piping in outside walls unless so shown on drawings. Wrap uninsulated piping in masonry walls with building paper.
- .4 Install concealed piping close to building structure to minimize furring dimensions.
- .5 Provide adequate space around piping to facilitate application of insulation.
- .6 Use dielectric couplings where piping of dissimilar metals connect.
- .7 Where piping passes through concrete floors, or walls, sleeves shall be sized to permit the pipe to expand freely without binding or crushing pipe insulation.
- .8 Where branch pipes are welded into main without the use of "T" connections, torch cut openings must be cut true, bevelled and filed smooth. Branch pipes must not be allowed to project inside of main pipe. Openings must not be cut large enough to permit entry of welding metal and slag within the pipe.
- .9 Arrange all take-offs from mains to allow for expansion and contraction of pipes. Hot water branches serving downfeed risers must be taken from lower sides or bottom of mains and grade down slightly to risers. Branches which serve units above the mains shall be taken from the top or sides of mains.

Common Work Results

- .10 Install automatic control valves and wells supplied under other Sections.

3.4 PIPING JOINTS

- .1 Make joints in piping installed under this Division using persons familiar with the particular materials being used and in accordance with CSA B51 and CSA B52, manufacturer's instructions, and as specified herein.
- .2 Use only welder and/or brazer operators, with a valid identification card, as issued under The Boiler and Pressure Vessels Act, to make joints in Registered Piping Systems, as indicated under Section 23 01 01, and 23 05 00.
- .3 Use silver solder or Silfos for joining copper tubing 4" (100 mm) and larger in size.
- .4 Carefully ream joints in threaded pipe and paint with approved graphite type joint sealer on male connections only. Make connections with proper wrench to suit pipe size. Where leaks occur, the joint shall be disassembled and corrected if possible, or replaced. Over-tightening, caulking or peening will not be acceptable.
- .5 When using Victaulic Grooved Piping Method:
- .1 Make joints in grooved piping with couplings and gaskets in accordance with Victaulic Company of Canada Ltd, General Catalogue G-100, latest edition. Cut or roll grooves using tools specifically designed for that purpose.
 - .2 Use Zero-flex or rigidlok couplings in locations where rigidity is required, in particular in mechanical rooms on coils, headers and pumps.
 - .3 Vic-Boltless couplings may be used.
- .6 Install unions or welding flanges at connections to valves, etc. to facilitate removal.
- .7 Use butt welding and/or schedule 40 carbon steel welding fittings to join sections of steel piping with welding ends.

3.5 WELDING

- .1 Welder's Qualifications
- .1 Welding qualifications to be in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure to be performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to Consultant and Owner.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .2 Inspector's Qualifications: qualified to CSA W178.2
- .3 Welding Procedures
- .1 Registration of welding procedures in Procedures accordance with CSA B51.
 - .2 Copy of welding procedures to be available for inspection at all times.
 - .3 Safety in welding, cutting and allied processes to be in accordance with CAN/CSA-W117.2.
- .4 Workmanship: Welding to be in accordance with ANSI/ASME B31.1 and B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, special procedures specified elsewhere in Division 15 applicable requirements of provincial authority having jurisdiction.
- .5 Installation Requirements:
- .1 Identify each weld with welder's identification symbol.
 - .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
 - .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.
- .6 Inspection and Testing:
- .1 Hydrostatically test all welds to requirements of ANSI/ASME B31.1.
 - .2 Review all weld quality requirements and defect limits of applicable codes and standards with Consultant before any work is started.
 - .3 Formulate "Inspection and Test Plan" in co-operation with Consultant.

Common Work Results

- .4 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .5 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Consultant, to ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
- .6 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .7 Failure of visual examinations: on failure of any weld by visual examination, perform additional testing as directed by Consultant of a total of up to 25% of all welds, selected at random by Consultant, by particle tests.
- .7 Defects Causing Rejection: as described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code, plus;
 - .1 Undercutting greater than 1/32" (0.8 mm) adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 1/32" (0.8 mm) adjacent to root bead on inside of pipe.
 - .3 Undercutting greater than 1/32" (0.8 mm) at combination of internal surface and external surface.
 - .4 Incomplete penetration and incomplete fusion greater than total length of 1-1/2" (38 mm) 97% in any 6" (150 mm) length of weld depth of such defects being greater than 1/32" (0.8mm).
 - .5 Repair all cracks and defects in excess of 1/32" (0.8mm) in depth.
 - .6 Repair defects whose depth cannot be determined accurately on the basis of visual examination or particle tests.
- .8 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.6 FLUSHING AND CLEANING

- .1 Thoroughly flush all piping installed by this Division.
- .2 Remove, clean and replace all strainers in systems after flushing.
- .3 Thoroughly clean and lubricate HVAC equipment, and leave all items in perfect order ready for operation.

3.7 PIPING SYSTEMS TESTING AND INSPECTION

- .1 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
- .2 Test all piping at the completion of roughing-in, before connecting to existing systems, and prior to concealment, insulation or covering of piping.
- .3 Make tests that are required by any authority having jurisdiction, in the presence of the authority's authorized inspector and shall be certified by him.
- .4 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Commissioning Agent
 - .3 The Owner's Representative
 - .4 The Consultant
- .5 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.
- .6 Repair all leaks exposed during testing and retest. If defects in pipe or fittings are discovered in the system, they shall be removed and replaced.
- .7 Certify tests not required by authorities having jurisdiction.

3.8 EQUIPMENT TESTING AND INSPECTION

- .1 Test operation of equipment installed under this Division according to instructions in appropriate articles of this Division. Make any required adjustments or replacements to ensure equipment is operating as intended. Retest equipment requiring adjustment or replacement.
- .2 Pay all fuel consumption charges for equipment under testing and during commissioning.
- .3 Conduct tests before application of external insulation and before concealment of piping or ductwork.
- .4 Arrange and pay for inspections by authorities as required by code and complete any changes or alterations required by such inspections.
- .5 Conduct tests in the presence of:

Common Work Results

- .1 Authorized inspector(s) for authorities having jurisdiction.
- .2 The Commissioning Agent.
- .3 The Consultant.
- .4 The Owner's Representative.
- .6 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.

3.9 TESTING AND BALANCING

- .1 Allow sufficient time for testing and verification prior to substantial completion. Notify Testing and Balancing Agency on completion of adjusting and balancing of systems.
- .2 Adjust systems and components (drives, sheaves, belts, etc.) as required by Testing and Balancing Agency.
- .3 Maintain systems in full operation during testing and verification.
- .4 Make adjustments to control systems as required to facilitate verification. Maintain all safety controls in operation.
- .5 Check and correct alignment of V-belts, drive shaft coupling drives, etc. as required by Testing and Balancing Agency.
- .6 Provide pitot tube test fittings at all main branches of sheet metal work and at intake and discharge locations of air handling systems as required by Testing and Balancing Agency.

3.10 ELECTRICAL COMPONENTS AND WIRING

- .1 Conform to requirements of Division 26 for all wiring included in Division 23. Includes pre-wired equipment provided by Sections under Division 23.
- .2 Ensure that all pre-wired electrical equipment is CSA approved. Arrange and pay for special approval where this is not possible.
- .3 Coordinate all wiring requirements with other Divisions. Line voltage wiring from power distribution panels to starters and from starters to motors will be provided under Division 26. All their field wiring for equipment shall be included under Division 23, unless specifically called for under Division 25.

3.11 PROTECTION

- .1 Protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division.
- .2 Repair to satisfaction of Consultant, damage to building resulting from failure to provide such protection.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.12 CUTTING AND PATCHING

- .1 Include cutting and patching as required in execution of work under respective Sections of this Division.
- .2 Holes through the structure will not be permitted without written approval of the Consultant. Any and all openings required through the completed structure must be clearly and accurately shown on a copy of the relevant structural drawing(s). Exact locations, elevations and size of the proposed opening must be identified well in advance of the need for the work.
- .3 All sleeved or formed openings through the structure must be shown on sleeving drawings and must be approved by the Structural Consultant prior to construction.

Common Work Results

- .4 The Contractor shall conduct exploratory work including x-ray of the existing structure, shall mark the location of embedded reinforcements, anchors, conduits and piping on exposed surfaces of adjacent floors and/or walls and shall pay all associated costs.
- .5 Reinforcing shall not be cut or modified without prior approval of the Structural Consultant. Should reinforcement be cut without such prior approval, the cost of any additional reinforcement deemed necessary by the Structural Consultant shall be the responsibility of this Contractor.
- .6 Alternative imaging techniques are subject to the approval of the Structural Consultant.
- .7 Ensure that cutting and patching of roofs and reinforced concrete structures is executed by specialists familiar with the materials affected, and is performed in a manner to neither damage nor endanger the work. Coordinate and supervise such cutting and patching.
- .8 Maintain the integrity of fire rated assemblies where they are pierced by ducts and pipes.
- .9 Make good surfaces affected by this work and repair finish to satisfaction of Consultant. Finish painting, where required, will be provided under Division 9.
- .10 Stop work immediately upon discovery of any hazardous material and report discovery to the Owner and Consultant. Obtain instruction prior to proceeding with the work.

3.13 SEALANTS & CAULKING

- .1 Fill voids around pipes:
 - .1 Seal between sleeve and pipe in foundation walls and below grade floors with penetration seals (link-seal)). Install as per manufacturer's installation instructions.
 - .2 Where sleeves pass through non-fire rated walls or floors, caulk space between pipe and sleeve with fibreglass. Seal space at each end with waterproof, fire retardant, non-hardening mastic.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with easily removable filler.
 - .5 Coat exposed exterior surfaces or ferrous sleeves with heavy application of zinc rich paint (VOC content not to exceed 250 g/L).
- .2 Temporarily plug all openings during construction.

3.14 FIRESTOPPING

- .1 All openings in fire separations and fire rated assemblies for service penetrations shall be protected with ULC listed service penetration firestop systems (SP).
- .2 The service penetration firestop system shall have F and FT ratings equal to or greater than ratings specified by the Architect for the fire separation (F) and firewall (FT) joint firestop systems (JF).
- .3 All components employed in the service penetration firestop system shall conform to the ULC listing.
- .4 Contractor shall prepare and submit a schedule of service penetration firestop systems to be employed indicating the ULC listing designation, services involved, location of opening through fire separation and the components of the fire separation assembly.
- .5 Refer to architectural drawings for ratings of fire separations and assemblies.

3.15 SLEEVES AND CURBS

- .1 Provide pipe sleeves at points where pipes pass through masonry or concrete.
- .2 Provide sleeves of minimum schedule 20 galvanized steel or cast iron.
- .3 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint:
 - .1 through foundation walls, with penetration seals.
 - .2 through floors of mechanical rooms and equipment rooms.
- .4 Provide 1/4" (6 mm) clearance all around, between sleeve and pipes or between sleeve and insulation.
- .5 Where piping passes below footings, provide minimum clearance of 2" (50 mm) between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing with concrete of same strength as footing.
- .6 Terminate sleeves flush with surface of concrete and masonry and 2" (50 mm) above floors. Not applicable to concrete floors on grade.
- .7 Provide watertight concrete curb 4" (100 mm) high around mechanical services (pipes, ducts,

Common Work Results

conduits) which rise through mechanical (service) room floors. Provide minimum 4" (100 mm) clearance between openings for services within curbs.

- .8 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction, caulk between sleeve recess and pipe, fasten roof flashing to clamp device, make water-tight durable joint. Co-ordinate with roofing Section.

3.16 FLASHINGS

- .1 Provide all flashing at each point where piping passes through the roof.
- .2 Coordinate this work with the roofing Trades to ensure a satisfactory installation and to avoid delays.

3.17 ESCUTCHEONS AND PLATES

- .1 Provide on pipes passing through finished walls, partitions, floors and ceilings.
- .2 Use chrome or nickel plated brass, solid type with set screws for ceiling or wall mounting.
- .3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.
- .4 Where sleeve extends above finished floor, escutcheon or plates shall clear sleeve extension.
- .5 Secure to pipe or finished surface, but not insulation.

3.18 SUPPORT AND ATTACHMENT

- .1 Support and attach piping, ductwork fixtures and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls, and do not support from or attach to steel roof deck and/or wall or ceiling finishes. Roof mounted mechanical equipment and services shall be anchored to the roof structure to resist both lateral and uplift wind forces in accordance with requirements of the Ontario Building Code.

3.19 PAINTING

- .1 Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Consultant.
- .2 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

3.20 DISSIMILAR METALS

- .1 Separate dissimilar metals in order to prevent galvanic corrosion.
- .2 Provide gaskets or shims of approved materials to avoid electrolytic action.
- .3 Use dielectric unions and/or flanges where piping of dissimilar metals are connected.

3.21 MOCK-UP

- .1 Refer to Division 01 for requirements for mock-up.
- .2 Each Section shall provide related components for mock-up.
- .3 Mock-up may not remain as part of the Work.

3.22 FIELD QUALITY CONTROL

- .1 Temporary and Trial Usage
 - .1 Allow the Owner the privilege of temporary and trial usage of installed equipment, as soon as work is complete, for a period of time required to conduct a thorough test.
 - .2 Do not construe such usage as evidence of acceptance of work by Owner.
 - .3 Repair damage to work tested, resulting from such trial usage, by this Contractor at no cost to Owner.
- .2 Systems Verification:
 - .1 Verify the correct installation and proper operation of equipment and systems installed. Adjust and balance each system as necessary to achieve optimum operation of each system.

Common Work Results

- .2 Co-operate with the TAB agency as follows:
 - .1 provide assistance when and as requested,
 - .2 co-ordinate completion of work systematically to permit orderly verification and adherence to schedules,
 - .3 provide additional necessary flow balancing devices as directed by agency,
 - .4 notify TAB Agency of tests being conducted.

3.23 ADJUST AND CLEAN

- .1 Clean equipment and fixtures, lubricate mechanical equipment installed under this Division and leave items in perfect order ready for operation.
- .2 Test and adjust control devices, instrumentation, relief valves, dampers, etc., installed in this Division after cleaning of systems and leave in perfect order ready for operation.
- .3 Remove from the premises upon completion of work of this division, debris, surplus, and waste materials resulting from operations.

3.24 MECHANICAL IDENTIFICATION INSTALLATION

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces for stencil painting.
- .3 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer (VOC content not to exceed 680 g/L).
- .4 Install tags with corrosion resistant chain.
- .5 Apply stencil markings on all covered piping.
- .6 Install plastic tape pipe markers complete around bare pipe to manufacturer's instructions.
- .7 Label piping that is heat traced or equipped with heating cable "HEAT TRACED" in addition to other identification. Locate such labels adjacent to other identifications.
- .8 Clearly identify abandoned services left in place as "ABANDONED".
- .9 Install underground plastic pipe markers 6"-8" (150-200 mm) below finished grade, directly above buried pipe.
- .10 Identify pumps, water heating equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .11 Identify control panels and major control components outside panels with plastic nameplates.
- .12 Identify valves in main and branch piping with tags. Consecutively number valves in each system.
- .13 Identify piping, concealed or exposed, with stencilled painting and plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- .14 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-3/8" x 9" (60 x 230 mm), reading: **"WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED. IT MAY START AT ANY TIME."**
- .15 Provide colour coded self-adhesive dots to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.25 MANUFACTURER'S NAMEPLATES

- .1 Provide metal nameplates on each piece of equipment, mechanically fastened with raised or recessed letters.
- .2 Include registration plates, Underwriters' Laboratories and CSA approval, as required by respective agency and as specified. Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors, all factory supplied.
- .3 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.26 FLOW DIAGRAMS AND DIRECTORIES

- .1 Provide Consultant with six identification flow diagrams of approved size for each system. Include tag

Common Work Results

schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

- .2 Install where agreed with the Owner one copy of each flow diagram and valve schedule mounted in glazed frame. Provide one copy of each in Operation and Maintenance Manual.

3.27 INSTALLATION OF ACCESS DOORS

- .1 Supply access doors for access to equipment requiring service, lubrication or adjustment and all concealed valves, cleanouts, trap primers, control and volume dampers, and other such equipment.
- .2 Turn over access doors to the appropriate general trade for installation under other Sections.
- .3 Refer to architectural drawings for ratings of fire separations and assemblies. install fire rated access doors in fire rated partitions, walls, and ceilings.
- .4 Access doors in ceilings shall be minimum 24" x 24" (600mm x 600mm), unless otherwise approved by the Consultant.
- .5 Provide concealed access doors in GWB ceilings and coordinate in-fill with general trades.

END OF SECTION

Supports and Anchors

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Pipe and equipment hangers and supports.
- .2 Sleeves and seals.
- .3 Flashing and sealing equipment and pipe stacks.

1.3 REFERENCES

- .1 ASME B31.1 - Power Piping.
- .2 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .3 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .4 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .5 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .6 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SUBMITTALS

- .1 Section 23 01 01: Procedures for submittals.
- .2 Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- .3 Product Data: Provide manufacturers catalogue data including load capacity.
- .4 Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- .5 Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

- .1 Conform to CSA B-51 for support of piping.

2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- .1 Manufacturers:
 - .1 Anvil
 - .2 Myat
 - .3 Hunt

2.2 ACCESSORIES

- .1 Hanger Rods: galvanized, carbon steel continuous threaded.
- .2 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's instructions and best trade practises.

3.2 INSERTS

- .1 Provide inserts for placement in concrete formwork.

Supports and Anchors

- .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4" (100 mm).
- .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .5 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.3 PIPE HANGERS AND SUPPORTS

- .1 Support horizontal piping as scheduled.
- .2 Install hangers to provide minimum 1/2" (13 mm) space between finished covering and adjacent work.
- .3 Place hangers within 12" (300 mm) of each horizontal elbow.
- .4 Use hangers with 1-1/2" (38 mm) minimum vertical adjustment.
- .5 Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- .6 Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.
- .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .8 Support riser piping independently of connected horizontal piping.
- .9 Provide copper plated hangers and supports for copper piping.
- .10 Design hangers for pipe movement without disengagement of supported pipe.
- .11 Prime coat exposed steel hangers and supports. Refer to Section 09 91 10. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 FLASHING

- .1 Flash floor drains in floors with topping over finished areas with lead, 10" (250 mm) clear on sides with minimum 36" x 36" (910 x 910 mm) sheet size. Fasten flashing to drain clamp device.
- .2 Seal roof, floor, shower and mop sink drains watertight to adjacent materials.
- .3 Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed to manufacturer's instructions for sound control.

3.5 SLEEVES

- .1 Set sleeves in position in formwork. Provide reinforcing around sleeves.
- .2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- .3 Extend sleeves through floors 1" (25 mm) above finished floor level. Caulk sleeves.
- .4 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk. air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- .5 Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

- .1 Imperial Measure (IP)

Pipe Size (in)	Rod Diameter (in)	Support Spacing (Ft)	
		Steel Pipe	Copper Tube
1/2	3/8	7	6
3/4	3/8	7	6
1	3/8	7	6
1-1/4	3/8	7	6

Supports and Anchors

1-1/2	3/8	9	8
2	3/8	10	9
2-1/2	3/8	12	10
3	3/8	12	10
4	5/8	14	12
6	7/8	17	
8	7/8	19	
10	7/8	21	
12	7/8	23	
14	1	25	
16	1	27	
18	1	28	

.2 Metric Measure (SI)

Pipe Size (mm)	Rod Diameter (mm)	Support Spacing (m)	
		Steel Pipe	Copper Tube
13	10	2.1	1.8
20	10	2.1	1.8
25	10	2.1	1.8
32	10	2.1	1.8
38	10	2.7	2.4
50	10	3	2.7
65	10	3.6	3
75	10	3.6	3
100	16	4.2	3.6
150	22	17	
200	22	5.7	
250	22	6.4	
300	22	7	

END OF SECTION

Vibration Controls

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Vibration control of piping, ductwork and equipment.
- .2 Coordination with Section 23 05 30 Supports and Anchors

1.3 REFERENCES

- .1 Ontario Building Code.
- .2 SMACNA "HVAC Duct Construction Standards"

1.4 PERFORMANCE REQUIREMENTS

- .1 Provide vibration isolation on motor driven equipment over (1/2 HP), plus connected piping and ductwork.
- .2 Provide minimum static deflection of isolators for equipment as indicated.
 - .1 Upper Floors, Normal
 - .1 Under 400 rpm: 1-1/2" (40 mm)
 - .2 400 - 600 rpm: 3-1/2" (90 mm)
 - .3 600 - 800 rpm: 2" (50 mm)
 - .4 800 - 900 rpm: 1" (25 mm)
 - .5 1100 - 1500 rpm: 1/2" (12 mm)
 - .6 Over 1500 rpm: 1/4" (5 mm)

1.5 SUBMITTALS

- .1 Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.
- .2 Product Data: Provide schedule of vibration isolator type with location and load on each.
- .3 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.
- .4 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturer shall be a member of VISCMA.
- .2 Coordinate selection of Manufacturer with Section.
- .3 Acceptable manufacturers;
 - .1 Kinetics Vibron
 - .2 Vibro Acoustics
 - .3 The VMC Group (Korfund-Masdom)

2.2 VIBRATION ISOLATORS

- .1 Isolators and bases shall be as tabulated on the equipment schedule.
- .2 Type 2 Hangers: Model SFH Combination Spring and Fiberglass Hangers, incorporating pre-compressed moulded fiberglass noise and vibration isolation pads, coated with a moisture impervious elastomeric membrane in series with springs, all encased in welded steel brackets. Springs shall be as specified above. Isolators shall be designed to accommodate rod misalignment over a 30 degree arc. Brackets shall be designed to carry 500% overload without failure.

Vibration Controls

- .3 Type 3 Isolators: Vibro Acoustics, Model CSR-2, Free-Standing, Laterally Stable, Spring Isolators, incorporating vertical limit stops to assure a constant operating height if the supported weight is removed, and to reduce movement due to wind loads. Limit stops shall be isolated from the housing to prevent short-circuiting.
- .4 Piping: All piping 1 in. (25 mm) diameter and over in the mechanical equipment room, and all piping three supports away from other mechanical equipment shall be isolated from the structure by means of vibration and noise control isolators. Suspended piping shall be isolated with Type 2 Hangers as described above. Floor-mounted piping shall be isolated with Type 2 Spring Isolators as described above.
- .5 Flexible members shall be incorporated in the ductwork adjacent to all reciprocating equipment, and shall be approved construction.
- .6 Flexible connections shall be incorporated in the ductwork adjacent to all air-moving units. The connections shall be neoprene or canvas of approved construction. High pressure ductwork, for a distance of 50 feet (1270 mm) from high pressure fans shall be isolated from the ductwork by means of Type 2 Hangers as described above.

3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's instructions.
- .2 Install isolation for motor driven equipment.
- .3 Install spring hangers without binding.
- .4 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- .5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- .6 Provide pairs of horizontal limit springs on fans with more than (6.0 in wg) static pressure, and on hanger supported, horizontally mounted axial fans.
- .7 Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.06" (1.5 mm) maximum clearance. Provide other snubbers with clearance between 1/8" and 1/4" (4 mm and 7 mm).
- .8 Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

- .1 Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 VIBRATION ISOLATOR SELECTIONS

- .1 Based on Kinetics Selection Guide. Copied with permission.
- .2 Notes to Selection Guide
 - .1 Isolator natural frequency to be 40% of the lowest equipment operating speed.
 - .2 Provide HSR thrust restraints for air-moving equipment operating at 2.1in. (501 Pa) static pressure and above..5 Provide 12 in. (305 mm) thick Type 7 inertia base for 75 HP (56 kW) and over pumps
- .3 Kinetics Products Meeting Selection Guide
 - .1 Type 2
Free-standing Steel Spring, Model FDS
Isolation Hanger, Model SH
Isolation Hanger, Model SFH
Isolation Hanger, Model SRH
 - .2 Type 3
Restrained Spring Isolator, Vibro Acoustics, Model CSR

END OF SECTION

Testing, Adjusting and Balancing

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Testing, adjustment, and balancing of air systems.
- .2 Testing, adjustment, and balancing of piping systems.
- .3 Testing, adjustment, and balancing of equipment.
- .4 Measurement of final operating condition of HVAC systems.
- .5 Sound measurement of equipment operating conditions.
- .6 Vibration measurement of equipment operating conditions.

1.3 REFERENCES

- .1 Ontario Building Code.
- .2 Ontario Fire Code.
- .3 AABC - National Standards for Total System Balance.
- .4 ACG - AABC Commissioning Guideline.
- .5 ADC - Test Code for Grilles, Registers, and Diffusers.
- .6 ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- .7 ASHRAE Guideline 0 The Commissioning Process,
- .8 ASHRAE Guideline 1 The HVAC Commissioning Process,
- .9 ASHRAE Guideline 1.1 HVAC&R Technical Requirements for the Commissioning Process,
- .10 ASHRAE Guideline 5 Commissioning Smoke Management Systems
- .11 ASTM E779 Determining Air Leakage Rate by Fan Pressurization.
- .12 NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- .13 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.
- .14 SMACNA HVAC Systems Commissioning Manual,

1.4 SUBMITTALS

- .1 Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
- .2 Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- .3 Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- .4 Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Consultant and for inclusion in operating and maintenance manuals.
- .5 Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side.
- .6 Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
- .7 Test Reports: Indicate data on AABC National Standards for Total System Balance forms. Submit data based on Project designation IP imperial/SI Metric Units.
- .8 All reports shall be prepared in electronic (computer) format using MS Word software and all tabulations shall be prepared in electronic (computer) format using MS Excel spreadsheet software. Submittals shall include three (3) copies each of hard copy printout and two (2) copies with text in ".pdf" and tabulations in ".xls" or ".xlsx" formats on CD, DVD, or USB flash drive.

1.5 PROJECT RECORD DOCUMENTS

- .1 Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

Testing, Adjusting and Balancing

- .2 Record actual locations of flow measuring stations.

1.6 QUALITY ASSURANCE

- .1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
- .2 Maintain one copy of each document on site.

1.7 INDEPENDENT AGENCY

- .1 All work of Mechanical Testing, Adjusting and Balancing shall be undertaken by a single agency, employed under Division 23. Other agencies may be proposed as an Alternate only, in accordance with Section 23 01 01, paragraph
- .2 The work of the agency consists of the furnishing of all labour, materials, equipment and accessories necessary in the testing, verification and documentation of the operational performance of all equipment and systems installed under the Sections of Division 23: Mechanical.

1.8 QUALIFICATIONS

- .1 Agency: Company specializing in the testing, adjusting, and balancing of systems under this Section with minimum five years documented experience certified by AABC or prequalified as listed below.
- .2 Work shall be performed under the supervision of an AABC certified Test and Balance Engineer, an NEBB Certified Testing, Adjusting and Balancing Supervisor or a registered Professional Engineer experienced in the performance of this work and licenced at the place where the Project is located.
- .3 Prequalified agencies include;
 - .1 (GTA, Hamilton & Niagara)
 - .1 Dynamic Flow Balancing
 - .2 Clark Balancing Ltd.
 - .3 National Air Balancing

1.9 PRE-BALANCING CONFERENCE

- .1 Convene one week prior to commencing work of this Section.

1.10 SEQUENCING

- .1 Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.11 SCHEDULING

- .1 Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

1.12 CO-OPERATION

- .1 Co-operate with installing Contractor(s) in advising them of specific scheduling requirements for systems verification.
- .2 Provide advice to installing Contractors regarding the location and installation of devices required to permit system balancing and measurements, prior to start of the installation work.

2 PRODUCTS

2.1 REFERENCE STANDARDS

- .1 All equipment required for the verification of equipment and systems shall be furnished by the agency employed to conduct the Mechanical Systems Verification.
- .2 Testing and measuring equipment used in the verification of the mechanical systems shall be calibrated to give true readings within the accuracy specifications of the equipment used. A certificate

Testing, Adjusting and Balancing

of calibration from an independent testing laboratory may be required by the Consultant if there is any reason to suspect that the equipment used is giving erroneous readings. In such an event the verification agency shall reconduct its verifications.

- .3 All equipment used by the agency in its verification of mechanical systems remains the property/responsibility of the agency and is not included in the supply to the project.

3 EXECUTION

3.1 EXAMINATION

- .1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - .1 Systems are started and operating in a safe and normal condition.
 - .2 Temperature control systems are installed complete and operable.
 - .3 Proper thermal overload protection is in place for electrical equipment.
 - .4 Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - .5 Duct systems are clean of debris.
 - .6 Fans are rotating correctly.
 - .7 Fire and volume dampers are in place and open.
 - .8 Air coil fins are cleaned and combed.
 - .9 Access doors are closed and duct end caps are in place.
 - .10 Air outlets are installed and connected.
 - .11 Duct system leakage is minimized.
 - .12 Hydronic systems are flushed, filled, and vented.
 - .13 Pumps are rotating correctly.
 - .14 Proper strainer baskets are clean and in place.
 - .15 Service and balance valves are open.
- .2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- .3 Beginning of work represents acceptance of existing conditions in the areas served.

3.2 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

- .1 Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- .2 Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.
- .3 Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- .1 Ensure recorded data represents actual measured or observed conditions.
- .2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- .3 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- .4 Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- .5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

Testing, Adjusting and Balancing

- .6 Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- .1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- .2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- .3 Measure air quantities at air inlets and outlets.
- .4 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- .5 Use branch volume control dampers and splitters to regulate air quantities. Devices at air outlets may be used only to the extent that adjustments do not create objectionable air motion or sound levels.
- .6 Vary total system air quantities by adjustment of fan speeds. Adjust airflow to design quantity. Provide drive changes as required. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- .7 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan.
- .8 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- .9 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- .10 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- .11 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 in.wg. (12.5 Pa) positive static pressure near the building entries.
- .12 Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- .13 For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.6 WATER SYSTEM PROCEDURE

- .1 Adjust water systems to provide required or design quantities.
- .2 Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- .3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- .4 Effect system balance with automatic control valves fully open to heat transfer elements.
- .5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- .6 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCHEDULES

- .1 Equipment requiring testing, adjusting and balancing:
 - .1 Plumbing Pumps
 - .2 HVAC Pumps
 - .3 Air Coils
 - .4 Terminal Heat Transfer Units
 - .5 Air Handling Units
 - .6 Fans
 - .7 Air Filters

Testing, Adjusting and Balancing

- .8 Air Terminal Units
- .9 Air Inlets and Outlets
- .2 Report Forms
 - .1 Title Page:
 - .1 Name of Testing, Adjusting, and Balancing Agency
 - .2 Address of Testing, Adjusting, and Balancing Agency
 - .3 Telephone number of Testing, Adjusting, and Balancing Agency
 - .4 Project name
 - .5 Project location
 - .6 Project Architect
 - .7 Project Engineer
 - .8 Project Contractor
 - .9 Project altitude
 - .10 Report date
 - .2 Summary Comments:
 - .1 Design versus final performance
 - .2 Notable characteristics of system
 - .3 Description of systems operation sequence
 - .4 Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - .5 Nomenclature used throughout report
 - .6 Test conditions
 - .3 Instrument List:
 - .1 Instrument
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Range
 - .6 Calibration date
 - .4 Electric Motors:
 - .1 Manufacturer
 - .2 Model/Frame
 - .3 HP/BHP
 - .4 Phase, voltage, amperage; nameplate, actual, no load
 - .5 RPM
 - .6 Service factor
 - .7 Starter size, rating, heater elements
 - .8 Sheave Make/Size/Bore
 - .5 V-Belt Drive:
 - .1 Identification/location
 - .2 Required driven RPM
 - .3 Driven sheave, diameter and RPM
 - .4 Belt, size and quantity
 - .5 Motor sheave diameter and RPM
 - .6 Centre to centre distance, maximum, minimum, and actual
 - .6 Pump Data:
 - .1 Identification/number
 - .2 Manufacturer
 - .3 Size/model
 - .4 Impeller
 - .5 Service
 - .6 Design flow rate, pressure drop, BHP
 - .7 Actual flow rate, pressure drop, BHP
 - .8 Discharge pressure
 - .9 Suction pressure
 - .10 Total operating head pressure
 - .11 Shut off, discharge and suction pressures

Testing, Adjusting and Balancing

- .12 Shut off, total head pressure
- .7 Air Cooled Condenser:
 - .1 Identification/number
 - .2 Location
 - .3 Manufacturer
 - .4 Model number
 - .5 Serial number
 - .6 Entering DB air temperature, design and actual
 - .7 Leaving DB air temperature, design and actual
 - .8 Number of compressors
- .8 Heat Exchanger:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Model number
 - .6 Serial number
 - .7 Steam pressure, design and actual
 - .8 Primary water entering temperature, design and actual
 - .9 Primary water leaving temperature, design and actual
 - .10 Primary water flow, design and actual
 - .11 Primary water pressure drop, design and actual
 - .12 Secondary water leaving temperature, design and actual
 - .13 Secondary water leaving temperature, design and actual
 - .14 Secondary water flow, design and actual
 - .15 Secondary water pressure drop, design and actual
- .9 Cooling Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual
 - .6 Entering air DB temperature, design and actual
 - .7 Entering air WB temperature, design and actual
 - .8 Leaving air DB temperature, design and actual
 - .9 Leaving air WB temperature, design and actual
 - .10 Water flow, design and actual
 - .11 Water pressure drop, design and actual
 - .12 Entering water temperature, design and actual
 - .13 Leaving water temperature, design and actual
 - .14 Saturated suction temperature, design and actual
 - .15 Air pressure drop, design and actual
- .10 Heating Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual
 - .6 Water flow, design and actual
 - .7 Water pressure drop, design and actual
 - .8 Entering water temperature, design and actual
 - .9 Leaving water temperature, design and actual
 - .10 Entering air temperature, design and actual
 - .11 Leaving air temperature, design and actual
 - .12 Air pressure drop, design and actual
- .11 Air Moving Equipment

Testing, Adjusting and Balancing

- .1 Location
- .2 Manufacturer
- .3 Model number
- .4 Serial number
- .5 Arrangement/Class/Discharge
- .6 Air flow, specified and actual
- .7 Return air flow, specified and actual
- .8 Outside air flow, specified and actual
- .9 Total static pressure (total external), specified and actual
- .10 Inlet pressure
- .11 Discharge pressure
- .12 Sheave Make/Size/Bore
- .13 Number of Belts/Make/Size
- .14 Fan RPM
- .12 Return Air/Outside Air Data:
 - .1 Identification/location
 - .2 Design air flow
 - .3 Actual air flow
 - .4 Design return air flow
 - .5 Actual return air flow
 - .6 Design outside air flow
 - .7 Actual outside air flow
 - .8 Return air temperature
 - .9 Outside air temperature
 - .10 Required mixed air temperature
 - .11 Actual mixed air temperature
 - .12 Design outside/return air ratio
 - .13 Actual outside/return air ratio
- .13 Exhaust Fan Data:
 - .1 Location
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Air flow, specified and actual
 - .6 Total static pressure (total external), specified and actual
 - .7 Inlet pressure
 - .8 Discharge pressure
 - .9 Sheave Make/Size/Bore
 - .10 Number of Belts/Make/Size
 - .11 Fan RPM
- .14 Duct Traverse:
 - .1 System zone/branch
 - .2 Duct size
 - .3 Area
 - .4 Design velocity
 - .5 Design air flow
 - .6 Test velocity
 - .7 Test air flow
 - .8 Duct static pressure
 - .9 Air temperature
 - .10 Air correction factor
- .15 Duct Leak Test:
 - .1 Description of ductwork under test
 - .2 Duct design operating pressure
 - .3 Duct design test static pressure
 - .4 Duct capacity, air flow

Testing, Adjusting and Balancing

- .5 Maximum allowable leakage duct capacity times leak factor
- .6 Test apparatus
 - .1 Blower
 - .2 Orifice, tube size
 - .3 Orifice size
 - .4 Calibrated
- .7 Test static pressure
- .8 Test orifice differential pressure
- .9 Leakage
- .16 Terminal Unit Data:
 - .1 Manufacturer
 - .2 Type, constant, variable, single, dual duct
 - .3 Identification/number
 - .4 Location
 - .5 Model number
 - .6 Size
 - .7 Minimum static pressure
 - .8 Minimum design air flow
 - .9 Maximum design air flow
 - .10 Maximum actual air flow
 - .11 Inlet static pressure
- .17 Air Distribution Test Sheet:
 - .1 Air terminal number
 - .2 Room number/location
 - .3 Terminal type
 - .4 Terminal size
 - .5 Area factor
 - .6 Design velocity
 - .7 Design air flow
 - .8 Test (final) velocity
 - .9 Test (final) air flow
 - .10 Percent of design air flow
- .18 Sound Level Report:
 - .1 Location
 - .2 Octave bands - equipment off
 - .3 Octave bands - equipment on
- .19 Vibration Test:
 - .1 Location of points:
 - .1 Fan bearing, drive end
 - .2 Fan bearing, opposite end
 - .3 Motor bearing, centre (if applicable)
 - .4 Motor bearing, drive end
 - .5 Motor bearing, opposite end
 - .6 Casing (bottom or top)
 - .7 Casing (side)
 - .8 Duct after flexible connection (discharge)
 - .9 Duct after flexible connection (suction)
 - .2 Test readings:
 - .1 Horizontal, velocity and displacement
 - .2 Vertical, velocity and displacement
 - .3 Axial, velocity and displacement
 - .3 Normally acceptable readings, velocity and acceleration
 - .4 Unusual conditions at time of test
 - .5 Vibration source (if non-complying)

3.8 VERIFICATION CHECKLIST

Testing, Adjusting and Balancing

- .1 Prepare a series of checklists to record the verification of each item of equipment and each system. Submit a draft of each checklist to the Consultant and the Owner for review and approval. Discuss comments offered the Consultant and Owner and include improvements as directed.
- .2 Checklists shall include the following as a minimum;
 - .1 date(s) of observations and/or tests,
 - .2 a record of the nameplate data for each equipment item and each associated motor,
 - .3 a list of observations appropriate to the equipment item or system with space adjacent to indicate whether the item was satisfactory or unsatisfactory,
 - .4 appropriate space for recording comments and/or instructions given during observations.

3.9 EQUIPMENT VERIFICATION

- .1 Test the operation of all equipment installed under Division 23 according to instructions in appropriate articles of this Division. Advise installing contractor of any required adjustments or replacements to ensure that equipment is operating as intended. Retest equipment after adjustment or replacement.
- .2 Ensure that the Contractor has given proper advance notification to all persons required to be present as tests are conducted.
- .3 Instrumentation: verify installation of air filter gauges, pumps, thermometers, thermometer wells, pitot traverse stations, and flow-measuring devices ensuring that:
 - .1 Location of points for readings is appropriate to measure what it is intended to measure;
 - .2 The scale range is appropriate to place the normal reading near mid-range of the scale;
 - .3 Proper positioning of instrumentation to allow reading from a convenient location, and for easy access.
- .4 Filters Inspection: visually inspect each filter installation. Verify adjustment of latching devices, installation of end spacers in filter boxes, and proper latching and sealing of access doors. Verify the installation of new (clean) filter media after Contractor's start-up procedures.
- .5 Pre-start-up Inspection:
 - .1 Verify proper equipment mounting and setting.
 - .2 Verify that control, interlock, and power wiring are complete.
 - .3 Verify proper alignment of motors and drives.
 - .4 Verify proper piping connections and accessories.
 - .5 Verify that lubrication is complete.
- .6 First Run Observation:
 - .1 Verify direction of rotation.
 - .2 Verify setting of safety controls.
 - .3 Monitor heat build-up in bearings.
 - .4 Check motor loads against nameplate ratings.
- .7 Equipment Checkout:
 - .1 Verify the proper overload heater sizes.
 - .2 Verify function of safety and operating controls.
 - .3 Verify proper operation of equipment.
 - .4 Report on inspection, observation, and checkout procedures.
- .8 Stuffing Boxes and Packing Glands: verify adjustment of boxes on pump shafts and packing glands on valve stems.
- .9 Motor Rotation: visually inspect and verify the direction of motor rotation. It is possible for motor rotation to have been checked by the electrician when power connections were made on temporary electric power, then when final connections were made to the permanent transformer bank, crossed phasing may reverse the rotation of all three-phase motors on the system.
- .10 Overload Heaters: verify supply voltage to each equipment. If the applied voltage is different from the motor nameplate, determine whether the applied voltage is within the range allowed under the motor guarantee. If not, take the necessary action to have the Contractor change the motor or the applied voltage. When the voltage is off the nameplate value, but within the allowable range, compute the equivalent amperage at nameplate voltage and compare to the overload heater amperage rating range. Then, consider whether the ambient temperature of the starter is above, below, or the same as the ambient temperature are not the same. Advise the Contractor to use overload heaters of higher range for "hot area" starters or ones of lower range for "cold area" starters to compensate the heater

Testing, Adjusting and Balancing

- .11 trip point for heat gains or losses with the environment.
- .11 Alignment of Drives: verify the alignment of drives, belt and direct coupled, and the adjustment of belt tension.
- .12 Control Diagrams and Sequences: provide for coordination with work under the automatic control systems to have the control diagrams and sequences of operation corrected to "as installed", reflecting changes brought about in response to contract modifications and to the more pragmatic changes in diagrams and sequences to make the installed system control the building systems as intended by the designer.
- .13 Safety and Operating Control Setpoints: systematically verify the safety and operating controls of equipment, including an operational check of associated control sequences.
- .14 Fin Straightening: inspect finned surface heat transfer coils for damages fins and advise Contractor of repairs required.
- .15 Verify that manufacturer's start-up procedures have been performed and that equipment is installed in accordance with the manufacturer's written installation recommendations.
- .16 Where work is noted to be done in stages a complete air balance and verification report will be required at the end of each stage.

3.10 PIPING SYSTEMS VERIFICATION

- .1 Review the drawings, specifications, and installed work to ensure that systems may be properly balanced in accordance with drawings. Advise the installing Contractor of any additional requirements for effective balancing.
- .2 Complete air balance must have been accomplished before water balance is verified.
- .3 Open all valves to full position, including coil stop valves, close bypass valves, and return line balancing cocks.
- .4 Verify that all strainers are clean.
- .5 Examine water in system to determine if it has been treated and is clean.
- .6 Check and record type and concentration of glycol in systems which require freeze protection.
- .7 Check pump rotation.
- .8 Check diaphragm expansion tanks to ensure that fill pressure is adequate (re. static head of systems plus 5 psig or 12 psig minimum (35 kPa or 83 kPa minimum).
- .9 Check open expansion tanks to make sure they are not air bound and that the system is full of water.
- .10 Check all air vents at high points of water systems to make sure they are installed properly and are operating freely. Verify that all air is removed from circulating system.
- .11 Set all temperature controls so that all coils are calling for full cooling. This should close all automatic bypass valves at coil and chillers. To balance hot water coils, set systems to call for full heating.
- .12 Verify operation of automatic bypass valve.
- .13 Verify operating temperature of heat exchangers, to design requirements.
- .14 Check and record the following items at each cooling and heating element:
 - .1 Inlet water and air temperatures. Note rise or drop in temperature train source.
 - .2 Leaving water and air temperatures.
 - .3 Pressure drop and flow through each coil.
 - .4 Pump operating suction and discharge pressure and final t.d.h. and flow delivered.
 - .5 Pressure drop across bypass valve.
 - .6 All mechanical specifications of pumps.
 - .7 Rated and actual running amperage of pump motor.
- .15 Witness all piping tests.

3.11 AIR SYSTEM VERIFICATION

- .1 Review drawings, specifications and installed work to ensure that systems may be properly balanced in accordance with drawings. Advise installing Contractor of any additional requirements for effective balancing.
- .2 In air handling systems which include supply fans with variable speed drives, airflows shall be verified to design with all filters clean and with all filters loaded to filter manufacturer's recommended final

Testing, Adjusting and Balancing

- (change-out) resistance. Motor and drive capacity to accommodate full range of filter loadings shall be verified.
- .3 In air handling systems which include supply fans without variable speed drives, air filters shall be verified to design airflows with air filters loaded so that the air pressure drop through each filter is equal to the average of the manufacturers listed initial resistance and recommended final (change-out) resistance.
 - .4 Test and record blower rpm for each fan and air handling unit.
 - .5 Test and record motor full load amperes.
 - .6 Make Pitot tube traverse of main supply and obtain operating air quantities at fans.
 - .7 Test and record system static pressures, suction and discharge.
 - .8 Test and record system operating outside air quantities.
 - .9 Test and record entering drybulb air temperatures (heating and cooling coils).
 - .10 Test and record entering wet bulb air temperatures (heating and cooling coils).
 - .11 Test and record leaving dry bulb air temperatures (heating and cooling coils).
 - .12 Test and record leaving wet bulb air temperatures (cooling coils only).
 - .13 Measure airflow in all main and zone branch supply and return air ducts.
 - .14 Test and record airflow at each diffuser, grille, and register.
 - .15 Witness and verify results of duct leakage tests.
 - .16 Tabulate and certify test results on suitable forms and submit Consultant for approval and record. Identify each diffuser, grille, and register as to location and area. Identify and list size, type, and manufacturer of diffusers, grilles, registers, and all testing equipment. Use manufacturer's rating on all equipment to make required calculations.

END OF SECTION

Duct Insulation

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Duct work insulation.
- .2 Insulation jackets.

1.3 REFERENCES

- .1 Section 23 01 01: Requirements for references and standards.
- .2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .4 ASTM C553 - Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .5 ASTM C612 - Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .6 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .7 ASTM C1071 - Fibrous Glass Duct Lining Insulation(Thermal Sound Absorbing Material).
- .8 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .9 ASTM E96 - Water Vapour Transmission of Materials.
- .10 ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- .11 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .12 NAIMA National Insulation Standards.
- .13 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- .14 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .15 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- .16 CGSB-Canadian General Standards Board.
- .17 CAN/CGSB-51.9 Mineral Fiber Thermal Insulation for Piping and Round Ducting.
- .18 CAN/CGSB-51.10 Mineral Fiber Board Thermal Insulation
- .19 CAN/CGSB-51.11 Mineral Fiber Thermal Insulation Blanket.
- .20 CAN/CGSB-5140 Mineral Insulation, Flexible, Elastomeric, Unicellular, Sheet & Pipe Coverup.
- .21 CAN/CGSB-51-GP-52 Ma Vapor Barrier, Jacket and Facing Material for Pipe, Duct & Equipment Thermal Insulation.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 23 01 01: Procedures for submittals.
- .2 Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 23 01 01: Procedures for submittals.
- .2 Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

Duct Insulation

- .2 Applicator Qualifications: Company specializing in performing the work of this section with minimum 6 years documented experience.

1.7 REGULATORY REQUIREMENTS

- .1 Materials: Flame spread/smoke developed rating of 25/50 to the requirements of the Ontario Building Code.

1.8 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 23 01 01: Transport, handle, store, and protect products.
- .2 Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Section 23 01 01: Environmental conditions affecting products on site.
- .2 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .3 Maintain temperature during and after installation for minimum period of 24 hours.

2 PRODUCTS

2.1 GLASS FIBRE, FLEXIBLE

- .1 Manufacturer: Owens Corning Fiberglas
- .2 Other acceptable manufacturers offering equivalent products:
 - .1 Manson
 - .2 Knauf Fiber Glass
 - .3 Johns Manville
 - .4 CertainTEED "Soft Touch" with FSK jacket
- .3 Insulation: ASTM C553; flexible, noncombustible blanket.
 - .1 'ksi' value : ASTM C518, 0.045 at 24 °C (0.31 @ 75.2 °F).
 - .2 Density: 0.75lb/ft3, 1.01lb/ft3
 - .3 .2 Maximum service temperature: 121 °C (250 °F).
 - .4 .3 Maximum moisture absorption: 0.20 % by volume.
- .4 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film. (FSK)
 - .2 Moisture vapour transmission: ASTM E96; 0.02 perm.
 - .3 Secure with pressure sensitive tape.
- .5 Vapour Barrier Tape:
 - .1 Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- .6 Outdoor Vapour Barrier Mastic:
 - .1 Vinyl emulsion type acrylic or mastic, compatible with insulation, black colour.
- .7 Tie Wire: Annealed steel, 1/16" (1.5 mm).

2.2 GLASS FIBRE, RIGID

- .1 Manufacturer: Owens Corning Fiberglas Model Vapour-Seal.
- .2 Other acceptable manufacturers offering equivalent products:
 - .1 Manson
 - .2 Knauf Fiber Glass
 - .3 Johns Manville
- .3 Insulation: ASTM C612; rigid, noncombustible blanket.

Duct Insulation

- .1 'ksi' value : ASTM C518, 0.036 at 75.2 °F (24 °C).
- .2 Maximum service temperature: 250 °F (121 °C).
- .3 Maximum moisture absorption: 0.20 percent by volume.
- .4 Density: 48 kg/cu m.
- .4 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; 0.04 perm.
 - .3 Secure with pressure sensitive tape.

2.3 ELASTOMERIC INSULATION

- .1 Acceptable Manufacturers:
 - .1 Armacell APArmaflex, APArmaflex SA or ArmaTuff Laminated Sheets and Rolls
- .2 Insulation material shall be a flexible, closed-cell elastomeric insulation in sheet form to ASTM C 534, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form."
- .3 Insulation materials shall have a closed-cell structure to prevent moisture from wicking.
- .4 Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's, formaldehyde free, low VOC's, fiber free, dust free and shall resist mold and mildew.
- .5 Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ULC S102, ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.
- .6 Materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
- .7 Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.
- .8 The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.

2.4 JACKETS

- .1 Canvas Jacket: UL listed.
 - .1 Fabric: ASTM C921, 220 g/sq m, plain weave cotton treated with dilute fire retardant lagging adhesive.
 - .2 Lagging Adhesive: Compatible with insulation.
- .2 Mineral Fibre (Outdoor) Jacket: Asphalt impregnated and coated sheet, 2.45 kg/sq m.
- .3 PVC Jacket (Indoor):
 - .1 Jacket: ASTM C921, One piece sheet material.
 - .1 Minimum Service Temperature: -31 °F (-35 °C).
 - .2 Maximum Service Temperature: 150 °F (66 °C).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.03 perm inches.
 - .4 Maximum Flame Spread: ASTM E84; 25 or less.
 - .5 Maximum Smoke Developed: ASTM E84; 50 or less.
 - .6 Thickness: 20 mil (0.4 mm) minimum.
 - .2 Colour: standard off-white OR coloured to suit duct identification [EDIT]
 - .3 Covering Adhesive Mastic
 - .1 Compatible with insulation, maximum VOC content of 50 g/L.
 - .4 Manufacturer;
 - .1 Ceel-Co 300 series
 - .2 Speedline *Smoke Safe*
- .4 Aluminum Jacket: ASTM B209M.
 - .1 Thickness: 0.40 mm sheet.
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal slip joints and 2" (50 mm) laps.
 - .4 Fittings: 0.4 mm thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Bands: 3/8" (10 mm) wide; 0.015" (0.38 mm) thick aluminum.

Duct Insulation

2.5 ACCESSORIES

- .1 Adhesives and finishes shall be as recommended by the insulation manufacturer and shall comply with Section 15100.2.2. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings specified.
- .2 Vapor retarder lap adhesive shall be water based, fire retardant
- .3 Tapes shall be of cloth reinforced aluminum, soft adhesive with minimum 2" (50 mm) width.
- .4 Tie wire shall be of 1/16" (1.5 mm) Ø stainless steel.
- .5 Fasteners shall be of 1/8" (4 mm) Ø pins, with 35 mm square clips. Clip length to suit insulation thickness.
- .6 Bands shall be 1/2" (12 mm) wide 1/4" (6mm) thick galvanized steel.
- .7 Facing shall be of 1" (25 mm) galvanized steel hexagonal wire mesh attached on both faces of insulation.

3 EXECUTION

3.1 EXAMINATION

- .1 Verify that ductwork has been tested before applying insulation materials.
- .2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 DUCT INSULATION

- .1 Insulate new or altered ductwork as follows:

Service	Insulation Type	Thickness
Air supply - rectangular	rigid	1"
Air supply - round	flexible	1"
Exhaust within 6' of outside - rectangular	rigid	3"
Exhaust within 6' of outside - round	flexible	3"
Fresh air intake - rectangular	rigid	3"
Fresh air intake - round	flexible	3"
Exhaust air plenums	rigid	3"
Air supply runouts to terminal units < 10' in length - Rectangular	rigid	1"
Air supply runouts to terminal units < 10' in length - Round	flexible	1"

Service	Insulation Type	Thickness
Air supply - rectangular	rigid	25 mm
Air supply - round	flexible	25 mm
Exhaust within 2m of outside - rectangular	rigid	75 mm
Exhaust within 2m of outside - round	flexible	75 mm
Fresh air intake - rectangular	rigid	75 mm
Fresh air intake - round	flexible	75 mm
Exhaust air plenums	rigid	75 mm
Air supply runouts to terminal units < 3m in length - Rectangular	rigid	25 mm

Duct Insulation

Air supply runouts to terminal units < 3m in length - Round	flexible	25 mm
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- .2 Inline duct silencers shall be insulated in the same manner as ductwork.

3.3 INSTALLATION

- .1 Install duct insulations to TIAC National Installation Standards.
- .2 Apply insulation materials, accessories, jackets and finishes in accordance with manufacturer' written instructions and as specified.
- .3 Insulated ductwork conveying air below ambient temperature:
- .1 Provide insulation with vapour barrier jackets.
 - .2 Finish with tape and vapour barrier jacket.
 - .3 Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - .4 Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- .4 Insulated ductwork conveying air above ambient temperature:
- .1 Provide with all service jacket.
 - .2 Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- .5 Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces below 3 metres above finished floor: Finish with canvas jacket sized for finish painting.
- .6 External Duct Insulation Application:
- .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
 - .2 Secure insulation without vapour barrier with staples, tape, or wires.
 - .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct work off trapeze hangers and insert spacers.
 - .4 Seal vapour barrier penetrations by mechanical fasteners with vapour barrier adhesive.
 - .5 Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- .7 Duct and Plenum Liner Application:
- .1 Adhere insulation with adhesive for 90 percent coverage.
 - .2 Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
 - .3 Seal and smooth joints. Seal and coat transverse joints.
 - .4 Seal liner surface penetrations with adhesive.
 - .5 Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

END OF SECTION

Ductwork

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 REFERENCES

- .1 ASHRAE HANDBOOK, HVAC SYSTEMS & EQUIPMENT, Duct Construction Recommendations
- .2 Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)
 - .1 HVAC Duct Construction Standards - Metal and Flexible
 - .2 HVAC Duct Systems Design
 - .3 Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
 - .4 HVAC Systems - Testing, Adjusting and Balancing
 - .5 HVAC Air Duct Leakage Test Manual.
- .3 National Fire Protection Association (NFPA)
 - .1 90A Standard for Installation of AC and Ventilation Systems
 - .2 90B Standard for Installation of Warm Air Heating and AC Systems
 - .3 255 Building Materials, Test of Burning Characteristics (same as ASTM E84)
- .4 American Society for Testing and Materials (ASTM)
 - .1 A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - .2 A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .3 A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - .4 A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
 - .6 B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - .7 A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
 - .8 A480 - Standard Specification for General Requirements for Flat Rolled Stainless Heat-Resisting Steel Plate, Sheet and Strip
 - .9 A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated by the Hot Dip Process
 - .10 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - .11 E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Material and Prefabricated Silencers
 - .12 E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops
- .5 American Welding Society (AWS)
 - .1 B2.2 Brazing Procedures and Performance Qualifications
 - .2 D9.1 Sheet Metal Welding Code
- .6 Underwriter's Laboratories (UL)
 - .1 181 Factory Made Air Ducts and Air Connectors
 - .2 555 Standard for Safety Fire Dampers
 - .3 555S Leakage Rated Dampers for Use in Smoke Control Systems
 - .4 723 Test for Surface Burning Characteristics of Burning Materials (ASTM E84)

1.3 PERFORMANCE REQUIREMENTS

- .1 No variation of duct configuration or sizes permitted except by written permission.
- .2 Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

Ductwork

- .3 Sizes indicated on drawings are clear inside dimensions and do not include for duct linings.

1.4 SUBMITTALS

- .1 Division 23 01 01: Procedures for submittals.
- .2 Product Data: Provide data for duct materials.
- .3 Shop Drawings:
 - .1 Plenums and plenum related items showing physical dimensions, joints, sealants, door construction and hardware.
 - .2 Factory fabricated ducts, fittings and joining systems.
 - .3 Firewall duct penetrations; fire and smoke dampers; louvers and access doors.
 - .4 Duct fitting particulars such as gauges, sizes, welds, reinforcements and configuration for 4" wg. (1000 kPa) pressure class and higher systems.
- .4 Submit changes or alterations in ductwork layout, with supporting calculations showing that the modified design will not increase total pressure, before work commences. Submittals for proposed changes shall be stamped for acceptance prior to commencement of work.
- .5 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- .6 Material Safety Data Sheets (MSDS) for sealants, adhesives and coatings.

1.5 PROJECT RECORD DOCUMENTS

- .1 Division 1: Submittals for project closeout.
- .2 Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

- .1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .2 Perform Duct Leakage Testing to SMACNA "HVAC Air Duct Leakage Testing Manual"
- .3 Maintain one copy of document on site.
- .4 Asbestos Free: Insulating and sealing materials must be certified to be free of asbestos.
- .5 Brazing: Certify brazing procedures, brazers, and operators in accordance with AWS B2.2 Brazing Procedures and Performance Qualifications
- .6 Welding: Certify welding procedures, welding equipment and welders in accordance with AWS D9.1 Sheet Metal Welding Code.

1.7 REGULATORY REQUIREMENTS

- .1 Ontario Building Code (OBC)
- .2 Ontario Fire Code (OFC)
- .3 Construct ductwork to NFPA 90A standards.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- .2 Maintain temperatures during and after installation of duct sealants.

2 PRODUCTS

2.1 MATERIALS

- .1 Table of Materials

APPLICATIONS	MATERIALS
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Ductwork

Rigid HVAC ducts, casings and fittings	ASTM A653 galvanized steel sheet, lock form quality, G90 zinc coating (0.90 oz/ft ²) to ASTM A90. Sheets free of pits, blisters, slivers, and ungalvanized spots.
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- .2 Hanger Rod: continuously threaded, ASTM A36 galvanized steel in general, stainless steel for stainless steel ducts.
- .3 Sealant: Non-hardening, water resistant, fire resitive, low VOC (VOC content not to exceed 250 g/L), compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- .4 Supports: Angle iron, channels, rods and related supporting materials shall be galvanized or red oxide coated.
- .5 Fasteners: Use galvanized rivets, screws and bolts throughout, except on stainless steel ductwork, use SS fasteners.
- .6 Reinforcements: Provide galvanized steel or stainless steel reinforcement shapes and plates to match ductwork.
- .7 Tie Rods: Use galvanized steel, 1/4 inch minimum diameter fasteners for ductwork 36 inch or less in length; use 3/8 inch minimum diameter for lengths longer than 36 in.

2.2 DUCT CONSTRUCTION

- .1 Duct Construction Schedule

Duct Application	Duct Pressure	Pressure Class (in.wg.)	Seal Class	Leakage Class
Rectangular HVAC Supply from AHU to terminal unit or reheat coil	Positive	4	A	6
Round HVAC Supply from AHU to terminal unit or reheat coil	Positive	4	A	3
Rectangular HVAC Supply from terminal unit or reheat coil to air outlet	Positive	2	A	6
Round HVAC Supply from terminal unit or reheat coil to air outlet	Positive	2	A	3
Rectangular HVAC Single zone supply from AC Unit to air outlet	Positive	2	A	6
Round HVAC Single zone supply from AC Unit to air outlet	Positive	2	A	3
Rectangular HVAC Return from air outlet to AHU	Negative	2	A	6
Round HVAC Return from air outlet to AHU	Negative	2	A	3
Rectangular Sanitary exhaust ductwork	Negative	2	A	6
Round Sanitary exhaust ductwork	Negative	2	A	3
<u>Notes:</u>				
1. Pressure class shall be the lower of exhaust fan shut-off pressure or value shown				

2.3 DUCT SEALING

- .1 Duct Sealing Requirements

SEAL CLASS	SEALING REQUIREMENTS
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Ductwork

A	All tranverse joints, longitudinal seams and duct wall penetrations
B	All tranverse joints and longitudinal seams a
C	All tranverse joints

2.4 DUCT LEAKAGE

- .1 Leakage Class is defined as
 $CL = F / (P)^{0.65}$
 where: CL = Leakage Class
 F = Leakage Factor (cfm/100-ft² of duct surface)
 P = Static pressure in the duct (in.wg.)
- .2 Table

LEAKAGE FACTOR (F) CFM/100 –sq.ft. of DUCT SURFACE					
LEAK CLASS	PRESSURE CLASS (in.wg.) (+ve or –ve)				
C_L	1	2	4	6	10
48	48	75	118	154	214
24	24	38	59	77	107
12	12	19	30	38	54
6	6	9	15	19	27
3	3	5	7	10	13
0	0	0	0	0	0

2.5 DUCTWORK FABRICATION

- .1 All Ductwork shall be constructed to withstand 1-1/2 times fan pressure at shut-off and 2" (500 Pa) minimum.
- .2 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated in accordance with recommendations of ASHRAE and SMACNA.
- .3 Joints and reinforcements:
 - .1 to SMACNA and ASHRAE
 - .2 may be made with the Ductmate System or Nexus System. System components shall be made of standard catalogue manufacture as supplied by Ductmate Industries, Inc. or Nexus Inc.
- .4 Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.
- .5 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- .6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.
- .7 Provide standard 45-degree lateral wye takeoffs. Alternative 90-degree conical tee connections may be used only where specifically indicated.

2.6 ROUND SPIRAL LOCK SEAM DUCTWORK

Ductwork

- .1 Spiral ducts and elbows shall not be used for watertight exhaust systems.
- .2 Ducts and fittings shall be manufactured from minimum G90 galvanized steel meeting ASTM A527/A527M-85.
- .3 Ductwork shall be "Uni-Seal" single wall, round spiral lock-seam type duct in wall thicknesses listed below.
- .4 Fittings shall be "Uni-Seal" single wall, round fittings suitable for use with "Uni-Seal" ductwork in wall thicknesses as follows:

ROUND SPIRAL LOCK SEAM DUCTWORK - IP			
Diameter		Minimum Steel Gauge	
From	To	Spiral Lock	Fittings
3"	14"	26	22
15"	26"	24	20
27"	36"	22	20
37"	50"	20	18
51"	60"	18	18

ROUND SPIRAL LOCK SEAM DUCTWORK - SI			
Diameter		Minimum Steel Gauge	
From	To	Spiral Lock	Fittings
75	356	0.56	0.70
380	660	0.71	0.86
686	914	0.86	1.01
939	1270	1.01	1.32
1321	1524	1.32	1.62

- .5 Acceptable Manufacturer: "Uni-Seal" spiral lock-seam duct and "Uni-Seal" fittings as manufactured by McGill. Other manufacturers refer to Section 23 01 01 2.3

2.7 FLEXIBLE DUCTWORK

- .1 Flexible ducts shall be factory fabricated to CAN/ULC S110, factory fabricated assembly with a laminated inner liner of aluminum foil, fiberglass and polyester, a galvanized steel helix coil formed to the inner liner, a fiberglass insulation blanket, and a polyethylene outer jacket. Flexible duct shall have a flame resistant rating of 25 or less and a smoke developed rating of 50 or less

FLEXIBLE DUCTWORK - IP		
Pressure rating	Low & Medium Pressure	High Pressure
Maximum positive pressure	6" wg	12" wg
Maximum negative pressure	4"wg	5" wg
Maximum velocity	4000 fpm	5500 fpm
Permeance	0.1 perm	0.1 perm

Ductwork

Operating temperature	-20°F to 250°F	-20°F to 250°F
Maximum thermal conductance	0.23 BTU/Hr-F°	0.23 BTU/Hr-F°
Listed & Labelled	Class 0, Class 1	Class 0, Class 1
Flexmaster type	5	3

FLEXIBLE DUCTWORK - SI		
Pressure rating	Low & Medium Pressure	High Pressure
Maximum positive pressure	3 kPa	6 kPa
Maximum negative pressure	2kPa	2.5 kPa
Maximum velocity	20 m/s	28 m/s
Permeance	0.1 perm	0.1 perm
Operating temperature	-20°F to 250°F	-28.9°C to 121.1°C
Maximum thermal conductance	0.23 BTU/Hr-F°	
Listed & Labelled	Class 0, Class 1	Class 0, Class 1
Flexmaster type	5	3

- .2 Accessories: conical spin-in collars with butterfly volume dampers for connections to ductwork, round rigid galvanized steel fittings fabricated to SMACNA Standards and ASHRAE recommendations, bridge and gear clamps.
- .3 Acceptable Manufacturers:
 - .1 Flexmaster

3 EXECUTION

3.1 INSTALLATION

- .1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .2 Install ductwork parallel to building lines.
- .3 Support all ductwork from structural members. Where structural bearings do not exist, suspend strapping or hangers from steel channels or angles. Provide supplementary structural members. Do not suspend from metal deck.
- .4 Do not break continuity of insulation vapour barrier by hangers or rods.
- .5 Hangers shall be steel angles with supporting rods, locking nuts and washers to following table;

DUCT HANGERS - IP			
Duct Sizes (Largest side)	Angle Size	Rod Size	Spacing
Up to 30"	1" x 1" x 1/8"	1/4" diameter	10 ft
31" to 42"	1-1/2" x 1-1/2" x 1/8"	1/4" diameter	10 ft
43" to 60"	1-1/2" x 1-1/2" x 1/8"	3/8" diameter	10 ft
61" to 84"	2" x 2" 1/8"	3/8" diameter	8 ft

DUCT HANGERS - SI

Ductwork

Duct Sizes (Largest side)	Angle Size	Rod Size	Spacing
Up to 30"	25 x 25 x 3 mm	6mm diameter	3 m
31" to 42"	40 x 40 x 3 mm	6mm diameter	3 m
43" to 60"	40 x 40 x 3 mm	10mm diameter	3 m
61" to 84"	50 x 50 x 3 mm	10mm diameter	2.5 m

- .6 Anchor all risers at bottom and support from building structure at each floor level.
- .7 Vertical ducts passing through floors shall be supported on angles secured to duct bearing on the floor.
- .8 Where ducts pass through walls, floors, openings required to have a fire resistance rating the opening in the construction around the duct shall be filled with an approved fire stop material as per NFPA 90A and fire damper shall also be installed with access doors as per the code.
- .9 Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- .10 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- .11 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .12 Use crimp joints with or without bead for joining round duct sizes 8" (200 mm) and smaller with crimp in direction of air flow.
- .13 Use double nuts and lock washers on threaded rod supports.
- .14 Connect terminal units to supply ducts directly or with 12" (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.
- .15 Connect diffusers or light troffer boots to low pressure ducts directly or with 60" (1.5 m) maximum length of flexible duct held in place with strap or clamp.
- .16 Connect flexible ducts to metal ducts with adhesive and metal or nylon straps.
- .17 Ground across flexible connector with No. 2/0 braided copper strap.
- .18 Set plenum doors 6" to 12" (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- .19 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.
- .20 Install HTL ductwork between duct silencer and mechanical room wall.
- .21 Balancing dampers shall be installed on branches as per locations shown on the drawings and as per the requirements of NEBB and AABC listing/measuring standards.
- .22 Perform duct leakage testing for all ductwork installed under this contract.

3.2 FLEXIBLE DUCTWORK

- .1 Flexible ductwork may be installed for final connections to air outlets provided that not more than 5 ft. (1.5 m) in length is used for each connection, and where specifically indicated on drawings.
- .2 All fittings used with flexible ductwork shall be rigid round duct.
- .3 Use pre-insulated flexible ductwork where application is to be insulated.

3.3 DUCT CLEANLINESS

- .1 All ductwork shall be handled and installed in accordance with the advanced level described in SMACNA Duct Cleanliness for New Construction Guidelines.
- .2 Ductwork leaving the premises of the manufacturer may include some or all of the following:
 - .1 self-adhesive labels or marking for part(s) identification shall be applied to external surfaces only;
 - .2 exposed mastic sealant;

Ductwork

- .3 light zinc oxide coating on the metal surface;
- .4 a light coating of oil on machine formed ductwork;
- .5 minor protrusions into the airway of rivets, screws, bolts and other jointing devices;
- .6 internal insulation and associated fasteners;
- .7 discoloration marks from plasma cutting process.
- .8 to maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping. Care must be taken to prevent damage during transportation and off loading.
- .3 A clean and dry environment where the ductwork is protected from dust must be provided for the storage of ductwork prior to installation. All sealed ends shall be visually examined and if damaged resealed with an appropriate material.
- .4 During installation, the working area shall be clean, dry and the ductwork protected from dust.
- .5 The internal surfaces of the uninsulated ductwork shall be wiped to remove excess dust immediately prior to installation.
- .6 Open ends on completed ductwork and overnight work-in-progress shall be sealed.
- .7 Access covers shall be firmly fitted in position on completion of each section of the work.
- .8 Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

3.4 HVAC SYSTEM CLEANING

- .1 Qualifications of HVAC Systems Cleaning Contractor
 - .1 Member of National Air Duct Cleaners Association (NADCA)
 - .2 Supervisor: Air System Cleaning Specialist certified by NADCA
 - .3 Firm: regularly engaged in HVAC system cleaning with minimum 3-years experience
 - .4 Employees: trained in safe use of equipment and individual health protection measures
- .2 Maintain a copy of all current MSDS documentation and safety certifications for products employed in the cleaning operations at the site at all times. Submit a copy of all MSDS sheets to Owner.
- .3 Standards: Conform to NADCA Standard ACR 2006, Assessment, Cleaning and Restoration of HVAC Systems and NADCA Guidelines.
- .4 Scope of HVAC System Cleaning Work;
 - .1 clean each HVAC System and component as follows;
 - .1 interior surfaces of all new ductwork and accessories installed as part of this project
 - .2 interior surfaces of all existing ductwork and accessories that are to remain in service on completion of this project,
 - .3 interior surfaces of all new and existing HVAC System components that are to remain in service on completion of this project, including; air handling units, fans, fan housings, air coils, drain pans, humidifiers, filters, filter frames, intake and exhaust and mixing plenums, air blenders, air outlets and inlets, air terminal units, power ventilators, sound attenuators, reheat coils, turning vanes, dampers, and sensors
 - .2 Verify the cleanliness of each HVAC System and component through visual inspection, video recording and testing indicated hereinafter.
- .5 Cleaning & Disinfection Requirements;
 - .1 mark and record position of any and all adjustable devices and ensure that they are re-set to their original position on completion of cleaning and verification work,
 - .2 document and report any and all damage to HVAC Systems and components discovered during inspections to Consultant and to Owner,
 - .3 Cleaning: remove all visible surface contaminants and deposits from each HVAC System and component
 - .4 Disinfection: disinfect all internal surfaces of ductwork, equipment.
 - .5 Containment: ensure that dust and debris collected during the cleaning process is contained within the HVAC System and not otherwise dispersed outside of the system.
 - .6 Particulate Collection: high power vacuums with HEPA filtration to 99.97% efficiency on particles greater than 0.3-micron size
 - .7 Odours and Mist control: ensure that odours and mist vapours arising from cleaning operations are contained within the HVAC System and are prevented from escaping to and

Ductwork

- dispersing outside of the system.
- .8 Provide adequate access into ductwork for cleaning purposes. Provide access doors conforming to project specifications.
- .9 Flexible ducts shall be disconnected to provide access for cleaning.
- .10 Protect components which may be harmed by excessive dirt with filters, or bypass during cleaning.
- .11 Where mechanical brushing and vacuuming is not appropriate or is not sufficient to clean a component of the system, dismantle and remove the component and clean or replace as appropriate.
- .12 Ensure that appropriate liquid collection and drainage measures are in place prior to undertaking any washdown procedures.
- .13 Anti-microbial Agents and Coatings: apply anti-microbial agents where active fungal growth is suspected or where unacceptable levels of fungal contamination exist. Apply anti-microbial treatments and coatings in strict adherence to the manufacturer's written recommendations and registration listings. Application of anti-microbial agents and coatings may be performed only after removal of surface deposits and debris.
- .6 Cleanliness Verification:
 - .1 Visual Inspection: no visible contaminants present when examined under a bright light (equivalent to 100w incandescent bulb). Maximum 0.75mg/100cm² with no significant local accumulations.
 - .2 Air Coils and reheat coils: restored to within 10% of original design pressure drop
 - .3 Particle Profiling Procedures: In the event of a dispute between Contractor and Owner regarding cleanliness, Contractor shall perform NADCA PP procedures in accordance with Chapter 2 of NADCA Guideline to ACR 2006; Particle Measurement, Air Sampling and Surface Sampling for each supply air system at representative locations selected by Owner and in the discharge plenum of each air handling unit.
- .7 Report:
 - .1 submit three (3) copies of cleaning report
 - .2 report shall include;
 - .1 certificate of cleanliness from third party inspection service with following minimum qualifications;
 - .1 Environmental Engineer licensed in the province of Ontario or
 - .2 Certified Industrial Hygienist, and
 - .3 minimum 3 years experience in duct cleaning
 - .2 photographic/video record of cleaned surfaces and components
 - .3 comparative record of damage discovered on initial inspection and of remedial measures implemented by others

3.5 DUCT LEAKAGE TESTING

- .1 Ductwork shall be leak tested in accordance with the SMACNA "HVAC Air Duct Leakage Test Manual". The maximum permitted duct leakage shall be determined by multiplying the leakage factor from paragraph 2.4 above by the surface area of the ductwork in the test zone.
- .2 Ductwork that exceeds the maximum permitted leakage shall be re-sealed and re-tested.
- .3 Duct leakage test shall be witnessed and certified by the Systems Verification Agency of section 23 01 05.
- .4 Record and submit three (3) copies of test results to the Consultant for review prior to application of duct insulation or concealment of ductwork.

3.6 CONTROLS DEVICES

- .1 Install remote sensors such as temperature, pressure and airflow sensors. Supply of sensors and controls wiring will be under Section 25.
- .2 Install remote mounted control dampers for airflow control. Supply of dampers, damper actuators and controls wiring will be under Section 25.
- .3 Install duct type smoke detectors in accordance with manufacturer's instructions. Supply of detectors

Ductwork

and fire alarm wiring will be under Division 26.

END OF SECTION

Air Duct Accessories

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Fire Dampers
- .2 Fire Dampers (Dynamic)
- .3 Duct access doors.
- .4 Duct test holes.
- .5 Flexible Duct Connections
- .6 Hangers and Supports
- .7 Duct Lining
- .8 Duct Sealants

1.3 REFERENCES

- .1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .2 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .3 UL 33 - Heat Responsive Links for Fire-Protection Service.
- .4 UL 555 - Fire Dampers.

1.4 SUBMITTALS

- .1 Section 23 01 01: Submittals.
- .2 Shop Drawings for shop fabricated assemblies including balancing dampers, volume control dampers, duct access doors and duct test holes.
- .3 Product Data for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.
- .4 Manufacturer's Installation Instructions for fire dampers and combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Record actual locations of access doors.

1.6 REGULATORY REQUIREMENTS

- .1 Products Requiring Electrical Connection: CSA Listed as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products.
- .2 Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Provide two of each size and type of fusible link.

2 PRODUCTS

2.1 FIRE DAMPERS

- .1 Manufacturers:

Air Duct Accessories

- .1 Price
- .2 Ruskin
- .3 Nailor
- .4 Ventex
- .5 Controller Air
- .6 NCA
- .2 Fire dampers shall be ULC listed, labelled, or Warnock-Hersey label, meet all requirements of NFPA 90A, and constructed and rated in conformance with:
 - .1 CAN4-S112-M82, "Standard for Fire Dampers", when used in a fire separation of not more than 2 hours, and which is not a firewall.
 - .2 CAN4-S104-M80, "Standard Method for Fire Tests of Door Assemblies", when used in a fire separation of more than 2 hours, or used in a firewall.
 - .3 CAN4-S112.2-M84, "Fire Test of Ceiling Firestop Flap Assemblies", when used in a ceiling fire separation.
- .3 Fire dampers shall be galvanized steel channel frame curtain type galvanized steel interlocking blades, minimum 22 gauge (0.9 mm) galvanized steel enclosure, and 160°F (71°C) fusible link standard.
- .4 Fire dampers for horizontal installation in vertical ductwork shall be operated by a stainless steel closure spring and latch.
- .5 Fire damper configuration shall be low resistance type B with blades located outside of the air stream for rectangular ductwork, and type C for round or oval ductwork.
- .6 Ceiling fire dampers shall be ULC labelled, for fire rated membrane type ceilings, galvanized steel construction with heat retardant blanket (non-asbestos) with standard 160°F (71°C) fusible link.
- .7 Thermal blanket shall be ULC labelled, for fire rated membrane type ceilings, to completely enshroud ceiling penetration.
- .8 Fusible Links: UL 33, separate at 160°F (71°C) with adjustable link straps for combination fire/balancing dampers.

2.2 FIRE DAMPERS (DYNAMIC)

- .1 Dynamic fire dampers tested, constructed and labeled in accordance with the latest edition of UL Standard 555. Dampers shall have a fire rating of 1-1/2 hours or 3 hours and shall meet the requirements of the latest edition of NFPA90A.
- .2 Each damper shall include a 165°F (74°C) fusible link and shall be labeled for use in dynamic systems. The damper shall be rated for dynamic closure at 2000fpm (10.16m/s) and 4 inches w.g. (1 kPa) static pressure and shall be rated to close with airflow in either direction.
- .3 Each dynamic fire damper shall include a steel sleeve and mounting angles furnished by the damper manufacturer to ensure appropriate installation. Submittals information shall include the fire protection rating, maximum velocity/pressure ratings and the manufacturer's UL installation instructions. The dampers shall be installed in accordance with the manufacturer's UL installation instructions.
- .4 Acceptable Product: Ruskin DIBD2/DIBD23, NCA, Ventex, Price, Controlled Air.

2.3 DUCT ACCESS DOORS

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated duct work, install minimum 1" (25 mm) thick insulation with sheet metal cover.
 - .1 Less Than 12" (300 mm) Square: Secure with sash locks.
 - .2 Up to 18" (450 mm) Square: Provide two hinges and two sash locks.
 - .3 Up to 24" x 48" (600 x 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - .4 Larger Sizes: Provide an additional hinge.
- .3 Access doors with sheet metal screw fasteners are not acceptable.
- .4 Acceptable Manufacturer: Acudoor, Duro-Dyne, Dyn-Air, Nailor, Kreuger

2.4 DUCT TEST HOLES

Air Duct Accessories

- .1 Provide test ports to suit intended application, (ie. insulated/uninsulated duct, round/rectangular duct).
- .2 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- .3 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
- .4 Acceptable Manufacturers: Air Power Co. Dial 1000, Dial 2000 or Duro-Dyne IP-1, IP-2, IPG-3, IP-4, Dyn-Air.

2.5 FLEXIBLE DUCT CONNECTIONS

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Connector: Fabric crimped into metal edging strip.
 - .1 Fabric: UL listed fire-retardant neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m.
 - .2 Net Fabric Width: Approximately 2" (50 mm) wide.
 - .3 Metal: 3" (75 mm) wide, 1/32" (0.6 mm) thick.
- .3 Acceptable Manufacturers" Durp-Dyna, Dyn-Air

2.6 HANGERS AND SUPPORTS

- .1 Fabricate strap hangers to same material as duct. Hanger configuration to SMACNA details. 20" (500 mm) is maximum duct size to be supported by strap hanger.
- .2 Rod and angle hangers: galvanized steel to SMACNA details.
- .3 Hanger attachments: manufactured concrete inserts, expansion shields and bolted steel clamps. Do not weld rods to steel decks or use powder actuated fasteners.

2.7 DUCT LINING

- .1 Knauf fibre free duct lining: self-sealing engineered polymer foam (3/4") (19mm) thick, complies with;
 - .1 UL 181 for erosion, mould growth and humidity,
 - .2 CAN/ULC-102.2, UL 723 and ASTM E84 flame spread (25) and smoke developed (50),
 - .3 ASTM C665 fungi resistance
- .2 AP Armaflex SA Duct Lining (1") (25mm) thick, flexible, closed-cell elastomeric insulation in sheet form meeting following requirements;
 - .1 ASTM C1534 "Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Absorbing Liner for Duct Systems"
 - .2 CAN/ULC-102.2 and ASTM E84 flame spread index of 25 or less and smoke developed index of less than 50.
 - .3 Maximum thermal conductivity of 0.27 Btu-in./ft²-°F at a mean temperature of 75°F
 - .4 Maximum water absorption rate of 0.2% (by volume) to ASTM C209
 - .5 Maximum vapour transmission rate of 0.08 perm-inches to ASTM E96, Procedure A
 - .6 Approved for installation in air plenums
 - .7 NFPA 90A, NFPA 90B and UL 181 Class 1 specifications.
 - .8 ASTM C411, materials perform up to 250°F
 - .9 ASTM C1071 erosion resistance
 - .10 ASTM G21 and ASTM C1338 fungi resistance
 - .11 ASTM G22 bacterial resistance
 - .12 Dust free, fibre free, non-particulating

2.8 DUCT SEALANT

- .1 General: Low VOC, water based sealant, non-toxic, non-combustible, non-flammable, and tested in accordance with CAN4/ULC-S102. Flame spread shall not exceed 25 and smoke developed shall not exceed 50.
- .2 Acceptable Products: Multi-Purpose Duct Sealant as manufactured by Trans Continental Equipment, Duro Dyne SWB Duct Sealer, Iron Grip 601 as supplied by Alpha Sheet Metal Co., or Uni-Grip Duct Sealer from United McGill Corporation.

Air Duct Accessories

3 EXECUTION

3.1 PREPARATION

- .1 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- .1 Install accessories to manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- .2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- .3 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8" x 8" (200 x 200mm) size for hand access, 18" x 18" (450 x 450 mm) size for shoulder access, and as indicated. Provide 4" x 4" (100 x 100 mm) for balancing dampers only. Review locations prior to fabrication.
- .4 Provide duct test holes where indicated and required for testing and balancing purposes.
- .5 Provide fire dampers, combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- .6 Demonstrate re-setting of fire dampers to Owner's representative.
- .7 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. For fans developing static pressures of 1250 Pa and over, cover connections with loaded vinyl sheet, held in place with metal straps.
- .8 Use splitter dampers only where indicated.
- .9 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- .10 Install control dampers supplied under Section 15900 in ducts or plena as indicated.
- .11 Provide test ports as required by Balancing Agency to completely test and balance the system. No temporary holes will be permitted in ductwork or flexible connections.

3.3 FIRE DAMPERS

- .1 Provide fire dampers where shown on drawings. In general, fire dampers are required where ducts pass through fire rated assemblies, floors and roofs and ducts entering and leaving duct shafts and mechanical rooms.
- .2 Install fire dampers in strict accordance with manufacturer's installation instructions and in conformance with NFPA 90A.
- .3 Install type A fire dampers anywhere there are extreme space limitations and then only where dimension of duct exceeds 12" (300 mm) in direction of blade closing, and is specifically approved by Consultant.
- .4 Install type B fire dampers for rectangular ductwork.
- .5 Install type C fire dampers for round or oval ductwork.
- .6 Openings for fire dampers must be properly prepared and the fire dampers installed, and secured prior to field review by the Consultant. Notify the Consultant when ready for review. Do not make any duct connections to fire dampers until review is complete and work found correct.
- .7 Support fire dampers from building structure. Submit erection Drawings, approved by all authorities, showing the locations and construction details of all fire dampers before proceeding with any work.
- .8 Install Ceiling Fire Dampers where ducts serve grilles and diffusers in rated ceilings. Support from building structure.
- .9 Install thermal blanket in all fire rated membrane type ceilings. Thermal blanket shall be wrapped and stapled around the unexposed perimeter of diffuser after installation of ceiling damper following manufacturer's installation instructions.
- .10 Use Dynamic Fire Dampers for Systems expected to be Operational during a Fire.

Air Duct Accessories

3.4 DUCT ACCESS DOORS

- .1 Provide duct access doors of suitable size in ductwork in the following locations:
 - .1 Suction inlet of all fans
 - .2 At not more than 12m intervals
 - .3 At not more than 6m intervals on the ductwork installed after a high efficiency filter
 - .4 At the base of all main risers
 - .5 In front of and behind all turning vanes and coils
 - .6 At all fire, smoke, and motorized dampers
 - .7 At all locations having an internally mounted piece of equipment or device. Provide a section of transparent plexiglass to permit viewing without opening the access doors.
 - .8 Where required for duct cleaning.
- .2 Wherever possible, doors shall be mounted to close in direction of air flow.

3.5 DUCT LINING

- .1 Line internal surfaces of all ductwork shown cross hatched on drawings with 1" (25 mm) thick duct lining.
- .2 No allowance has been made in duct sizes indicated for internal lining. Increase duct size 1" (25 mm) all around where lining is to be internally applied.
- .3 Adhere directly to clean, oil-free surfaces with full coverage of flame resistant adhesive.
- .4 Ambient temperature must be between 40°F and 100°F.
- .5 Armaflex:
 - .1 Smooth side shall be exposed to airstream.
 - .2 Butt edges tightly with a compression fit. Overlap the insulation 1/4" at the butt-edges and compress edges into place. Leave a 1/2" wide release liner border at the butt edge.
 - .3 Apply metal nosing to every leading edge for air velocities over 4000-fpm (20.3m/sec.)

END OF SECTION

Air Terminal Units

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Single duct terminal units (VAV/BP).

1.3 REFERENCES

- .1 ADC 1062 - Air Distribution and Control Device Test Code.
- .2 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- .3 UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE TOLERANCES

- .1 Base performance on tests conducted to ADC 1062.

1.5 SUBMITTALS

- .1 Section 23 01 01: Procedures for submittals.
- .2 Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
- .3 Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalogue performance ratings which indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- .4 Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 250 to 1000 Pa.
- .5 Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

1.6 PROJECT RECORD DOCUMENTS

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Record actual locations of units.

1.7 OPERATION AND MAINTENANCE DATA

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.8 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.10 WARRANTY

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Provide five year warranty.

Air Terminal Units

- .3 Warranty: Include coverage of system powered control systems.

1.11 EXTRA MATERIALS

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Provide two additional electric motors of each size.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Single Duct Terminal Units (VAV/BP): E. H. Price products indicated.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Titus
 - .2 Anemostat
 - .3 Krueger
 - .4 Metalaire

2.2 SINGLE DUCT TERMINAL UNITS (VAV/BP)

- .1 Basic Unit:
 - .1 Configuration: Air volume damper assembly inside unit casing. Locate control component inside protective metal shroud.
 - .2 Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 0.25 kPa inlet static pressure.
 - .3 Mount damper operator to position damper normally open.
- .2 Basic Assembly:
 - .1 Casings: Minimum 22-ga (0.85 mm) G-90 galvanized steel.
 - .2 Lining:
 - 1" thick 1.5 lb/cu.ft. density fibreglass insulation with woven fabric and perforated metal liner, Price WFPM
 - .3 Plenum Air Inlets: Rectangular stub connections for duct attachment.
 - .4 Plenum Air Outlets: S slip and drive connections.
- .3 Damper Operator: electronic

3 EXECUTION

3.1 INSTALLATION

- .1 Install all units neat and level following manufacturers instructions.
- .2 All control wiring, conduit, accessories, etc., shall be installed in accordance with the requirements specified by Division 16 and the local electrical authority.
- .3 All power wiring from motor control centers and/or motor starter panels to driven motor of equipment shall be by Division 16.
- .4 Co-ordinate with Electrical Division all power wiring to VAV/BP terminal units and accessories.
- .5 Furnish the services of a trained representative of the equipment manufacturer to supervise the installation, wiring, set up.
- .6 Provide ceiling access doors or locate units above easily removable ceiling components.
- .7 Support units individually from structure. Do not support from adjacent ductwork.
- .8 Provide safety chains for ceiling mounted units.
- .9 Connect to ductwork.
- .10 Verify that electric power is available and of the correct characteristics.

END OF SECTION

Air Outlets and Inlets

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Diffusers.
- .2 Linear Diffusers and Grilles
- .3 Grilles and Registers

1.3 REFERENCES

- .1 ADC 1062 - Air Distribution and Control Device Test Code.
- .2 AMCA 500 - Method of Testing Louvres for Ratings.
- .3 AMCA 5000 - Method of Testing Dampers for Ratings.
- .4 AHRI 650 - Air Outlets and Inlets.
- .5 ASHRAE 70 - Method of Testing for Rating the Performance of Outlets and Inlets.
- .6 SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- .7 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTALS

- .1 Section 23 01 01: Procedures for submittals.
- .2 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- .3 As built record drawings to record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

- .1 Test and rate air outlet and inlet performance to ADC Equipment Test Code 1062 and ASHRAE 70.
- .2 Test and rate louvre performance to AMCA 500.

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Diffusers, grilles and registers shall be Price model indicated or equivalent products by;
 - .1 Titus
 - .2 Nailor

2.2 SQUARE PLAQUE DIFFUSERS

- .1 Manufacturer's Reference: Price Model SPD/31/B12
- .2 Type: Square face plaque and back cone, fixed 360° horizontal pattern with sectorizing baffles where indicated.
- .3 Frame: Inverted T-bar type.
- .4 Fabrication: Steel with baked enamel off-white finish.
- .5 Accessories: butterfly type volume control damper, adjustable from diffuser face.

Air Outlets and Inlets

2.3 LINEAR SLOT DIFFUSERS (Model AS)

- .1 Manufacturer's Reference: Price Model AS (Ajusta Slot)
- .2 Type: custom flow, continuous linear, straight slot diffusers, integral hanger, spacer bars,
- .3 Frame:
type 22 - concealed
- .4 Mounting:
C surface mounting, concealed screws
- .5 End Configurations: factory made,
- .6 Pattern Controllers: fully adjustable, steel
- .7 Finish: face - powder coated white to match Architect's selection, interior - black
- .8 Plenum: factory engineered to suit published performance data
- .9 Accessories: integral hangers, spacer bars, return air sight baffles, blank-offs, attachment plates, alignment strips,
opposed blade damper - coated steel
- .10 Performance: based on catalogued data obtained from tests conducted in accordance with ASHRAE Standard 70. Pattern controllers shall be set in the normal operating position. Select slot diffusers to maximum of 10 less the PNC (Preferred Noise Criterion) rating of the room.

2.4 RETURN/EXHAUST GRILLES

- .1 Manufacturer's Reference: Price Model 530/530D. Steel return grille with 45 degree deflection fixed louver type, blades spaced $\frac{3}{4}$ in. (19mm) on center, blades parallel to long dimension, opposed blade volume control.
- .2 Mounting type: concealed border, no mounting frame, concealed fastening.
- .3 Finish: Finish selection by Architect. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with AST M D1654 and 1000 hours with no rusting or blistering as per AST M D610 and AST M D714.

3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- .3 Install diffusers and grilles and connect to ductwork with air tight connections.
- .4 Provide balancing dampers in duct take-off to diffusers, grilles and registers, whether or not dampers are included as part of the diffuser, grille or register assembly.
- .5 Paint visible ductwork behind air outlets and inlets matte black.
- .6 Provide safety chains for ceiling mounted filter units and for diffusers 24" x 48" (600 x 1200mm) and larger.
- .7 Install filters in diffusers, grilles and registers after final cleaning of rooms and ductwork has been completed and accepted and when environmental conditions are suitable. Ensure that air tight seal is achieved.

3.2 PROTECTION

- .1 Protect each diffuser, grille and register from damage during construction.
- .2 Protect each diffuser, grille, register and ductwork from contamination and entry of dust and debris during construction.

END OF SECTION

Radiant Snow Melting System

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 23 01 01.

1.2 SECTION INCLUDES

- .1 Radiant snow melting systems and control strategies, using cross-linked polyethylene (PEX) tubing and appropriate fittings.

1.3 REFERENCES

- .1 General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- .2 Certified to ASTM International by NSF:
 - .1 ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing.
 - .2 ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.
- .3 Certified to ASTM International, UL, NFPA and ULC by Intertek:
 - .1 ASTM E84, Standard Test Method for Surface Burning Characteristics of Test Materials.
 - .2 ASTM E119, UL 263 and NFPA 251 Fire Tests of Building Construction and Materials.
 - .3 CAN/ULC S101-04, Standard Test Methods for Fire Tests of Building Construction and Materials.
- .4 Certified to Canadian Standards Association (CSA) by NSF:
 - .1 CAN/CSA B137.5 Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications.
- .5 Certified to International Code Council (ICC) by NSF:
 - .1 International Mechanical Code (IMC)
 - .2 International Building Code (IBC)
- .6 Certified to International Association of Plumbing and Mechanical Officials (IAPMO) by NSF:
 - .1 Uniform Mechanical Code (UMC)
- .7 German Institute for Standards (Deutsches Institut für Normung e.V., DIN):
 - .1 DIN 4726 Pipelines of Plastic Materials Used in Warm Water Floor Heating Systems; General Requirements
- .8 International Association of Plumbing and Mechanical Officials (IAPMO):
 - .1 Certificate of Listing
- .9 National Sanitary Foundation (NSF) International:
 - .1 NSF - PW (Potable Water)
 - .2 NSF - RFH (Radiant Floor Heating)
 - .3 NSF CL - TD and CL - R (as specified in NSF Protocol P - 171)
- .10 Plastics Pipe Institute (PPI)
 - .1 Technical Report TR - 3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
 - .2 Technical Report TR - 4 Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Piping and Fitting Compounds
- .11 Watts Radiant
 - .1 RadiantPEX, RadiantPEX+, and RadiantPEX-AL Installation Manual
 - .2 RadiantWorks Professional Software

1.4 SYSTEM DESCRIPTION

- .1 Design Requirements: Cross-linked Polyethylene Tubing (PEX): Standard Grade hydrostatic pressure ratings from Plastics Pipe Institute in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required:

Radiant Snow Melting System

- .1 200 degrees F (93 degrees C) at 80 psi (551 kPa).
- .2 180 degrees F (82 degrees C) at 100 psi (689 kPa).
- .3 73.4 degrees F (23 degrees C) at 160 psi (1102 kPa).
- .2 Performance requirements: Provide Hydronic system that is manufactured, fabricated and installed to comply with regulatory agencies and authorities with jurisdiction, and maintain performance criteria stated by the tubing manufacturer without defects, damage, or failure.
- .3 Cross-linked Polyethylene Tubing (PEX):
 - .1 Show compliance with ASTM F877
 - .2 Show compliance with DIN 4726 regarding oxygen diffusion concerns where applicable.
 - .3 Show compliance with NFPA 90A requirements of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 through certification listings with Intertek.
 - .4 Show compliance with ASTM E119, UL 263, NFPA 251, and CAN/ULC S101 through certification listings with Intertek:
 - .1 Intertek Design No. WR/WA 60-01: 1 hour wood or steel stud/gypsum wallboard wall assembly.
 - .2 Intertek Design No. WR/FCA 60-01: 1 hour wood frame floor/ceiling assembly
 - .3 Intertek Design No. WR/FCA 120-01: 2 hour concrete floor/ceiling assembly

1.5 SUBMITTALS FOR REVIEW

- .1 Section 23 01 01: Procedures for submittals.
- .2 Product Data: Submit manufacturer's product submittal data and installation instructions for each product.
- .3 Shop Drawings:
 - .1 Provide engineering analysis using manufacturer's proprietary software.
 - .2 Provide installation drawings indicating tubing layout, manifold locations, zoning requirements, and manifold schedules with details required for installation of the system.
 - .3 Provide mechanical schematic indicating heat source, mechanical piping and accessories from heat source to manifolds, circulators, water tempering, and zone controls. Indicate supply water temperatures and flow rates to manifolds.

1.6 SUBMITTALS FOR INFORMATION

- .1 Provide manufacturer's detailed instructions for site preparation and product installation.
- .2 Provide documentation indicating the installer is trained to install the manufacturer's products, as needed.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Section 23 01 01: Submittals for project closeout.
- .2 Project Record Documents: Final as-built tubing layout drawing
- .3 Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- .4 Manufacturer's field reports as specified in this document
- .5 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.

1.8 QUALITY ASSURANCE

- .1 Materials shall be from a single manufacturer to ensure consistent quality and compatibility.
- .2 Manufacturer Qualifications:
 - .1 Manufacturer shall have a minimum of ten years experience in similar systems.
 - .2 Manufacturer shall provide products of consistent quality in appearance and physical properties.
 - .3 Manufacturer shall use the highest quality products in the production of systems and components referenced in this document.
- .3 Installer Qualifications:
 - .1 Use and installer with demonstrated experience on projects of similar size and complexity

Radiant Snow Melting System

and/or documentation proving successful completion of familiarization training hosted/approved in writing by the system manufacturer.

- .2 Electrical rough-in and connections shall be done by a licensed electrician.
- .4 Certifications: Provide letters of certification as follows:
 - .1 Installer employs skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades person.
 - .2 test reports from recognized testing laboratories.

1.9 REGULATORY REQUIREMENTS

- .1 Products Requiring Electrical Connection: Listed and classified by CSA, ULC, cUL or Special Inspection as suitable for the purpose specified and indicated.
- .2 Radiant system shall comply with the following requirements:
 - .1 International Code Council (ICC):
 - .1 International Mechanical Code (IMC)
 - .2 International Building Code (IBC)
 - .3 ICC Evaluation Service (ES) Evaluation Report No. ESR 1155
 - .2 International Association of Plumbing and Mechanical Officials (IAPMO):
 - .1 Uniform Mechanical Code (UMC)

1.10 PRE-INSTALLATION MEETINGS

- .1 Verify project requirements, substrate conditions, excavation conditions, system performance requirements, coverings, manufacturer's installation instructions, and warranty requirements.
- .2 Review project construction timeline to ensure compliance or discuss modifications as required.
- .3 Coordinate with other trade representatives to verify areas of responsibility.
- .4 Establish the frequency (during construction phase of the project) the engineer intends for site visits and inspections by the manufacturer's representative.

1.11 DELIVERY, STORAGE, AND HANDLING

- .1 General: Comply with Division 1 Product Requirements Section.
- .2 Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- .3 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .4 Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer:
 - .1 Store tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
 - .2 Do not expose tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing that is exposed to direct sunlight.

1.12 ENVIRONMENTAL CONDITIONS

- .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 absolute limits.
- .2 Mortar-set Systems: Mortar shall cure for 25 days (or time specified by mortar manufacturer) prior to starting heating systems.

1.13 WARRANTY

- .1 Refer to Conditions of the Contract for project warranty provisions.
- .2 Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
 - .1 Warranty covers the repair or replacement of any tubing or fittings proven defective.
 - .2 Warranty may transfer to subsequent owners.

Radiant Snow Melting System

- .3 Warranty Period for Tubing is 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.
- .4 Warranty Period for Manifolds and Fittings is 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.
- .5 Warranty period for Controls and Electrical components is a 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.

1.14 SYSTEM START-UP

- .1 Do not start the system for a minimum of 25 days or as specified by mortar, concrete and/or covering manufacturer as applicable.
- .2 Verify all electrical components are installed per local and National Electrical Code (NEC) prior to start-up.

1.15 OWNER'S INSTRUCTION

- .1 Instruct Owner about operation and maintenance of installed system.
- .2 Provide Owner with manufacturer's installation instructions for installed components within the system.
- .3 Provide Owner with all operating instructions/documents for sensors and controls.
- .4 Provide Owner with copies of any detailed layout drawings and photos of installed product before coverings are installed.

2 PRODUCTS

2.1 MANUFACTURERS

- .1 Acceptable Manufacturers;
 - .1 Watts Radiant, Inc. (Subsidiary of Watts Water Technologies, Inc.)
 - .2 WIRSBO
 - .3 Rehau
 - .4 Heat Link

2.2 PRODUCT CHARACTERISTICS

- .1 Material:
 - .1 Cross-linked polyethylene (PEX)
 - .2 Manufactured by PEX-b or Silane method to ensure the highest level of oxidation protection.
- .2 Material Standard:
 - .1 Manufactured in accordance with ASTM F876 and ASTM F877
 - .2 Tested for compliance by an independent third-party agency.
- .3 Pressure Ratings:
 - .1 Standard Grade hydrostatic design
 - .2 Pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).
- .4 Temperature/Pressure Ratings: shall be capable of withstanding temperatures of:
 - .1 73.4°F (23°C) at 160 psi (1.10 MPa)
 - .2 180°F (82.2°C) at 100 psi (0.69 MPa)
 - .3 200°F (93.3°C) at 80 psi (0.55 MPa).
- .5 Minimum Bend Radius (Cold Bending):
 - .1 No less than six times the outside diameter.
 - .2 Use the tubing manufacturer's bend supports if radius is less than stated.
- .6 Barrier Tubing Type: Watts Radiant RadiantPEX+
 - .1 Oxygen Diffusion Barrier
 - .1 Tubing has an oxygen diffusion barrier that shall not exceed an oxygen diffusion rate of 0.10 g/cubic meter (.000062 lb/cu. ft.) per day at 104 degrees F (40 degrees C) water temperature in accordance with German DIN 4726.
 - .2 Tubing also adds a protective polypropylene layer to the outside of the EVOH barrier.

Radiant Snow Melting System

- .2 Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated:
 - .1 3/8" (9.53 mm)
 - .2 1/2 inch (12.7 mm)
 - .3 1/2" (15.88 mm)
 - .4 3/4 inch (19.05 mm)
 - .5 1 inch (25.4 mm)
- .7 Barrier Tubing Type: Watts Radiant RadiantPEX
 - .1 Oxygen Diffusion Barrier
 - .1 Tubing has an oxygen diffusion barrier shall not exceed an oxygen diffusion rate of 0.10 g/cubic meter (.000062 lb/cu. ft.) per day at 104 degrees F (40 degrees C) water temperature in accordance with German DIN 4726.
 - .2 Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated:
 - .1 1 1/4 inch (31.75 mm)
 - .2 1 1/2 inch (38.1 mm)
 - .3 2 inch (50.8 mm)
- .8 Non-Barrier Tubing Type: Watts WaterPEX
 - .1 Watts WaterPEX tubing does not feature an oxygen diffusion barrier.
 - .2 Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated:
 - .1 3/8" (9.53 mm)
 - .2 1/2 inch (12.7 mm)
 - .3 ? inch (15.88 mm)
 - .4 3/4 inch (19.05 mm)
 - .5 1 inch (25.4 mm)
 - .6 1 1/4 inch (31.75 mm)
 - .7 1 1/2 inch (38.1 mm)
 - .8 2 inch (50.8 mm)
 - .3 An oxygen diffusion barrier tubing is not required if one of the following design strategies is used:
 - .1 Isolate the ferrous materials in the boiler and other components within the primary side of the mechanical system with a heat exchanger. Use non-ferrous components within the secondary system side (e.g., pumps, expansion tanks, etc.).
 - .2 Use non-ferrous components within the entire fluid pathway.
- .9 Use Watts Radiant RadiantPEX or RadiantPEX+ tubing when oxygen diffusion barrier tubing is required. Use Watts WaterPEX when non-barrier tubing is required.
- .10 Fittings
 - .1 For system compatibility, use fittings offered by the tubing manufacturer.
 - .1 The fitting assembly shall comply with ASTM F877 and CAN/CSA B137.5 requirements.
 - .2 Fittings shall be designed to work with either ASTM F1807 CrimpRings or ASTM F2098 CinchClamps or a Compression ferrule, and are designed to be used with ASTM F876 (SDR-9) rated PEX tubing.
 - .3 Available connections:
 - .1 Sweat
 - .2 NPT
 - .3 BSP
 - .4 Material:
 - .1 UNS 31400 Copper Alloy
 - .2 UNS 36000 Copper Alloy
 - .3 UNS 37700 Copper Alloy

2.3 SUPPLY AND RETURN PIPING

- .1 Supply and Return Piping to the Manifolds (below ground piping):

Radiant Snow Melting System

- .1 Properly size supply and return distribution piping for the given volume and velocities required at system design.
- .2 Use suitable distribution piping material for all supply fluid temperatures and flows in systems with ferrous components.
 - .1 When using Watts Radiant RadiantPEX tubing, do not exceed 200 degrees F (93 degrees C) at 80 psi (551 kPa).
 - .2 When using Watts Radiant RadiantPEX+ tubing, do not exceed 200 degrees F (93 degrees C) at 80 psi (551 kPa).
- .3 Use suitable distribution piping material (i.e., Watts WaterPEX or HDPE) for systems free of or isolated from ferrous components.
 - .1 When using HDPE mains, do not exceed 140 degrees F (60 degrees C) at 80 psi (551 kPa).
 - .2 When using Watts WaterPEX mains, do not exceed 200 degrees F (93 degrees C) at 80 psi (551 kPa).
- .4 Use fittings compatible with piping material. Fittings shall transition from distribution piping to system manifolds.

2.4 HYDRONIC RADIANT SNOW MELTING CONTROLS

- .1 Use sensors/controls provided by manufacturer:
 - .1 HSC-5 Snow Melting Slab Detector
 - .1 Slab / Pavement mounted
 - .2 Senses actual pavement conditions
 - .3 Microprocessor control eliminates ice-bridging
 - .4 Provides a low-amperage output relay contact
 - .5 Heavy-duty machined brass housing
 - .6 Removable top cover
 - .7 Plug-in electronic assembly
 - .8 24 VAC
 - .2 Integrate into existing control infrastructure and sequencing for Snow Manifold #3.

3 EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions:
 - .1 Verify that site conditions are acceptable for installation of the system. Refer to manufacturer's installation manual for information.
 - .2 Do not proceed with installation of the system until unacceptable conditions are corrected.

3.2 INSTALLATION OF HYDRONIC SNOW MELTING SYSTEM

- .1 Slab-On-Grade Installation:
 - .1 Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's installation recommendations.
 - .2 Install tubing at a consistent depth below the surface elevation. Ensure sufficient clearance to avoid control joint saw cutting.
 - .3 Install an extruded polystyrene insulation board at the edge of, and optionally under, the slab, depending on site conditions.
 - .4 Where tubing crosses metal expansion joints in the concrete, ensure that the tubing passes below the joints or is sleeved through the joints in accordance with manufacturer's instructions.
- .2 Brick Pavers over Concrete Slab Installation:
 - .1 Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's installation recommendations.
 - .2 Install tubing at a consistent depth below the surface elevation.

Radiant Snow Melting System

- .3 Install the brick pavers on top of the concrete according to proper masonry practice and guidelines for this application.

3.3 FIELD QUALITY CONTROL AND TESTING

- .1 Site tests:
 - .1 To ensure system integrity, pressure test the system before covering tubing in concrete or when other trades are working in the vicinity of the tubing.
 - .2 Test all electrical controls in accordance with respective installation manuals.
 - .3 System shall be checked after 3 years of operation and every year thereafter. System shall be checked for pH levels to ensure that it is operating within suggested guidelines.

3.4 SYSTEM ADJUSTING

- .1 Balancing Across Manifold: Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total manifold flow.
- .2 Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold when direct return piping is used for the supply and return mains or the circuits deviate by more than 10%.

3.5 CLEANING

- .1 Remove temporary coverings and protection of adjacent work areas.
- .2 Repair or replace damaged installed products.
- .3 Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- .4 Remove construction debris from project site and legally dispose of debris.

3.6 DEMONSTRATION

- .1 Demonstrate operation of system to Owner or Owner's personnel.
- .2 Instruct the Owner or Owner's personnel about the type, concentration and maintenance of the glycol and water solution.
- .3 Provide Owner or Owner's personnel with manufacturer's installation, operation, and maintenance instructions for installed components within the system.

3.7 PROTECTION

- .1 Protect installed work from damage caused by subsequent construction activity on the site. Provide Owner with copy of photos and drawings of product locations to assist.

END OF SECTION

General Requirements

PART 1 - GENERAL

1.1 General Requirements

- .1 Read and conform to:
 - .1 The Contract CCDC2-2020, Stipulated Price Contract as amended,
 - .2 Division 1 requirements and documents referred to therein.
- .2 Section 25 01 01 applies to and governs the work of all Sections of Division 25.
- .3 The technical Sections of this Division are generally divided into units of work for the purpose of ready reference. The division of the work among subcontractors is not the Consultant's responsibility and the Consultant assumes no responsibility to act as an arbiter and/or to establish subcontract limits between any Sections of the work.
- .4 The specifications are integral with the drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one but implied in the other is fully and properly required.
- .5 Wherever differences occur in the tender documents, the most onerous condition governs. Base the bid on the most costly arrangement.

1.2 Definitions

- .1 The following are definitions of words found in this specification and on associated drawings under this Division:
 - .1 "Concealed" - locations hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.
 - .2 "Exposed" - mechanical work normally visible to building occupants.
 - .3 "Furnish" - (and its derivatives) has the same meaning as the term "Supply".
 - .4 "Install" - (and its derivatives) - receive, store and handle at the site, mount and support and connect all required services. Includes adjustment and calibration, testing, commissioning, inspection by authorities having jurisdiction & documentation.
 - .5 "Provide" - (and its derivatives) - supply, install in place, connect the associated required services ready for operation, adjust and calibrate, test, commission, warrant, and document. Includes inspection by authorities having jurisdiction.
 - .6 "Supply" - (and its derivatives) purchase and deliver to the site for installation. Includes submittals, manufacturer's field inspection and warranty.
 - .7 "Wet" - locations exposed to moisture, requiring special materials and arrangement.

1.3 Work Included

- .1 Products and methods mentioned or shown in the Contract Documents complete with incidentals necessary for a complete operating installation. Provide all tools, equipment and services required to do the work.
- .2 Cutting and patching of new or existing work
- .3 Identification of equipment, valves, dampers and controllers
- .4 Motors required for equipment supplied under this Division.
- .5 Take such measures and include in Bid Price for the proper protection of the existing

General Requirements

- building and its finishes at all times during alterations and construction of the new addition. Coordinate this protective work with all trades.
- .6 Refer to Mechanical/Electrical Equipment Schedule for extent of wiring and electrical characteristics.
- .7 Verify the correct operation of each equipment item provided and/or altered and each system in total and obtain the Owner's approval prior to starting and/or returning to operation.

1.4 Submittals

- .1 Approval Drawings: Prepare and submit drawings necessary for approval to any authority having jurisdiction, and obtain two (2) copies of approved drawings for retention by Consultant prior to commencement of work under this Division.
- .2 Shop Drawings: Prepare and submit two (2) copies of shop drawings of major equipment items (including those items specifically indicated under Part 1: General of each Section), to the Consultant for review. The Consultant will return one copy, marked with comments and his review stamp as he deems appropriate. Prepare the necessary number of copies of the returned set and distribute to the Owner, the Prime Consultant, the General Contractor, the site, and to subcontractors and suppliers.
 - .1 Clearly indicate manufacturer's and supplier's names, catalogue model numbers, details of construction, accurate dimensions, capacities and performance. Prior to submission check and certify as correct, shop drawings and data sheets. Do not order equipment until a copy of the shop drawings, reviewed by Consultant, has been returned to Contractor.
 - .2 Clearly indicate the weight, location, method of support and anchor point forces and locations for each piece of equipment on shop drawings.
 - .3 The Consultant will not review shop drawings that fail to bear the Contractor's stamp of approval or certification.
 - .4 Read the following in conjunction with the wording on the shop drawing review stamp applied to each and every drawing submitted:

"This review by the Consultant is for the sole purpose of ascertaining conformance with general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub trades."
- .3 Composite Wiring Diagrams: Prepare and submit three (3) copies of complete composite wiring diagrams of each specific control system. Indicate all electrical equipment and wiring, both internal and external, for review and coordination of trades.
- .4 Contractor's Material and Test Certificates: Prepare and submit certificates for each system installed. Where certificates are prescribed by regulations, codes or standards ensure they conform to the requirements of those documents (eg. NFPA-standards). Include a copy of each certificate in the Operation and Maintenance manual. Certificates shall include the following:
 - .1 description of the system (description and type),
 - .2 description of the tests conducted and results observed, including re-testing, where necessary,
 - .3 description of any corrective measures undertaken,
 - .4 description of materials used (pipe and fittings),
 - .5 list of witnesses for each test conducted,

General Requirements

- .6 date system left ready for service,
- .7 signature of installing Contractor.
- .5 Directories & Schematics
 - .1 Submit five (5) copies of a neat typewritten directory indicating the valve number, related service, and location of each valve under this Division.
 - .2 Submit five (5) copies of system control schematics for each mechanical system indicating relative locations of equipment and control devices.
 - .3 Enclose one (1) copy of each directory/schematic under glass in a neat polished 18" x24" (460 mm x 610 mm) metal frame, complete with mounting clips.
- .6 Maintenance Data and Operating Instructions
 - .1 Submit three (3) copies of Operation and Maintenance Manual individually bound in hard backed three-ring binders.
 - .2 Ensure the binder spines have typewritten lettering as follows:
OPERATION & MAINTENANCE MANUAL
for
[Insert name of project]
[Insert date of submission]
[Insert Division Title]
 - .3 Provide a list of names, addresses and telephone numbers of equipment suppliers, installing contractors, general contractors, architect and Consultant. Include special telephone numbers for service departments on normal and emergency call basis.
 - .4 Provide descriptive literature (shop drawings) of each manufactured item. Include a bill of material with purchase order numbers and vendor's identification of equipment orders for each item.
 - .5 Include copies of start-up reports and checklists and all certificates issued with respect to this contract.
 - .6 Ensure operating instructions include the following:
 - .1 General description of each mechanical system.
 - .2 Step by step procedure to follow in putting each piece of equipment into service.
 - .3 Schematic control diagrams for each separate mechanical system, control thermometers, freezestats, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control device on these diagrams.
 - .4 Diagram of the electrical control system indicating the wiring of all related electrical components such as PE and EP switches, firestats, freezestats, fuses, interlocks, electrical switches and relays.
 - .5 Drawings of each control panel including temperature control and electrical panels, completely identifying all components on the panels and their function.
- .7 Ensure maintenance instructions include the following:
 - .1 Manufacturer's maintenance instructions for each item of mechanical equipment installed under this Division. Instructions shall include installation instructions, parts numbers and lists, name of supplier and maintenance and lubrication instructions.
 - .2 Summary list of each item of mechanical equipment requiring lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication.
 - .3 Equipment directory indicating name, model, serial number and nameplate data of each item of equipment supplied, and system with which it is associated.
 - .4 Balancing and testing reports.
 - .5 Copy of valve directory.
- .8 As-Built Records: Prepare and submit complete as-built records prior to Substantial

General Requirements

- .9 Performance of the Contract. Refer to paragraph 3.2.5 and to Division 1 for requirements.
Requests for Shut-Down: Obtain permission for systems shut-down and/or service interruption from the Owner prior to disruption of any system or service in use by the Owner. Employ the Owner's standard form of request where available. Refer to Division 1 for additional requirements.
- .10 Requests for Start-up: Obtain permission from the Owner to start-up or to return to service any item of equipment, system or service installed new or previously shut-down. Refer to Division 1 for additional requirements.

1.5 Quality Assurance

- .1 Conform to minimum requirements or better of provincial and local codes, where existing, and to requirements of local inspection authorities for execution of work under this Division.
- .2 Ensure materials supplied under this Division conform to minimum requirements and recommendations or better of applicable standards of the following:
- | | | |
|-----|--------|--|
| .1 | ANSI | American National Standards Institute |
| .2 | ASA | American Standards Association |
| .3 | ASHRAE | American Society of Heating, Refrigerating, and Air Conditioning Engineers |
| .4 | ASME | American Society of Mechanical Engineers |
| .5 | ASTM | American Society of Testing and Materials |
| .6 | CAN2 | National Standard of Canada (Published by CGSB) |
| .7 | CAN3 | National Standard of Canada (Published by CSA) |
| .8 | CGSB | Canadian General Standards Board |
| .9 | CSA | Canadian Standards Association |
| .10 | EEMAC | Electrical & Electronic Manufacturer's Association of Canada |
| .11 | NBC | National Building Code of Canada |
| .12 | NEBB | National Environmental Balancing Bureau |
| .13 | NFPA | National Fire Protection Association |
| .14 | NEMA | National Electrical Manufacturers Association |
| .15 | OBC | Ontario Building Code |
| .16 | OFC | Ontario Fire Code |
| .17 | OFM | Ontario Fire Marshall |
| .18 | ULC | Underwriter's Laboratories of Canada Ltd |
| .19 | UL | Underwriter's Laboratories (including cUL) |
- .3 Use latest editions and amendments in effect on date of Bid call subject to requirements of OBC.
- .4 Arrange and pay for permits and inspections by authorities having jurisdiction, required in the undertaking of this Division. Make modifications required by authorities.
- .5 All tradesmen employed on the project shall hold valid trade certificates/licenses and shall make a copy available for review by the Consultant and/or Owner when requested.

1.6 Product Delivery, Handling and Storage

- .1 Immediately after letting of contract, review material and equipment requirements for this work, determine supply and delivery dates for all items, and notify Consultant of any potential delays in completion of this project in order that remedial action may be taken.
- .2 Store neatly out of the way and protected from damage and theft, materials and equipment supplied under this Division that are received at the site by this Division.

1.7 Job Conditions

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily

General Requirements

- completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.8 Interruptions

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

1.9 Warranty

- .1 Refer to Division 1 and to Section 25 01 01 General Requirements.
- .2 Arrange with each manufacturer/supplier to extend warranties as necessary to coincide with warranty period or those periods specified.
- .3 Make submissions necessary to register product warranties to the benefit of the Owner.
- .4 Submit to Consultant, prior to Substantial Performance of the Contract, manufacturer's written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Owner's name.

1.10 Extras and Credits

- .1 Accompany all price submissions requested by Consultant for extra work, or work to be deleted, with a complete cost breakdown as follows:
 - .1 Materials, quantities and unit costs including any applicable contractors trade discount clearly identified.
 - .2 Labour hours and unit costs.
 - .3 Total materials and labour costs.
 - .4 Overhead and profit mark-ups in accordance with the General Conditions of the Contract.

PART 2 - PRODUCTS

2.1 Materials and Equipment

- .1 Ensure materials and equipment provided under this Division are new and free from defects and bear labels of approval as required by codes referred to in this Division and/or by inspection authorities.
- .2 Ensure apparatus and equipment provided under this Division bears manufacturer's nameplate indicating name of manufacturer, model number or type, size, capacity, CRN, and other pertinent information. Ensure nameplates are easily read and clearly visible, with openings provided where equipment is insulated.

General Requirements

- .3 Ensure manufacturers and suppliers of equipment or materials under this Division determine if their products are composed of any hazardous materials. If they are, the products are suitably labeled and supplied with Material Safety Data sheets. Obtain the Owner's approval in writing to bring hazardous materials onto the site prior to doing so.
- .4 When utilizing any products that are hazardous, keep Material Safety Data sheets on file at the job site and present them to anyone requesting this information. When transferring hazardous materials from original container into other containers, provide Workplace Labels on such containers.

2.2 Acceptable Products

- .1 First item named or specified by catalogue number meets specifications regarding performance, quality of material and workmanship, and is acceptable to the Consultant.
- .2 Items, other than first named, meeting specifications regarding quality of materials and workmanship are acceptable to the Consultant, only, if they also meet performance and/or capacities specified and can be accommodated within the space allotted.
- .3 General approval indicated by inclusion of other manufacturers named is subject to final review of shop drawings, performance data and test reports.

2.3 Equivalentents and Alternatives

- .1 Suppliers wishing approval for additional equipment items as equivalent to those specified must submit complete description, technical and performance data to Consultant at least ten (10) working days prior to Bid closing date. Such equivalent equipment, if accepted, to conform to specifications with regard to all details, accessories, modifications, features and performance. Deviations from specifications must be stated in writing at time of submission for approval.
- .2 Bid Prices shall include only products specified or approved equivalentents. Contractors may propose unsolicited alternatives to the products specified. Alternative proposals shall be submitted in sealed envelope at time of general contract Bid submission and shall include full description and technical data, and a statement of the related increase or decrease in Bid Price should alternatives be accepted. All additional costs associated with unsolicited alternative proposals such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in alternative price. Prior approval by Consultant is not required for unsolicited alternative proposals.
- .3 Where the Contractor uses equipment other than that first named, on which the design is based, he shall be responsible for all details of installation including equipment size, arrangement, fit, and maintenance of all required clearances. Contractor shall prepare and submit revised layouts to indicate arrangement of all affected piping, ductwork, conduit, lighting, equipment, etc. Failure by Contractor to provide such drawings will be considered indication that original arrangements and space allocations are adequate. All additional costs associated with equivalent equipment such as larger motor starters, larger power feeders, space revisions to associated equipment, controls, etc. shall be included in Bid Price.

2.4 Substitutions During Progress of Work

- .1 If during the progress of work, specified products are not obtainable, equivalent or similar products by other manufacturers may be permitted by Consultant.
- .2 Apply, in writing, to Consultant for substitution of any products, indicating the following:
 - .1 Manufacturer's name, model number, details of construction, accurate dimensions, capacities and performance of proposed products.
 - .2 Reason for substitution.
 - .3 Any revisions to the contract price made necessary by substitution.
 - .4 Any revisions to the contract time made necessary by substitution.

General Requirements

- .5 Any revisions to layout, arrangement or services made necessary by substitution.
- .3 No substitutions will be permitted without written authorization from the Consultant.

2.5 Consultant's Review

- .1 The consultants will review and evaluate unsolicited alternatives and substitutions proposed by the Contractor. Such review and evaluation work will be undertaken by the Consultant on an additional fee basis. The Contractor shall reimburse the Owner for all costs associated with such reviews and evaluations.
- .2 The Contractor shall also reimburse the Owner for any and all costs incurred in updating Contract Documents to reflect such changes.

PART 3 - EXECUTION

3.1 Relationship with Other Trades

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Provide materials to be built-in, such as sleeves, anchors, and inserts, together with templates and/or measurements, promptly when required by other trades.
- .3 Provide structural supports for equipment to be mounted on or in walls, supported above floors and/or suspended from the structure.

3.2 Installation Requirements

- .1 The Consultant's drawings and instructions govern the location of all items. Prepare fully coordinated installation drawings prior to installation.
- .2 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise install products and services to follow building planes. Ensure installation permits free use of space and maximum headroom.
- .3 Confirm the exact location of outlets, fixtures and connections. Confirm location of outlets for equipment supplied under other Divisions.
- .4 Install equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
- .5 Install metering and/or sensing devices to provide proper and reliable sampling of quantities being measured. Install instruments to permit easy observation.
- .6 Provide suitable shielding and physical protection for devices.
- .7 Install products and services in accordance with the manufacturer's requirements and/or recommendations.
- .8 Provide bases, supports, hangers and fasteners. Secure products and services so as not to impose undue stresses on the structure and systems.
- .9 Do not use powder activated tools except as permitted by the Prime Consultant and the Owner's workplace health and safety policies.
- .10 Ensure that the load onto structures does not exceed the maximum loading per square metre indicated on the structural drawings or as directed by the Consultant.

3.3 Contract Drawings

- .1 The drawings of this Division are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- .2 Obtain accurate dimensions from the architectural and structural drawings, or by measurement. Location and elevation of services are approximate. Verify them before construction is undertaken.
- .3 Make changes where required to accommodate structural conditions, (beams, columns,

General Requirements

- etc.). Obtain Consultant's approval before proceeding.
- .4 Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Note that outlets and/or equipment may be relocated up to 10 feet (3 m) in any direction without a change to the contract price.
 - .5 Note that the layout and orientation of the ceiling outlets on the architectural reflected ceiling drawings may differ from that shown on the mechanical drawings. Make the installation in accordance with the latest architectural ceiling drawings. Provide the equipment as specified and/or shown on the documents of this Division.
 - .6 The drawings of this Division are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as shown on the mechanical documents. If there is a difference in quantity between the architectural and drawings of this Division, base the contract price on the greater quantity.
 - .7 Prepare installation (construction) drawing to reflect the latest architectural ceiling layout.

3.4 Record Drawings

- .1 Maintain project "as-built" record drawings. Obtain white prints from the Consultant for this purpose and pay printing costs. Identify each set as "Project Record Copy".
- .2 Record deviations from contract documents caused by site conditions or by changes ordered by the Consultant. Record deviations in red ink clearly and accurately, using industry standard drafting procedures consistent with quality and standards of Consultants documents.
- .3 Record deviations as work progresses throughout the execution of this contract. Maintain record drawings on site in clean, dry, legible condition, making them available for periodic review by the Consultant.
- .4 Record location of concealed services, particularly underground services. Before commencing any backfilling, obtain accurate measurements and information concerning correct location and depth of services.
- .5 Transfer records from the "Project Record Copy" to a DVD in Autocad format matching the Consultant's documents. Arrange computer file in layers to exactly match the layering system of the Consultant.
- .6 Submit the "Project Record Copy" on one or more DVD with white prints of each drawing to the Consultant at the time of Substantial Performance.

3.5 Instruction

- .1 Instruct and familiarize Owner's operating personnel with the various mechanical systems. Arrange instruction for each system separately.
- .2 Provide instruction for each system on two separate occasions, coordinated with the Owner's staff operating schedule, in order that interested personnel may arrange to attend.
- .3 Ensure each instruction period includes, but is not limited to the following;
 - .1 a classroom seminar with operating manuals, product and system drawings and such other audio/visual aids as may be appropriate,
 - .2 instruction during the classroom seminar by the manufacturer's representative regarding the proper operating and maintenance procedures for each item of equipment,
 - .3 demonstration of the proper operating procedures for each item of equipment,
 - .4 explanation of the purpose and function of all safety devices provided,
 - .5 demonstration of all measures required for safe and proper access for operation and maintenance.
- .4 Provide a period of follow-up instruction (on two occasions) approximately one month after completing Owner's instruction to clarify and reinforce earlier instructions.

General Requirements

- .5 Submit a letter from the Owner's management staff indicating the instruction has been given satisfactorily to the Consultant prior to substantial completion of the project.

3.6 Commissioning

- .1 Refer to Section 01 80 50 Commissioning.
- .2 The Contractor shall start-up and completely commission all equipment and systems installed and/or modified under this contract. Commissioning work shall be completed to the satisfaction of the Consultant prior to acceptance of the Work or any part thereof.
- .3 The Commissioning Team shall be comprised of;
 - .1 Representatives of the Commissioning Coordinator (Commissioning Agent)
 - .2 The individual, company or agency undertaking the work of each Section,
 - .3 Representatives of the Contractor and his sub-contractors as required,
 - .4 Representatives of equipment manufacturers,
 - .5 Representatives of the Consultants,
 - .6 Representatives of the Owner.
- .4 The Contractor and his sub-contractors shall each assign an individual representing each of the relevant trades to the commissioning team and shall ensure that representatives of the equipment manufacturers are present during the relevant commissioning tasks.
- .5 The Contractor shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, test and commission each system provided as part of the Work.
- .6 Each Section shall prepare Check Sheets in accordance with the standards listed above and shall issue them to the commissioning team for use during the commissioning process.
- .7 Three (3) copies of commissioning manuals shall be provided, bound in hard cover D-ring binders with transparent cover on front and spine personalized to indicate;
 - .1 name and logo,
 - .2 name of the project,
 - .3 the Owner's project number,
 - .4 identification of the system commissioned,
 - .5 the date that the system was commissioned.
- .8 Commissioning manuals shall include machine printable index dividers to organize each manual by system and by commissioning stage.

END OF SECTION

Demolition & Renovations

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 25 01 01.

1.2 WORK INCLUDED

- .1 Identification of existing services and utility connections.
- .2 Installation, protection and maintenance of temporary services as required to support continuing operation of the facility.
- .3 Disconnection and removal of various mechanical equipment in areas to be turned over to the Owner.
- .4 Disconnection and making safe of various mechanical systems and equipment in areas to be demolished and/or renovated.
- .5 Disposal of waste materials in accordance with waste management requirements.
- .6 Re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction including requirements for marking of equipment.

1.3 REGULATORY REQUIREMENTS

- .1 Notify all authorities of intent to demolish and schedule for the work. Obtain required permits from authorities.
- .2 Conform to all codes for demolition work, dust control, products requiring disconnection and re-connection.
- .3 Do not close or obstruct egress width to any building or site exit.
- .4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.
- .5 Conform to procedures applicable when hazardous or contaminated materials are discovered.
- .6 Arrange for re-certification and inspection of changes made to any equipment, machine or apparatus by authorities having jurisdiction. This includes requirements for marking of equipment under rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

1.4 JOB CONDITIONS

- .1 Visit site and examine existing conditions which may affect work of this Division.
- .2 Examine all Contract Documents to ensure that work of this Division may be satisfactorily completed.
- .3 Notify Consultant upon discovery of conditions which adversely affect work of this Division. No allowance will be made after letting of contract for any expenses incurred through failure to do so.
- .4 Submission of a bid confirms that the Contract Documents and site conditions are accepted without qualifications, unless exceptions are specifically noted in the Bid.

1.5 INTERRUPTIONS

- .1 Arrange execution of work to maintain present building operations, and to minimize the effect of work under this Division on existing operations.
- .2 Prior to interrupting any existing service notify the Owner and Consultant, in writing, at least 7 days in advance, and obtain written authorization. Do not interrupt any existing service without Consultant's specific authorization. Refer to Division 1 for requirements.
- .3 Arrange time and duration of interruption through the Owner's Physical Plant Department. Include in Bid Price for all overtime or premium time hours necessary to minimize duration of service interruption.
- .4 Test and verify the proper operation of existing equipment and systems that are shut down due to work of this project, prior to returning to service.
- .5 Assume responsibility for consequential costs on failure to obtain permission to shut-down and/or start-up any item of equipment, system or service.

Demolition & Renovations

2 PRODUCTS

3 EXECUTION

3.1 PREPARATION

- .1 Prior to start of work under this Section, ensure that the General Trades;
 - .1 Provide, erect, and maintain temporary barriers at locations indicated.
 - .2 Erect and maintain weatherproof closures for exterior openings.
 - .3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
 - .4 Prevent movement of structure; provide bracing and shoring.
- .2 Install, protect and maintain temporary services as required to support continuing operation of the facility.
- .3 Protect services and equipment which are not to be demolished.
- .4 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
- .5 Notify affected utility companies before starting work and comply with their requirements.
- .6 Mark location and termination of utilities.
- .7 Provide appropriate temporary signage including signage for exit or building egress.

3.2 RELATIONSHIP WITH OTHER TRADES

- .1 Cooperate with other trades whose work affects or is affected by work of this Division to ensure satisfactory installation and to avoid delays.
- .2 Remove and dispose of built-in items such as sleeves, anchors, and inserts.
- .3 Remove and dispose of bases, supports and anchors for piping, equipment and ductwork mounted on or in walls, supported above floors and/or suspended from the structure.

3.3 PROTECTION

- .1 Protect existing and new work to remain free from damage due to execution of work under this Division with tarpaulins and other protective coverings as necessary.
- .2 Repair any and all damage to the building and components resulting from failure to provide sufficient protection, to the satisfaction of the Consultant.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.4 DEMOLITION

- .1 Notify all authorities of intent to demolish and schedule for the work.
- .2 All demolition work shall conform to all codes, regulations, standards and by-laws applicable to the work.
- .3 Isolate and drain systems as required to effect demolition. Disconnect, cap and make safe all mechanical services to the building including, but not limited to; sanitary sewer(s), storm sewer(s), water service, natural gas service, steam service, condensate return, water supply to standpipe and sprinkler systems, fire suppression systems hot water heating systems, steam and condensate systems.
- .4 Protect existing equipment and services to remain from debris and unwanted materials. Clean as

Demolition & Renovations

- necessary to maintain service during demolition period and on completion of the work.
- .5 Coordinate all service shut downs with Owner's project coordinator. Provide notice as required by Owner and submit schedule for the work.
 - .6 Remove and dispose of all redundant mechanical services and equipment within the limits of the demolition site and where demolished systems extend beyond these limits.
 - .7 Turn over items identified for recovery by the Owner.
 - .8 All demolition work shall conform to Occupational Health & Safety and Environmental regulations. Ensure that all parties are familiar with requirements and experienced in the work to be undertaken.
 - .9 Waste disposal shall conform to the requirements of Division 1, municipal By-Laws and Ministry of the Environment regulations and standards.
 - .10 All existing air intake and exhaust openings that may be affected by dust and/or debris from the demolition work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from demolition work with new filters.
 - .11 In the event that dust and debris from demolition work does penetrate the building and/or its air distribution systems, this Section shall be responsible for cleaning the affected areas and/or systems.
 - .12 Disconnect remove, cap and identify all utilities within demolition areas.
 - .13 Demolish in an orderly and careful manner. Protect existing supporting structural members.
 - .14 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
 - .15 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
 - .16 Remove temporary Work.

3.5 RENOVATIONS

- .1 Isolate and drain systems as required to effect renovations, modifications and/or repairs. On completion of renovations, modifications and/or repairs, test entire system as if new. Report repairs or replacements required of existing equipment, piping, fittings or devices that are not included in contract to Consultant and Owner for instruction. Flush, clean and refill renovated systems as specified for new.
- .2 Relocate or remove existing items so designated unless specifically indicated to be relocated or removed under other Sections.
- .3 Existing items to be relocated shall be cleaned and repaired or altered as required to suit new location. All damaged or ineffective parts shall be replaced and the item made "as new".
- .4 Existing items to be removed remain the property of the owner and shall be delivered to a location on site designated by the owner. If the owner declares no interest in the removed items, assume ownership and remove the items from the site.
- .5 Make good all surfaces and finishes in areas from which items have been removed and in which items are relocated. Cap all existing services required to be severed to effect alterations and do all other work necessary to make good such areas to satisfaction of consultant.
- .6 Openings in existing floor assemblies and vertical fire separations necessitated by installation of equipment and systems or construction in general must be temporarily sealed with fire barrier materials such as mineral wool or other noncombustible insulation.
- .7 If during alteration work existing asbestos material, other than known asbestos, is discovered (e.g. fireproofing, acoustic or thermal insulation, tank covering), stop work in the affected area and immediately notify consultant.
- .8 Existing refrigerant indicated to be removed shall not be discharged to the atmosphere, but shall be salvaged and reclaimed or disposed of following the guidelines of the authority having jurisdiction.
- .9 All existing air intake and exhaust openings that may be affected by dust and/or debris from the renovation work shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from renovation work with new filters.
- .10 In the event that dust and debris from renovation work does penetrate the building and/or its air

Demolition & Renovations

distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.

- .11 Temporary filters shall be removed on completion of the renovation work.

3.6 INSPECTION AND RE-CERTIFICATION

- .1 Where any equipment, machine or apparatus is modified, rebuilt or rewound with any change resulting in its performance or capacity rating and characteristics it shall be inspected and re-certified as required by authorities having jurisdiction.
- .2 A nameplate giving the name of the person or firm making the change and the resulting changes in performance or capacity shall be provided and affixed to the equipment, machine or apparatus adjacent to the original nameplate. Where the original nameplate is removed, the original manufacturer's name and original identifying data, such as serial numbers, shall be added to the nameplate.
- .3 Refer to rules 2-100 and 2-102 of the Ontario Electrical Safety Code.

END OF SECTION

Common Work Results

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with General Requirements of Section 25 01 01.

1.2 COMMON WORK RESULTS

- .1 Section 25 05 00 applies to and governs all work of Division 25.

1.3 REFERENCE STANDARDS

- .1 Provide all work in accordance with requirements of Regulatory Agencies and conform to:
 - .1 Local and district by-laws, regulations and published engineering standards.
 - .2 the Ontario Building Code (OBC) as amended,
 - .3 the Ontario Fire Code (OFC) as amended,
 - .4 the Ontario Electrical Safety Code (OESC).
 - .5 Regulations for Construction Projects under The Occupational Health and Safety Act.
- .2 Conform to following National Research Council Canada publications:
 - .1 National Building Code of Canada (NBC) and Supplements to National Building Code of Canada
 - .2 National Fire Code of Canada (NFC).
- .3 Conform to following National Fire Protection Association publications:
 - .1 NFPA 70 National Electrical Code (NEC)

1.4 FIELD QUALITY CONTROL

- .1 All work, materials, and equipment shall comply with the rules and regulations of applicable local, provincial and federal codes and standards.
- .2 Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

1.5 QUALIFICATIONS

- .1 Motor manufacturer: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- .2 Firestop Sealant Manufacturer: Company specializing in manufacture of sealants with minimum three years documented product development, testing, and manufacturing experience.
- .3 Firestop components and assemblies shall be ULC listed and tested in accordance with ULC S115 Standard Method of Fire Test for Firestop Systems.

1.6 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 25 01 01, for the following items:
 - .1 firestopping compounds and applications schedule
 - .2 access doors

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products. refer to Division 1 requirements as well.
- .2 Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

Common Work Results

1.8 WASTE MANAGEMENT & DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 1 Waste Management and Disposal, and with the Contractor's Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.9 WARRANTY

- .1 Provide extended coverage five year warranty for controls and instrumentation components.

2 PRODUCTS

2.1 ELECTRICAL COMPONENTS AND WIRING

- .1 Conform to requirements of Division 26 for all wiring, conduits and raceways, boxes, and cable trays included in Division 25.
- .2 All pre-wired equipment provided by Sections under Division 25 shall conform to requirements of Division 26. Ensure that all pre-wired electrical equipment is CSA approved. Arrange and pay for special approval where this is not possible.
- .3 Communication and control wiring and power supplies specified as conforming to NEC Class 1, Class 2 and Class 3 wiring practices must also conform to OESC Section 16 requirements.

2.2 COMMUNICATION AND CONTROL WIRING

- .1 General:
 - .1 Provide copper wiring, plenum cable, and raceways as specified in the applicable Sections of Division 26 unless otherwise noted herein.
 - .2 All insulated wire to be copper conductors, ULC labeled for 90°C minimum service.
- .2 Wire Sizing and Insulation
 - .1 Wiring shall comply with minimum wire size and insulation based on services listed below:

Service	Minimum Gage/Type	Insulation Class
AC 24V Power	12 Ga Solid	600 Volt
DC 24V Power	10 Ga Solid	600 Volt
Class 1	14 Ga Stranded	600 Volt
Class 2	18 Ga Stranded	300 Volt
Class 3	18 Ga Stranded	300 Volt

- .2 Provide plenum-rated cable when open cable is permitted in supply or return air plenum.
- .3 Power Wiring:
 - .1 115V power circuit wiring above 100 feet distance shall use minimum 10 gage.
 - .2 24V control power wiring above 200 feet distance shall use minimum 12 gage.
- .4 Control Wiring:
 - .1 Digital Input/Output wiring shall use Class 2 twisted pair, insulated.
 - .2 Analog inputs shall use Class 2 twisted shielded pair, insulated and jacketed and require a grounded shield.
 - .3 Actuators with tri-state control shall use Class 3 conductor with same characteristics
- .5 Communication Wiring
 - .1 Ethernet Cable shall be minimum CAT5e and as required for system components.
 - .2 Secondary level network shall be 24 gage, TSP, low capacitance cable
- .6 Approved Cable Manufacturers: Wiring from the following manufacturers which meet the above criteria

Common Work Results

shall be acceptable:

- .1 Anixter
- .2 Belden
- .3 Cerco

2.3 POWER SUPPLIES AND LINE FILTERING

- .1 Control transformers shall be ULC listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
- .2 DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - .1 Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - .2 Line voltage units shall be ULC recognized and CSA approved.
- .3 Power line filtering: Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
 - .1 Dielectric strength of 1000 volts minimum
 - .2 Response time of 10 nanoseconds or less
 - .3 Transverse mode noise attenuation of 65 dB or greater
 - .4 Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.4 FIRESTOPPING COMPOUNDS

- .1 Manufacturer: 3M products indicated.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Dow Corning
 - .2 John Manville
 - .3 Hilti Firestop Systems
- .3 Fire Rated Sealants: intumescent material, synthetic elasomers, capable of expanding up to 8 to 10 times when exposed to temperatures of 250°F (121°C) or higher. ULC listed and labelled.

2.5 NAMEPLATES

- .1 Provide laminated plastic plates with black face and white centre of minimum size 3-1/2" x 1-1/2" x 3/32" (90 x 40 x 2 mm) nominal thickness, engraved with 1/4" (6 mm) high lettering. Use 1" (25 mm) lettering for major equipment.
- .2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- .3 Identify equipment type and number and service of areas or zone of building served.
- .4 For each item of equipment supplied and/or installed under this Division which may be started automatically or remotely, provide a red lamacoid plate, 2-1/2" x 9" (60 x 230 mm), reading:
"WARNING. THIS EQUIPMENT IS AUTOMATICALLY
CONTROLLED AND MAY START AT ANY TIME."

2.6 TAGS

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 1-1/2" (40 mm) diameter. OR
- .2 Metal Tags: Brass, aluminum or stainless steel with stamped letters; tag size minimum 1-1/2" (40 mm) diameter with smooth edges.
- .3 Charts: Typewritten letter size list in anodized aluminum frame.

Common Work Results

3 EXECUTION

3.1 INSPECTION

- .1 Inspect installed work of other trades and verify that such work is complete to point where work under this Division may properly commence.
- .2 Verify that work of this Division may be executed in accordance with pertinent codes and regulations, specifications, drawings, and referenced standards.
- .3 Review drawings and verify dimensions at the site. Report discrepancies immediately to Consultant before proceeding with any construction work or shop drawings.

3.2 PREPARATION

- .1 Existing services and equipment shall be relocated or removed to suit new construction and renovation work.
- .2 Services that are no longer required shall be removed or cut back and capped to the satisfaction of Consultant.
- .3 Obtain written authorization from Consultant for renovation work that is not specifically indicated.
- .4 Where modifications or connections to existing systems require shutdown of the system the Contractor shall submit a request for system shutdown describing the system or part to be shutdown, the duration of the shutdown, the work planned and steps to be taken to reinstate the system to full operation. The request shall be submitted in the format stipulated by the Owner.
- .5 All work required to prepare systems for shutdown and/or re-instatement, such as draining, chemical treatments, and re-filling shall be included in this Bid Price.

3.3 ELECTRICAL COMPONENTS AND WIRING

- .1 Coordinate all wiring requirements with other Divisions. Line voltage wiring from power distribution panels to starters and from starters to motors will be provided under Division 26. All other field wiring for equipment shall be included under Division 25.

3.4 PROTECTION

- .1 Protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division.
- .2 Repair to satisfaction of Consultant, damage to building resulting from failure to provide such protection.
- .3 All existing air intake and exhaust openings that may be affected by dust and/or debris from the construction work of this Division shall be fitted with appropriate filter media to protect against entry of dust and/or debris into the building and its air distribution systems. Filters shall be closely monitored and replaced when necessary. The Contractor shall replace existing filters that become contaminated with dust and/or debris from construction work with new filters.
- .4 In the event that dust and debris from construction work does penetrate the building and/or its air distribution systems, the Contractor shall be responsible for cleaning the affected areas and/or systems.
- .5 Temporary filters shall be removed on completion of the construction works.

3.5 CUTTING AND PATCHING

- .1 Include cutting and patching as required in execution of work under respective Sections of this Division.
- .2 Holes through the structure will not be permitted without written approval of the Consultant. Any and all openings required through the completed structure must be clearly and accurately shown on a copy of the relevant structural drawing(s). Exact locations, elevations and size of the proposed opening must be identified well in advance of the need for the work.

Common Work Results

- .3 All sleeved or formed openings through the structure must be shown on sleeving drawings and must be approved by the Structural Consultant prior to construction.
- .4 The Contractor shall conduct exploratory work including x-ray of the existing structure, shall mark the location of embedded reinforcements, anchors, conduits and piping on exposed surfaces of adjacent floors and/or walls and shall pay all associated costs.
- .5 Reinforcing shall not be cut or modified without prior approval of the Structural Consultant. Should reinforcement be cut without such prior approval, the cost of any additional reinforcement deemed necessary by the Structural Consultant shall be the responsibility of this Contractor.
- .6 Alternative imaging techniques are subject to the approval of the Structural Consultant.
- .7 Ensure that cutting and patching of roofs and reinforced concrete structures is executed by specialists familiar with the materials affected, and is performed in a manner to neither damage nor endanger the work. Coordinate and supervise such cutting and patching.
- .8 Maintain the integrity of fire rated assemblies where they are pierced by ducts and pipes.
- .9 Make good surfaces affected by this work and repair finish to satisfaction of Consultant. Finish painting, where required, will be provided under Division 9.
- .10 Stop work immediately upon discovery of any hazardous material and report discovery to the Owner and Consultant. Obtain instruction prior to proceeding with the work.

3.6 SEALANTS & CAULKING

- .1 Fill voids around pipes:
 - .1 Seal between sleeve and pipe in foundation walls and below grade floors with penetration seals (link-seal)). Install as per manufacturer's installation instructions.
 - .2 Where sleeves pass through non-fire rated walls or floors, caulk space between pipe and sleeve with fibreglass. Seal space at each end with waterproof, fire retardant, non-hardening mastic.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with easily removable filler.
 - .5 Coat exposed exterior surfaces or ferrous sleeves with heavy application of zinc rich paint (VOC content not to exceed 250 g/L).
- .2 Temporarily plug all openings during construction.

3.7 FIRESTOPPING

- .1 All openings in fire separations and fire rated assemblies for service penetrations shall be protected with ULC listed service penetration firestop systems (SP).
- .2 The service penetration firestop system shall have F and FT ratings equal to or greater than ratings specified by the Architect for the fire separation (F) and firewall (FT) joint firestop systems (JF).
- .3 All components employed in the service penetration firestop system shall conform to the ULC listing.
- .4 Contractor shall prepare and submit a schedule of service penetration firestop systems to be employed indicating the ULC listing designation, services involved, location of opening through fire separation and the components of the fire separation assembly.
- .5 Refer to architectural drawings for ratings of fire separations and assemblies.

3.8 SUPPORT AND ATTACHEMENT

- .1 Support and attach raceways and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls.
- .2 Do not support from or attach to steel roof deck and/or wall or ceiling finishes.

3.9 PAINTING

- .1 Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Consultant.
- .2 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from

Common Work Results

ferrous metals.

3.10 FLOW DIAGRAMS AND DIRECTORIES

- .1 Provide Consultant with six identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.
- .2 Install where agreed with the Owner one copy of each flow diagram and valve schedule mounted in glazed frame. Provide one copy of each in Operation and Maintenance Manual.

3.11 INSTALLATION PRACTICES

- .1 BMS Wiring
 - .1 All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
 - .2 All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
 - .3 Class 2 Wiring
 - .1 All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - .2 Class 2 wiring in concealed accessible locations shall be FT-6 plenum rated.
 - .3 Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
 - .4 Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
 - .5 Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.
- .2 BMS Line Voltage Power Source
 - .1 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided under Division 26.
 - .2 Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
 - .3 DDC terminal unit controllers may use AC power from motor power circuits.
- .3 BMS Raceway
 - .1 All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
 - .2 Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 - .3 All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
 - .4 Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- .4 Penetrations
 - .1 Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
 - .2 All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 - .3 All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

Common Work Results

- .4 Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- .5 BMS Identification Standards
 - .1 Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
 - .2 Cable types specified in Item A shall be color coded for easy identification and troubleshooting.
- .6 BMS Panel Installation
 - .1 The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
 - .2 The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
- .7 Input Devices
 - .1 All Input devices shall be installed per the manufacturer recommendation
 - .2 Locate components of the BMS in accessible local control panels wherever possible.
- .8 HVAC Input Devices - General
 - .1 All Input devices shall be installed per the manufacturer recommendation
 - .2 Locate components of the BMS in accessible local control panels wherever possible.
 - .3 The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
 - .4 Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
 - .5 Air Flow Measuring Stations:
 - .1 Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.
 - .2 Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.
 - .6 Duct Temperature Sensors:
 - .1 Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - .2 The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - .3 For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - .4 The sensor shall be mounted to suitable supports using factory approved element holders.
 - .7 Space Sensors:
 - .1 Shall be mounted per ADA requirements.
 - .2 Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
 - .8 Air Differential Pressure Status Switches:
 - .1 Install with static pressure taps, tubing, fittings, and air filter.
- .9 HVAC Output Devices
 - .1 All output devices shall be installed per the manufacturers' recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
 - .2 Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
 - .3 Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 - .4 Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI.

Common Work Results

- .5 Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.12 WIRING

- .1 All control and interlock wiring shall comply with provincial electrical codes, standards and Division 26.
- .2 All NEC Class 1 wiring shall be ULC Listed in approved conduit according to OESC and Division 26 requirements.
- .3 All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-fused when required to meet NEC Class 2 current limitations.
- .4 Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in conduit may be used provided that cables are ULC Listed for the intended application. For example, cables used in ceiling plenums shall be ULC Listed specifically for that purpose.
- .5 All wiring in mechanical, electrical, or service rooms-or where subject to mechanical damage- shall be installed in conduit.
- .6 Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- .7 Do not install wiring in conduit containing tubing.
- .8 Where plenum rated cable is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
- .9 Where plenum rated cable is used without conduit, it shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical conduits, piping, or ceiling suspension systems.
- .10 All wire-to-device connections shall be made at a terminal block or wire nut. All wire-to-wire connections shall be at a terminal strip or wire nut.
- .11 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- .12 Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, this Division shall provide step-down transformers or interposing relays.
- .13 All plenum rated wiring shall be installed as continuous lengths, with no splices permitted between termination points
- .14 All wiring in conduit shall be installed as continuous lengths, with no splices permitted between termination points or junction boxes.
- .15 Maintain fire rating at all penetrations. Install plenum wiring in sleeves where it passes through walls and floors.
- .16 Size and type of conduit and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- .17 Include one pull string in each conduit 3/4 in. or larger.
- .18 Control and status relays are to be located in designated enclosures only. These enclosures can include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- .19 Conceal all conduit, except within mechanical, electrical, or service rooms. Install conduit to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes, gas vents or flues).
- .20 Secure conduit with conduit clamps fastened to the structure and spaced according to code requirements. Conduit and pull boxes may not be hung on flexible duct strap or tie rods. Conduits may not be run on or attached to ductwork.
- .21 Adhere to this specification's Division 26 requirements where conduit crosses building expansion joints.
- .22 This Division shall terminate all control and/or interlock wiring and shall maintain updated (as-built)

Common Work Results

- wiring diagrams with terminations identified at the job site.
- .23 Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal conduit less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.
 - .24 Conduit must be adequately supported, properly reamed at both ends, and left clean and free of obstructions. Conduit sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.13 COMMUNICATION WIRING

- .1 This Division shall adhere to the items listed in the "Wiring" article 3.14.
- .2 All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- .3 Do not install communication wiring in raceway and enclosures containing NEC Class 1 or other Class 2 wiring.
- .4 Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- .5 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- .6 When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- .7 All runs of communication wiring shall be unspliced length when that length is commercially available.
- .8 All communication wiring shall be labeled to indicate origination and destination data.
- .9 Grounding of coaxial cable shall be in accordance with OESC and NEC regulations on "Communications Circuits, Cable, and Protector Grounding."

3.14 INPUT/OUTPUT INTERFACE

- .1 Hardwired inputs and outputs may tie into the system through building or application specific controllers.
- .2 All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.
- .3 Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- .4 Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- .5 Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with-and field configurable to-commonly available sensing devices.
- .6 Binary outputs shall provide for On/Off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have three-position (On/Off/Auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.
- .7 Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC, 4 to 20 mA or 0-20 PSI signal as required to provide proper control of the output device. Analog outputs on building or custom application controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- .8 Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point

Common Work Results

floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

- .9 System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

3.15 INSTALLATION OF SENSORS

- .1 General:
 - .1 Install sensors in accordance with the manufacturer's recommendations.
 - .2 Mount sensors rigidly and adequately for the environment within which the sensor operates.
 - .3 Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
 - .4 All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
 - .5 Sensors used in mixing plenums and hot and cold decks shall be of the averaging type.
 - .6 Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across the full face of the coil.
 - .7 All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
 - .8 Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
- .2 Room Instrument Mounting
 - .1 Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted 53 inches above the finished floor unless otherwise shown.
- .3 Averaging Temperature Sensing Elements
 - .1 Sensing elements shall be installed in a serpentine pattern.
 - .2 Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

3.16 ACTUATORS

- .1 Mount and link control damper actuators according to manufacturer's instructions.
 - .1 To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 - .2 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - .3 Provide all mounting hardware and linkages for actuator installation.
- .2 Electric/Electronic
 - .1 Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
 - .2 Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.
- .3 Identification of Tubing and Wiring
 - .1 All wiring and cabling including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

Common Work Results

- .2 Permanently label or code each point of field terminal strips to show the instrument or item served.
- .3 All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

3.17 IDENTIFICATION OF HARDWARE AND WIRING

- .1 All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.
- .2 All pneumatic tubing shall be removed.
- .3 Permanently label or code each point of field terminal strips to show the instrument or item served.
- .4 Identify control panels and major control components on outside with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- .5 Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- .6 Identify room sensors relating to terminal box or valves with nameplates.
- .7 Manufacturers' nameplates and ULC or CSA labels are to be visible and legible after equipment is installed.
- .8 Identifiers shall match record documents.
- .9 Degrease and clean surfaces to receive adhesive for identification materials.
- .10 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer (VOC content not to exceed 680 g/L).
- .11 Install tags with corrosion resistant chain.
- .12 Clearly identify abandoned services left in place as "ABANDONED".
- .13 For each item of equipment which may be started automatically or remotely, add a red lamacoid plate, 2-3/8" x 9" (60 x 230 mm), reading: **"WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED. IT MAY START AT ANY TIME."**
- .14 Provide colour coded self-adhesive dots to locate control devices and panels located above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.18 EQUIPMENT TESTING AND INSPECTION

- .1 Test operation of equipment installed under this Division according to instructions in appropriate articles of this Division. Make any required adjustments or replacements to ensure equipment is operating as intended. Retest equipment requiring adjustment or replacement.
- .2 Pay all fuel consumption charges for equipment under testing and during commissioning.
- .3 Conduct tests before application of external insulation and before concealment of piping or ductwork.
- .4 Arrange and pay for inspections by authorities as required by code and complete any changes or alterations required by such inspections.
- .5 Conduct tests in the presence of:
 - .1 Authorized inspector(s) for authorities having jurisdiction.
 - .2 The Commissioning Agent.
 - .3 The Consultant.
 - .4 The Owner's Representative.
- .6 Notification must be given at least 48 hours in advance of tests being conducted, to all persons required to be present.

3.19 ADJUST AND CLEAN

- .1 Clean up all debris resulting from their activities daily. Remove all cartons, containers, crates, etc. as soon as their contents have been removed. Collect and sort waste and deposit in designated locations.
- .2 At the completion of work in any area, clean all work keeping it free from dust, dirt, and debris. Check all equipment furnished under this Division for paint damage. Repair any factory-finished paint that has been damaged to match the adjacent areas. Any equipment item, cabinet or enclosure that has been

Common Work Results

- deformed shall be replaced with new material and painted to match adjacent areas.
- .3 Lubricate mechanical equipment installed under this Division.
- .4 Test and adjust control devices, instrumentation, valves, dampers, etc. installed under this Division after cleaning of systems and leave in perfect order ready for operation.
- .5 Remove from the premises upon completion of work of this Division, debris, surplus, and waste materials resulting from operations.

END OF SECTION

Controls and Instrumentation

PART 1 - GENERAL

1.1 Product Data

- .1 Submit product data in accordance with Section 01 33 00 - submittal procedures.

1.2 Waste Management And Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 03 - construction/demolition waste management and disposal, and with the waste reduction work plan.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from students.

1.3 Scope Of Work

- .1 Removal of all existing pneumatic control devices and components present within the area to be renovated.
- .2 Installation/integration of new Distributed Digital Control (DDC) system for energy management, equipment monitoring and control consisting of microprocessor based DDC Controllers. The apex of the new BAS architecture shall be a Facility Explorer Supervisory Controller which can be accessed via operator workstation or through a web-based interface. The supervisory controller shall be open protocol BACnet MS/TP and have the capability to be integrated the existing Campus wide BAS.
- .3 The installation of the control system shall be performed with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation.
- .4 All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specifically for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- .5 Contractor shall be responsible for all BAS and temperature control wiring for a complete and operable system.
- .6 Provide power wiring to field panels and other devices requiring a main supply from circuit breakers.
- .7 The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers and operator interface devices.

1.4 Quality Assurance

- .1 The BAS system shall be designed and installed, commissioned and serviced by factory trained personnel.
- .2 The contractor shall provide an experienced project supervisor and single contract person.
- .3 Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements. All BAS Peer-To-Peer Network Controllers, Central System Controllers And Local User Displays Shall Be UL Listed Under Standard UL 916, Category PAZX; Standard ULC C100, Category UUKL7; And Under Standard UL 864, Categories UUKL, UDTZ, And QVAX, And Be So Listed At The Time Of Bid. All Floor Level Controllers Shall Comply, at a minimum, with UL Standard UL 916category PAZX; Standard UL 864, Categories UDTZ, And QVAX. And Be So Listed At The Time Of Bid.
- .4 Provide electric and electronic equipment that is CSA or Ontario Hydro approved where the

Controls and Instrumentation

regulatory authorities require such approvals.

- .5 The manufacturer of the building automation system shall provide documentation supporting compliance with iso-9002 (model for quality assurance in production, installation, and servicing) and iso-140001 (the application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a quality system and framework that will assure consistency in the products delivered for this project.
- .6 This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.
- .7 Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers, or protocol converters.

1.5 Manufacturers

- .1 Base Building Controls Contractor: Johnson Controls Inc.
- .2 Acceptable alternates include: Any controls vendor supplying Facility Explorer products

1.6 Related Work

- .1 Provide interfacing of all controls to the BAS under this contract as described in this specification.
- .2 Provide hardware interfacing to all controls instrumentation provided as specified in this section.

1.7 Electrical Wiring

- .1 All wiring shall be in accordance with the governing electrical authority and Electrical Contractor requirements. This includes wiring between control components and wiring from such components to electrical circuits of fans, pumps, and any other equipment.
- .2 Electrical interlock wiring of field devices (i.e., flow switches, thermostats) associated with equipment specified under other sections of this division is the responsibility of this section, unless indicated otherwise.
- .3 The BAS contractor is responsible for all communication wiring interconnecting the panels to the BAS.

1.8 Co-ordination of Work

- .1 The controls contractor shall design, provide, install, test, commission, and guarantee the system.
- .2 Provide all control devices, instrumentation, relays, auxiliary contacts, and transformers as specified and as required to meet the control and monitoring points and sequence of operation.
- .3 Mount and wire third party open protocol interface panels.
- .4 Automatic control valves
 - .1 Supply all automatic control valves required by the sequences of operation, and not specified as an integral part of equipment specified elsewhere in this Division, for installation by Section 23 21 13 – Hydronic Piping. Controls contractor shall provide and connect all associated valve actuators.

Controls and Instrumentation

1.9 Shop Drawings

- .1 Submit shop drawings for the following:
 - .1 All building automation and other control components.
 - .2 Workstation hardware (if applicable).
 - .3 Identified schematic control diagrams for all systems, each diagram indicating control components, component catalogue numbers, operation sequence, and interlocking.
 - .4 Riser diagram showing the physical location of building control system equipment and the system architecture. DDC Controller trunk conductors shall also be shown.
 - .5 List of connected data points, including DDC Controller's to which they are connected and input/output devices (sensors, transducers, etc.), show panel spare capacity.
 - .6 Drawings of each HVAC system showing all connected (connected and calculated) point addresses and operator notations.
 - .7 Complete sequences of operation of the DDC systems in both flow chart and program format.
 - .8 BAS central system configuration complete with all peripheral devices, batteries, power supplies, modems, etc. with interconnection diagrams.
 - .9 Technical specification data sheets of each system component and software module.
 - .10 Descriptive data and sequence of operation of all operating, user, and application software including a complete Operators Manual and Programmers Manual tailored to the job.
 - .11 Valve and damper schedules.

1.10 Reference Standards

- .1 Provide electrical and electronic equipment, which is C.S.A. or Ontario Hydro approved where such approvals are required by the regulatory authorities.
- .2 Provide ASCII American standard for communication and information interchange code input/output devices with standard via electronic industry association interface.

1.11 Submittals

- .1 Submit operation and maintenance manuals prior to acceptance testing. Manuals shall include:
 - .1 Index sheet, listing contents in alphabetical order
 - .2 Manufacturer's equipment parts list of all functional components of the system
 - .3 Auto-CAD disk of system schematics, including wiring diagrams
 - .4 Description of sequence of operations
 - .5 As-Built interconnection wiring diagrams
 - .6 Operator's Manual
 - .7 Trunk cable schematic showing remote electronic panel locations and all trunk data
 - .8 List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)

Controls and Instrumentation

- .9 Conduit routing diagrams
- .2 Provide programmer information.
- .3 Provide manufacturer's certification letter.

1.12 Networking Communications

- .1 The network architecture shall consist of multiple levels for communication efficiency with DDC controller floor level local area BACnet MS/TP networks with access being totally transparent to the user when accessing data or developing control programs.
- .2 The design of BAS shall allow the co-existence of new Facility Explorer DDC controllers with other third party DDC controllers in the same network without the use of gateways or protocol converters. The intent is to use the system provided under this contract to communicate with control systems provided by other vendors. A PICS must be provided describing the BACnet, ANSI/ASHRAE 135-2004 implementation. Minimum system functionality must include monitoring, commanding, and alarming for daily operator functions from a common workstation.
- .3 Peer-to-peer building level network:
 - .1 All operator devices either network resident or connected remotely shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
 - .2 The peer-to-peer network shall support a minimum of 100 DDC controllers and PC workstations
 - .3 The system shall support integration of third party systems (fire alarm, security, lighting, fume hoods) via panel mounted BACnet open protocol processor. This processor shall exchange data between the two systems for processing control. All exchange points shall have full system functionality as specified herein for hardwired points.
 - .4 Field panels must be capable of integration with open standards including Modbus, BACnet, and LonWorks as well as with third party devices via existing vendor protocols.
 - .5 The peer-to-peer Building Level Network shall use BACnet IP over Ethernet. All devices must:
 - .1 Auto-sense 10/100 Mbps networks.
 - .2 Receive an IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.
 - .3 Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.
 - .4 Allow access using Telnet.

1.13 DDC SUPERVISORY CONTROLLER LEVEL NETWORK

- .1 A web-based, Niagara 4 supervisor class Facility Explorer controller shall support a family of application specific controllers using BACnet MS/TP protocol and shall communicate with the peer-to-peer network through DDC controllers for transmission of global data.

Controls and Instrumentation

1.14 PCX MODULAR & COMPACT DDC CONTROLLERS

- .1 The Facility Explorer Programmable DDC controllers shall reside on the building level network.
- .2 DDC controllers shall use the same programming language and tools. DDC controllers, which require different programming language or tools on a network, are not acceptable.
- .3 DDC controllers, which do not meet the functions specified in Section 1.7.4 are not acceptable.
- .4 DDC controller
 - .1 The PCX Modular DDC Controllers shall be a 32-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a single floor level application specific controller device network.
 - .2 Each DDC Controller shall have sufficient memory, a minimum of 72 MB, to support its own operating system and databases, including:
 - .1 Control processes
 - .2 Energy management applications
 - .3 Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - .4 Historical/trend data for points specified
 - .5 Maintenance support applications
 - .6 Custom processes
 - .7 Password-protected Operator I/O
 - .8 Internet/Intranet communications
 - .3 Each DDC Controller shall support firmware upgrades without the need to replace hardware.
 - .4 Provide all processors, power supplies, and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
 - .5 DDC Controllers shall provide a RS-485 serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals.
 - .6 Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication.
 - .7 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

Controls and Instrumentation

- .1 RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
- .2 Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
- .3 Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
- .4 Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
- .8 Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:
 - .1 IEEE Standard 587-1980
 - .2 UL 864 Supply Line Transients
 - .3 Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
- .9 In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and SDRAM battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.
 - .1 Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 - .2 Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-485 port, via telephone line dial-in or from a network workstation PC.
- .10 Provide a separate DDC Controller for each AHU or other HVAC system equipment. It is intended that each unique system be provided with its own point resident DDC Controller.

1.15 PCX Modular & Compact DDC Controller Resident Software Features

- .1 General
 - .1 The University currently utilizes Facility Explorer Software.
 - .2 The software programs specified in this section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.
 - .3 All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the PC workstation.
 - .4 All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter)).
- .2 Control software description:
 - .1 The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:
 - .1 Two-position control
 - .2 Proportional control
 - .3 Proportional plus integral control

Controls and Instrumentation

- .4 Proportional, integral, plus derivative control
- .5 Automatic tuning of control loops
- .3 DDC controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.
 - .1 Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.
 - .1 The SSTO program shall operate in both the heating and cooling seasons.
 - .1 It shall be possible to apply the SSTO program to individual fan systems.
 - .2 The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.
 - .2 The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.
 - .2 Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.
 - .1 It shall be possible to individually command a point or group of points.
 - .2 For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and stop within that group.
 - .3 The operator shall be able to define the following information:
 - .1 Time, day
 - .2 Commands such as on, off, auto, and so forth.
 - .3 Time delays between successive commands.
 - .4 There shall be provisions for manual overriding of each schedule by an appropriate operator.
 - .4 It shall be possible to schedule events up to one year in advance.
 - .1 Scheduling shall be calendar based.
 - .2 Holidays shall allow for different schedules.
 - .3 Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
 - .4 Night setback control: The system shall provide the ability to automatically adjust set points for night control.
- .4 DDC controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
 - .1 A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and

Controls and Instrumentation

HVAC Mechanical Equipment Controllers on the network. Database shall support 30-character, English language point names, structured for searching and logs.

- .2 Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 - .3 DDC Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task-orientated information from the user manual.
 - .4 DDC Controller shall be capable of comment lines for sequence of operation explanation.
- .5 Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC mechanical equipment controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC controllers ability to report alarms be affected by either operator or activity at a pc workstation, local i/o device, or communications with other panels on the network.
- .1 All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 - .2 The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 - .3 Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hour's destinations) or based on priority.
 - .4 In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - .5 In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.
- .6 A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the i/o summary. The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a short amount of time for a large group of points. Ability to produce a summary of changes in a log file.
- .1 Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC shall have a dedicated RAM-based buffer for trend data and shall be

Controls and Instrumentation

capable of storing data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

- .1 Time-interval based trending shall have the capability of synchronizing the trend sampling of discrete points. This allows for the comparison of values of several different points at the same moment in time.
 - .2 Trended points shall have the option of sampling data values based on the condition of a "trigger" point (i.e., conditional trending). Options for sampling shall include: always sampling as defined, only sampling when the trended point is in the alarm condition, or not sampling.
- .2 DDC Controllers shall also provide high-resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
- .1 Loop tuning shall be capable of being initiated either locally at the DDC Controller, from a network workstation or remotely using dial-in modems. For all loop-tuning functions, access shall be limited to authorized personnel through password protection.
- .7 DDC controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point i/o schedule.
- .8 The peer-to-peer network shall allow the DDC controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC mechanical equipment controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC mechanical equipment controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer-to-peer network shall also allow any DDC and HVAC mechanical equipment controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.
- .9 The peer-to-peer network shall allow the DDC controllers to assign a minimum of 50 passwords access and control priorities to each operator individually. The login password (at any pc workstation or portable operator terminal) shall enable the operator to monitor, adjust, and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.
- .1 Passwords shall have the option to be configured to expire within a selected timeframe (1-365 days).
 - .1 Configuring the password expiration shall also enable the functionality to lock out a user account after three failed log-on attempts.

1.16 Floor Level Network Application Specific Controllers (ASC)

- .1 Each DDC controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through floor level LAN device networks using BACnet MS/TP advanced application controller (B-AAC) device profile.

Controls and Instrumentation

- .2 Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.
- .3 Terminal equipment controllers:
 - .1 Provide for control of each piece of equipment, including, but not limited to, the following:
 - .1 VAV/BP Boxes
 - .2 Perimeter Baseboard Heaters
 - .3 Ex. Split AC Unit for IT Room
 - .4 Entrance Heaters
 - .5 Ex. Snow Melt Manifold #3
 - .2 Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control and 0 to 10V, allowing for interface to a variety of modulating actuators.
 - .3 All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable.

1.17 Operator Interface

- .1 Please note this project will not be able to be integrated with the existing Iconics 32 Graphic User Interface. The installed system is to have the capabilities described in this section so that this project can be easily integrated to the new University GUI once the University selects this system.
- .2 Basic existing operator server interface description
 - .1 Operator interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with and share data between any combination of dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:
 - .1 Real-time graphical viewing and control of the BAS environment
 - .2 Reporting
 - .3 Scheduling and override of building operations
 - .4 Collection and analysis of historical data
 - .5 Point database editing, storage, and downloading of controller databases.
 - .6 Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system
 - .7 Alarm reporting, routing, messaging, and acknowledgment
 - .8 "Collapsible tree," dynamic system architecture diagram application:

Controls and Instrumentation

- .1 Showing the real-time status and definition details of all workstations and devices on a management level network
- .2 Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
- .3 Showing the status and definition details of all field-level application controllers
- .9 Definition and construction of dynamic colour graphic displays.
- .10 Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
- .11 On-screen access to User Documentation, via online help or PDF-format electronic file.
- .12 Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals
 - .1 Backups shall produce a configuration file that contains pertinent details regarding the specific backup. This log file shall be created each time a backup is run and be stored in the backup directory.
 - .2 Restore dialog box shall list detailed information to facilitate the restore of the correct database.
 - .3 Ability to restore selected components of a backup.
 - .4 Delete old backup directories automatically or individually from a detailed list.
- .13 Display dynamic trend data graphical plot.
 - .1 Must be able to run multiple plots simultaneously
 - .2 Each plot must be capable of supporting 10 pts/plot minimum
 - .3 Must be able to command points directly off dynamic trend plot application.
 - .4 Must be able to plot both real-time and historical trend data
- .14 Program editing
- .15 Transfer trend data to 3rd party spreadsheet software
- .16 Scheduling reports
- .17 Operator Activity Log
- .18 Open communications via OPC Server option
- .19 Open communications via BACnet Client & Server option
- .20 Tracking of supervised objects
- .21 Tracking of points through the alarm process
- .22 Provide remote notification of points in alarm

Controls and Instrumentation

- .2 Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.
- .3 The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows XP, 2000 or Server 2003 operating system. System database parameters shall be stored within an object-oriented database, which is compliant with the Open Database Connectivity (ODBC) or Structured Query Language (SQL) standards. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information
 - .1 Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
 - .1 Dynamic colour graphics application
 - .2 Alarm management application
 - .3 Scheduling application
 - .4 Dynamic trend graph data plotter application
 - .5 Dynamic system architecture diagram application
 - .6 Control Program and Point database editing applications
 - .7 Reporting applications
 - .2 Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.
- .4 Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows user account as a foundation.
 - .1 The workstation software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding,

Controls and Instrumentation

schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format, and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.

- .5 Dynamic Colour Graphics application shall include the following:
 - .1 Must include graphic editing and modifying capabilities
 - .2 A library of standard control application graphics and symbols must be included
 - .3 Must be able to command points directly off graphics application
 - .4 Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks
 - .5 Animation status indicators shall give you a quick visual indication of a point's value, priority, or status in the form of an icon.
 - .6 Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure or view recently opened graphics through a backward and forward paging.
 - .7 Graphics viewing shall include zoom capabilities
 - .8 Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
 - .9 Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), Internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
- .6 Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers, or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:
 - .1 A general listing of all or selected points in the network
 - .2 List of all points currently in alarm
 - .3 List of all points currently in override status
 - .4 List of all disabled points
 - .5 List of all points currently locked out
 - .6 List of user accounts and access levels
 - .7 List all weekly schedules and events
 - .8 List of holiday programming
 - .9 List of control limits and dead bands
 - .10 Custom reports from 3rd party software

Controls and Instrumentation

- .11 System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
- .12 List of programs
- .13 List of point definitions
- .14 List of logical point groups
- .15 List of alarm strategy definitions
- .16 List of DDC Control panels
- .17 Point totalization report
- .18 Point Trend data listings
- .19 Initial Values report
- .20 User activity report
- .7 Scheduling and override
 - .1 Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action, or function key. Provide the following capabilities as a minimum:
 - .1 Weekly schedules
 - .2 Zone schedules
 - .3 Event schedules – an event consists of logical combinations of equipment and/or zones
 - .4 Report schedules
 - .5 Ability to schedule for a minimum of up to 365 days in advance
 - .2 Additionally, the scheduling application shall:
 - .1 Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
 - .2 Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
 - .3 Provide searching capabilities of schedules based on name – with wildcarding options
- .8 Collection and Analysis of Historical Data
 - .1 Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports.

Controls and Instrumentation

Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

- .2 The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a small amount of time for a large group of points. Ability to produce a summary of changes in a log file.
- .3 Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.
- .4 Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. A minimum of fifteen points may be plotted, of either real-time or historical data. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed. A minimum of 8 true graphs shall run simultaneously. Operator shall be able to command points directly on the trend plot by double clicking on the point. Operator shall be able to zoom in on a specific time range within a plot. The dynamic trend plotting application shall support the following types of graphs, with option to graph in 3D: line graph, area graph, curve graph, area-curve graph, step graph, and scatter graph. Each graph may be customized by the user, for graph type, graph text, titles, line styles and weight, colours, and configurable x- and y-axes.

.3 Dynamic colour graphic displays

- .1 Create colour graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and hot water boiler systems, and room level terminal units, shall be provided by the BAS contractor to optimize system performance, analysis and speed alarm recognition.
 - .2 The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of AutoCAD or scanned pictures for use in the system.
 - .3 Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
- .1 Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of

Controls and Instrumentation

mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the workstation software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed. Animation shall also indicate the priority and alarm status of the point.

- .2 Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
 - .3 Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
 - .4 Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or set point.
 - .5 State text for digital points can be user-defined up to eight characters.
- .4 Colours shall be used to indicate status and change as the status of the equipment changes. The state colours shall be user definable.
 - .5 Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), Internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
 - .6 The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
 - .7 Off the shelf graphic software, Micrografx Designer or Corel Draw software, shall be provided to allow the user to add, modify or delete system graphic background displays.
 - .8 A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.
 - .9 The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.
- .4 System configuration & definition
 - .1 A "Collapsible tree" dynamic system architecture diagram/display application of the site-specific BAS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers or HVAC Mechanical Equipment controllers, as well as 3rd-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons

Controls and Instrumentation

representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration, and diagnostics of dial-up modems to DDC Controllers.

- .2 Network wide control strategies shall not be restricted to a single DDC Controller or HVAC Mechanical Equipment controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
 - .3 Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller or HVAC Mechanical Equipment Controller. Changes made at the user-interface of DDC Controllers or HVAC Mechanical Equipment Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
 - .4 System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system backup must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.
 - .5 Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.
 - .1 The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.
 - .6 Control program configuration shall be available to the user within a dedicated control program editor application included in the workstation software. The editor shall allow for creation, modification, and deletion of control programs. The editor shall include a programming assistance feature that interactively guides the user through parameters required to generate a control program. The editor shall also include the ability to automatically compile the program to ensure its compatibility with the DDC Controllers. The editor shall provide the option for editing the control programs in an online or offline mode, and also the ability to selectively enable or disable the live program execution within the DDC Controllers.
- .5 Alarm management
- .1 Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.
 - .2 Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time & date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.

Controls and Instrumentation

- .3 Alarm Display shall have the ability to list & sort the alarms based on alarm status, point name, ascending or descending alarm time.
- .4 Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.
- .5 Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm, which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state.
- .6 Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.
- .7 Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.
- .8 Remote notification of messages
 - .1 Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition. A point's alarm status will be configurable for remote notification whether the point is in a specific alarm priority, has returned to normal, failed, out of service, in trouble, alarm disabled by program or operator and alarm by command.
 - .2 There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices, which can receive messages from the system.
 - .3 On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
 - .4 Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
 - .5 System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
 - .6 Message detail shall be configurable on a per user basis.
 - .7 During a mass influx of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.

Controls and Instrumentation

- .8 Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- .9 Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.
- .10 Ability to configure Fire and Life Safety points for remote notification through the point editor application.
- .9 Expanded Alarm Issue Management
 - .1 As optional functionality, configurable point-by-point, the system shall impose an ordered process for managing the lifecycle of an alarm. The process requires the operator to:
 - .1 Acknowledge the alarm.
 - .2 Assign the alarm issue to a contact (e.g., tradesperson or trained staff).
 - .3 Answer – an explanation of the diagnosis or solution to the alarm.
 - .4 Resolve – this happens when at least one Answer is provided and the point has returned to a stable Normal state.
 - .5 Clear – the operator may clear the alarm issue from the display.
 - .2 Each step in the lifecycle is automatically recorded for audit trail historical purposes.
- .6 Audit trail of user actions
 - .1 To protect against inadvertent changes damaging critical system functions, and to enable audit-trail tracking on selected database objects, optional functionality shall be provided to configure selected objects for increased supervision. The additional supervision functionality shall allow for designation of points, control programs, trend collection reports, panels on a building level network and user account objects for detailed tracking of user modifications and deletions. Display an icon, which indicates the level of supervision for an object within specified applications.
 - .1 The minimal setting for additional supervision shall warn the user that he is attempting to modify or delete a supervised object, and will require the user to input a reason-for-change in order to proceed. The warning shall be customizable for each object.
 - .2 Additional supervision levels shall be optional to require the user to re-enter his user password, and/or require that a “supervisor” enter his user password, in order to proceed with the modification or deletion of the supervised object.
 - .3 Supervised objects shall be assigned a dedicated “revision number,” and the revision number shall be incremented automatically by the system upon each user modification. This revision number may serve as a method for tracking changes to objects.
 - .4 Point in an alarm state can have annotations added which can be viewed from the alarm display screen, graphic display screen, and anytime the point is being commanded to a new value or state. For supervised objects, the point annotation will automatically populate the reason for change field.

Controls and Instrumentation

- .2 Audit Trail tracking of supervised objects shall record the following:
 - .1 The property of the object that was changed
 - .2 The value of the property before the change
 - .3 The value of the property after the change
 - .4 Who made the change
 - .5 The reason for change (entered by the operator)
 - .6 Who the change was authorized by (if configured for this level of supervision)

1.18 Field Devices

- .1 Room thermostats
 - .1 Provide electronic wall mounted 24 VAC with 0 to 10 Volt output. Each thermostat shall be equipped with a thermometer, and shall be tamperproof with locking cover. Provide temperature set point override and unoccupied override.
- .2 Temperature sensors
 - .1 All supply air sensors and mixed air sensors shall be 1000 Ohm platinum, resistance temperature detector (RTD) type with a twenty-five foot averaging element. Accuracy of the RTD and transmitter shall be $\pm 0.3^{\circ}\text{C}$ (0.5°F) over a range of 40°C (104°F) to 116°C (241°F).
 - .2 All return air sensors shall be RTD type temperature detectors. The sensor probe shall have a minimum length of 450mm (18"). The accuracy of the sensor shall be $\pm 0.3^{\circ}\text{C}$ (0.5°F) over a range of 40°C (104°F) to 116°C (241°F).
 - .3 All space sensors shall be RTD or thermistor type temperature detectors. Sensors shall be provided with vented protective covers, mounted 1500mm (6 ft) from floor level.
 - .1 Space sensors for use in conjunction with terminal unit DDC controllers in office areas shall have override button to restore occupied set point outside of normal occupancy period and local set point adjust feature.
 - .2 Space sensors in public areas shall be the sensing-only type with no local override, display, or adjust features. These sensors shall connect to their respective controllers via a preformed cable with RJ-11 type connectors at each end. The sensor shall also contain an RJ-11 jack for connection of a laptop PC for commissioning purposes.
 - .3 Provide clear plastic or beveled metal guards for space sensors located in public corridors, entrance lobbies and washrooms where shown on the mechanical plans.
 - .4 All liquid immersed sensors shall be RTD type temperature detectors. Each sensor shall be provided with a well, suitable for the working temperature and pressure of the fluid. The accuracy of the sensor shall be $\pm 0.3^{\circ}\text{C}$ (0.5°F) over a range of 40°C (104°F) to 116°C (241°F).
- .3 Humidity sensors
 - .1 The humidity sensor shall have solid state sensing element suitable for a range of 5-90% RH with an operating range of 0°C (32°F) to 60°C (140°F).

Controls and Instrumentation

- .2 Each sensor shall be provided with an industry standard 4-20mA transmitter, mounted at the sensor. The transmitter and sensing element shall have a combined accuracy of $\pm 2\%$ RH over the humidity range.
- .3 Duct mounted sensors shall be mounted half way across the duct. Room mounted sensor shall be provided with vented covers.
- .4 Differential pressure sensors
 - .1 Differential pressure sensors shall be provided for differential pressure air and static pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal pressure.
 - .2 Each sensor shall be provided with an industry standard 4-20mA transmitter, mounted at the sensor. The transmitter and sensor shall have a combined accuracy of 0.5% of the differential pressure range.
- .5 Panels
 - .1 Control panels shall be fully enclosed cabinets. Cabinets shall have hinged door with locking latch or bolt on cover plate. All cabinet locks shall be common keyed.
 - .2 Panels shall be wall mounted or free standing and shall be as located on the mechanical drawings.
 - .3 All relays, transducers etc., shall be located within the control panels.
 - .4 Each DDC Controller enclosure shall have a standard duplex AC power receptacle located within the enclosure to provide power for test equipment, operation communication devices.
- .6 Nameplates
 - .1 Duct and pipe mounted sensors and panels shall be provided with lamacoid nameplates, clearly identifying the equipment and the zone in which it is controlling. Refer to Section 23 01 01 – Mechanical General Requirements for detail.
- .7 Flow measuring probes
 - .1 Provide where indicated, an array of airflow traverse probes capable of continuously monitoring the fan or duct capacities (air volumes) they serve.
 - .2 Each airflow traverse probe shall contain multiple total and static pressure sensors located along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds.
 - .3 The flow sensors shall not protrude beyond the surface of the probe(s) and shall be the offset (Fechheimer) type for static pressure and the chamfered impact type for total pressure measurement.
 - .4 Probes shall be AMCA certified and be capable of measuring the airflow rates within an accuracy of $\pm 2\%$ without the use of correction factors.
 - .5 Flow probes shall be installed in the fan inlets or supply and return ducts of VAV air handling systems as specified in the points list and within the system operational sequences.

Controls and Instrumentation

- .6 Standard of acceptance: Air Monitor VOLU-probe.
- .8 Current sensing relays
 - .1 Provide solid-state, adjustable, current operated relay. Provide a relay, which changes switch contact state in response to an adjustable set point value of current in the monitored AC circuit.
 - .2 Adjust the relay switch point so that the relay responds to motor operation under load as an “on” state and so that the relay responds to an unloaded running motor as an “off” state. A motor with a broken belt is considered an unloaded motor.
 - .3 Provide for status device for all fans and pumps.
- .9 Control relays
 - .1 Supply and install load relays capable of switching 10 Amps at 120/1/60.

1.19 Project Management

- .1 Provide a designated project manager who will be responsible for the following:
 - .1 Construct and maintain project schedule
 - .2 On-site coordination with all applicable trades, subcontractors, and other integration vendors
 - .3 Authorized to accept and execute orders or instructions from Owner/Consultant/Architect
 - .4 Attend project meetings as necessary to avoid conflicts and delays
 - .5 Make necessary field decisions relating to this scope of work
 - .6 Coordination/Single point of contact

1.20 General Installation

- .1 Install all equipment, accessories, conduits, interconnecting wiring and pneumatic piping in a neat manner by skilled and qualified work persons using the latest standard practices of the industry.
- .2 Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.
- .3 Notify consultant in writing of any conflict between these specifications and manufacturer's instructions.
- .4 Retain, at no additional cost to the owner, original equipment suppliers to provide contacts that are required on the point schedules and in the software and sequences specified. Provide the necessary relays and transformers required to interconnect equipment.
- .5 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of equipment.
- .6 Install equipment to allow for easy maintenance access. Ensure equipment does not interfere in any way with access to adjacent equipment and personal traffic in the surrounding space.
- .7 Install equipment in locations providing ventilation and ambient conditions for its specified function.
- .8 Install all electrical wiring in conformance with the requirements of the local electrical authority, provincial building code and, unless otherwise indicated, the specifications of Division 26000 –

Controls and Instrumentation

Electrical.

- .9 Install low voltage wiring in accordance with the control manufacturer's recommendations and Electrical Contractor. Run all wiring in a protective conduit in areas where exposed or where required to meet with applicable codes. Plenum rated (ft6) type cables may be used in accordance with applicable codes, in concealed, accessible locations such as ceiling spaces and wall cavities.
- .10 Shield and ground communication trunk wiring at a single end. Do not splice trunk cables.

1.21 Installation Of Controlled Devices & Sensors

- .1 Install all equipment in accordance with manufacturer's published instructions.
- .2 Supply equipment to be installed by other divisions in accordance with their work schedule.
- .3 Coordinate final location of all sensors with consultant's field representative prior to installation.
- .4 Sensor assemblies and elements must be readily accessible. Provide access doors as required to allow for easy replacement and servicing.
- .5 Support field mounted transmitters and sensors on pipe stands or channel brackets.
- .6 Locate all sensing elements to correctly sense measured variable. Isolate elements from vibrations and temperatures, which could affect measurement.
- .7 Install averaging type RTDs in serpentine configuration with adequate provision for the mechanical protection of the sensor. Support along its entire length.
- .8 Modifications to plenum and ductwork must achieve the intent of the contract documents and adhere to the following:
 - .1 Mount sensors with extension necks such that access to sensors is not restricted by insulation.
 - .2 Keep cutting to a minimum and perform in a neat and workmanlike manner.
 - .3 Provide patches and access covers of the same material and thickness as adjoining ductwork. Provide necessary reinforcing and fastening materials.
 - .4 Provide gaskets, seals and insulation to restore to, or exceed as found conditions in areas where this contractor has made modifications.
- .9 Where the point schedules indicate that auxiliary contact provision, provide all instrumentation, wiring, conduit, power supplies, and services as required to integrate these points into the BAS.
- .10 Provide interposing and motor control relays at the local item of equipment or at the associated mcc as applicable. Provide all relays, wiring, conduit, power supplies and services as required to integrate these points into the BAS.

1.22 Electrical Wiring And Materials

- .1 Install, connect, and wire the items included under this section. This work includes providing required conduit, wire, fittings, and related wiring accessories. Unless indicated otherwise, all wiring shall be installed in conduit. Provide electrical material and installation in accordance with the appropriate sections of the current edition of the applicable local electrical codes. Install wiring in conduit or approved totally enclosed raceways. Do not use cable raceways or troughs. Ft6 rated plenum wire may be used without conduit for sensor, 24-volt power, and network communications

Controls and Instrumentation

wiring associated with terminal equipment controllers provided that the installation complies with all relevant codes.

- .2 Provide wiring between thermostats, aqua stats, and unit heater motors, all control and alarm wiring for all control and alarm devices for all sections of Mechanical specifications.
- .3 Provide 120 volt, single phase, 60 hertz emergency power to every BAS DDC controller panel, power supply, transformer, annunciator, modems, printers and to other devices as required. It is the intent that the entire building management system except terminal equipment shall be operative under emergency power conditions in the building. The power supplies are to be extended in conduit and wire from emergency circuit breakers.
- .4 Provide status function conduit and wiring for equipment covered under this section.
- .5 Provide conduit and wiring between the BAS panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring in conduit.
- .6 Provide conduit and control wiring for devices specified in this section.
- .7 Provide conduit and wiring between the pc workstation, electrical panels, metering instrumentation, indicating devices, miscellaneous alarm points, remotely operated contractors, and BAS panels, as shown on the drawings or as specified.
- .8 All wiring to be compliant to all relevant local building codes.
- .9 Provide electrical wall box and conduit sleeve for all wall-mounted devices.

1.23 Identification Of Equipment

- .1 Identify each piece of equipment, including sensors, controlled devices and control panels, with a nameplate identifying the equipment and functions with a letter and number designation.
- .2 Nameplates shall be minimum size 75mm x 25mm (3" x 1") and 3.2mm (1/8") thick laminated plastic with 6.4mm (1/4") deep engraved lettering. Nameplates shall be securely attached to the equipment. Adhere to electrical colour schedule.
- .3 Printed nametags are acceptable for cabinet mounted components providing they are securely attached.

1.24 Performance

- .1 Unless stated otherwise, control temperatures within plus or minus 1.1°C (2°F), humidity within plus or minus 3% of the set point, and static pressure within 10% of set point.

1.25 Start-Up And Commissioning

- .1 When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting, and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.
- .2 Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.
- .3 After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed.

Controls and Instrumentation

1.26 Commissioning, Testing And Acceptance

- .1 Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets, which shall be submitted prior to acceptance testing. Commissioning work, which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner, construction manager, and commissioning consultant to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.
- .2 Provide temporary operator workstation for exclusive use by commissioning team.
- .3 Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications, and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:
 - .1 Sensor accuracy at 10, 50 and 90% of range.
 - .2 Sensor range.
 - .3 Verify analog limit and binary alarm reporting.
 - .4 Point value reporting.
 - .5 Binary alarm and switch settings.
 - .6 Actuator ranges.
 - .7 Fail safe operation on loss of control signal, electric power, and network communications.
- .4 Provide a systems specialist to operate systems as required by the commissioning coordinator.
- .5 After control devices have been commissioned (i.e. calibrated, tested, and signed off), each bas program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
- .6 After all BAS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:
 - .1 Data communication, both normal and failure modes.
 - .2 Fully loaded system response time.
 - .3 Impact of component failures on system performance and system operation.
 - .4 Time/Date changes.
 - .5 End of month/ end of year operation.
 - .6 Season changeover.
 - .7 Global application programs and point sharing.

Controls and Instrumentation

- .8 System backup and reloading.
 - .9 System status displays.
 - .10 Diagnostic functions.
 - .11 Power failure routines.
 - .12 Battery backup.
 - .13 Smoke Control, if required, in concert with Fire Alarm System testing.
 - .14 Testing of all electrical and HVAC systems with other division of work.
- .7 Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.
- .8 Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
- .9 The contractor shall supply all instruments for testing.
- .1 All test instruments shall be submitted for approval.
 - .1 Test Instrument Accuracy

Temperature	0.2°C (¼°F) or ½ % full scale, whichever is less
Pressure	High Pressure (psi): 3.5 kPa (½ psi) or ½ % full scale, whichever is less Low Pressure (in w.c.): ½ % of full scale
Humidity	2% RH
Electrical	¼ % full scale
- .10 After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty-day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.

1.27 Training

- .1 The manufacturer shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. Provide 24 hours of training. All training shall be held during normal working hours of 8:00 am to 4:30 pm weekdays.
- .1 Explanation of drawings, operations and maintenance manuals
 - .2 Walk-through of the job to locate control components

Controls and Instrumentation

- .3 DDC controller and ASC operation/function
 - .4 Operator control functions including graphic generation and field panel programming
 - .5 Explanation of adjustment, calibration and replacement procedures
 - .6 Student binder with training modules
- .2 Since the owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the manufacturer. If such training is required by the owner, it will be contracted at a later date.

1.28 Warranty

- .1 Provide all services, materials, and equipment necessary for the successful operation of the entire bas system for a period of one year after beneficial use.
- .2 The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.
- .3 The on-line support services shall allow the local bas subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.
- .4 If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the bas manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within 3 hours of the time that the problem is reported.

1.29 Programming

- .1 Program, set up, and tune all control loops during initial start-up of the systems.
- .2 Create all DDC controller databases containing all real system input/output points as well as pseudo or calculated points required for global operating strategies.
- .3 Assign all points to logical system groups to permit an operator to access a specific point by calling up a dynamic display of the logical system in which the point is contained.
- .4 Assign all I/O points to the point history file function described previously in this section.
- .5 Assign all change of state activity of points, as well as operator actions, to the historical archiving program of the BAS as described previously in this section.
- .6 Assign all change of state activity of points to the appropriate alarm and/or off-normal summary program of the BAS as described previously in this section.
- .7 Create all application programs and store as executable files on the principal BAS operator workstation bulk storage disk for automatic downloading to field DDC controllers.
- .8 For each major mechanical system, provide a dynamic system graphic incorporating all input signal values and output command values.

1.30 Control Strategies

- .1 Refer to the sequence of operation and associated control schematics for the required number of control loops. Provide all hardware and software necessary to achieve specified control.

Controls and Instrumentation

1.31 Sequences Of Operation

- .1 Refer to Mechanical Drawings for Control Diagrams which include specific sequences of operation.

END OF SECTION

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

1. Conform to General Requirements, Division 1.
2. Provide the Unit Prices as listed in the 'Schedule of Structural Unit Prices' in Division 1.

1.02 SCOPE OF WORK

1. Refer to the Contract Drawings for detailed requirements.
2. Provide all plant, labour, equipment and materials to carry out the work of this section. The work includes, but is not limited to the following:
 1. Excavation and disposal.
 2. Backfill and compaction.
 3. Underpinning
 4. Dewatering during construction.
3. Related Work Specified Elsewhere:
 1. Under Slab Vapour Barrier – Section 03 30 00
 2. Under Slab Vapour Retarder – Section 03 30 00.

1.03 REFERENCE STANDARDS

1. All standards to be latest issue with amendments.
2. Unless otherwise stated, the applicable provisions of these reference standards are to be considered as part of this specification.
3. Ontario Building Code.
4. The Occupational Health Safety Act, local by-laws and all other regulations of the Ontario Ministry of Labour relating to the work of this Section.
5. O.P.S.S. Form 1010, Specification for Selected Granular Base Course.

1.04 SUB-SURFACE CONDITIONS

1. GEOTECHNICAL INVESTIGATIONS HAVE BEEN PREVIOUSLY UNDERTAKEN FOR THIS SITE BUT NOT SPECIFICALLY FOR THIS PROJECT. THE PREVIOUS GEOTECHNICAL INVESTIGATIONS INCLUDE REPORT #88 F454 PREPARED BY PETO MACCALLUM LTD DATED OCTOBER 1988 FOR THE GOODMAN SCHOOL OF BUSINESS (FORMERLY TARO BUILDING) AND REPORT # HAM-00800745-A0 PREPARED BY EXP SERVICES INC DATED 04-08-15 FOR THE GOODMAN SCHOOL OF BUSINESS ADDITIONS.
- 2.

Previous reports are not available, refer to item 3 below. It is incumbent upon the Contractor to make any additional tests to obtain any additional information deemed necessary for the proper execution of the work, at no additional cost to the Owner.

3. Geotechnical consultant is required to view footing founding elevations prior to pouring concrete to confirm the specified soil bearing capacities are provided.

1.05 DRAWINGS

1. Examine all drawings forming a part of this Contract and conform to the requirements of all such drawings.
2. Submit shop drawings certified by a qualified registered professional engineer for any shoring systems required to brace the adjacent foundations and/or to perform the excavation, wherever 'open cuts' are not feasible.
3. The Consultant's review of shop drawings will not relieve the Contractor of his responsibility for ensuring that their work is complete, accurate and in accordance with the drawings and specifications.

1.06 CO-ORDINATION

1. Co-ordinate the work of this Section with the work of all other Sections in accordance with the General Conditions and the project schedule.
2. Co-ordination and co-operation is particularly important between contractors involved with building excavation, excavation for under slab mechanical/electrical and with contractors who may be working on site services.

1.07 EXAMINATION

1. Examine the site for the purpose of determining the conditions prevailing there, which may affect the work of this Section, including available access to the site, existing street conditions, adjacent structures, etc.
2. Determine the nature and locations of all existing services below and above ground, which may affect the work of this Section.

1.08 SPECIAL CONDITIONS

1. The site is adjacent to the existing college. The Contractors attention is drawn to the fact that the building is fully operational and must be kept operational. The presence of existing buildings, fire & vehicle routes, roadways and site works which may affect the work of this Section including hoisting, delivery and the availability of lay-down areas.
2. The Contractor's attention is drawn to the presence of an existing service tunnel

adjacent to the area of the new link addition. The roof of the existing tunnel is not to be used as a thoroughfare for construction traffic, the storage of materials or a setup location of mobile crawler or wheeled cranes.

3. Excavation and backfill for building foundation and underpinning to be coordinated with relocation and removal of existing site services. Provide all necessary lateral and vertical support of existing underground services until such time as they are decommissioned or relocated. All decommissioned services located below new slab on grade to be removed and trenches backfilled with lean concrete fill.
4. Existing Fill material is present below existing site grade. All fill material below new floor Slab on grade is to be removed and backfilled with imported Granular 'B' compacted to 100% standard proctor dry density over approved proofed rolled native subgrade.

PART 2: PRODUCTS

2.01 MATERIALS

1. Concrete – In accordance with Division 3 of this Specification as follows:
 1. -underpinning F'c = 25 MPa., slump = 5" max.
 2. -mud slabs F'c = 10 MPa., slump = 6" max.
2. Reinforcing Steel (plain): Weldable low alloy deformed steel bars conforming to C.S.A. Standard G30.18, Grade 400.
3. Reinforcing Steel (Epoxy Coated): Weldable low alloy deformed steel bars conforming to C.S.A. Standard G30.18, Grade 400, Epoxy coating in accordance with ASTM A775. All shop and/or field cut ends to be coated in accordance with ASTM M775 and MTO Form 1443.
4. All deformed bars to have the grade or guaranteed yield strength rolled into the bar.
5. Granular Fills – Class 'A' and Class 'B' – Imported, in accordance with current O.P.S.S. From 1010 except as noted here.
 - a) Reclaimed Asphalt Pavement material is not permitted within the building perimeter.
 - b) Granular 'A' for this project is to exclude Reclaimed Concrete Material.
 - c) Granular 'B' may contain 100% by mass Reclaimed Concrete Material.
6. Crushed Stone – Clean, screened crushed stone, well graded in size between 3/8" and 3/4", with sufficient angular particles rather than round, to ensure proper compaction.
7. Granular Materials – shall be free draining and not susceptible to frost action as

determined by current O.P.S.S. Standards.

8. Site Excavated Materials – The use of site excavated materials are restricted as follows:
 - a) Site excavated materials are not suitable for use as fill within the building nor as fill for exterior areas susceptible to frost or settlement, such as the exterior sidewalk/unit pavers area between the main entrance and the east end of the bridge.
 - b) Except as previously noted site excavated materials subject to approval of the geotechnical consultant may be used as backfill 1500mm (5'-0") and further beyond the building's exterior measured from exterior face of foundations/grade beams.
9. Submit representative samples of each class of proposed material to the Inspection Company for testing and approval for use on this project. Mark samples as to source of supply, including pit locations.
10. Supply only those materials approved for use on this project by the Inspection Company.
11. Grout – Sand/cement dry pack mixture.
12. Blinding Layer – “Chips and Dust” by product of crushed stone production

2.02 FABRICATION

1. Mixing, transporting, placing, curing and protection of concrete in accordance with CSA – A23.
2. Job mixed concrete will not be allowed on this project.
3. Provide mixed-in-transit, ready-mixed concrete in accordance with CSA Standard A23.1, obtained from a supplier approved by the Consultant for use on this project.
4. Mix all concrete with materials so graded and proportioned to produce a plastic mass of such consistency that it will flow slowly under its own weight and which can be readily worked into corners of forms and under and around reinforcing without forming voids or honeycombed surfaces.
5. Furnish to the Contractor, a ‘delivery ticket’ for each batch of concrete delivered to the site, which shall be kept on record for the inspection of the Consultant. Each ticket shall show the following:
 1. Date and truck number
 2. Contractor's name
 3. Job designations
 4. Specified concrete strength, slump, and air
 5. Content and admixtures
 6. Batch volumes
 7. Time of batching

6. The compressive strength of all concrete is to be determined from test cylinders made in accordance with and at the frequency specified by CSA Standard A23.2.
7. Minimum concrete truckload 1-1/2 m³.
8. All reinforcing steel to be provided and bent by a supplier approved by the Consultant.
9. Fabricate reinforcing to C.S.A. Standard CSA-A23.1.
10. Fabrication tolerances for reinforcing steel to >Reinforcing Steel Manual of Standard Practice= by Reinforcing Steel Institute of Canada.
11. Obtain Consultant=s approval for location of reinforcement splice if different than shown on structural drawings.
12. Ship bundles of bar reinforcement, clearly identified in accordance with bar list.
13. Welding in accordance with current C.S.A. Standard W186. Both the welding company and the welder performing the welding are to be fully certified by the C.W.B. for the type of welding being performed.
14. Supply **all** necessary slab bolsters, high chairs, support bars, blocking and other accessories necessary for the proper placing and support of reinforcing.

2.03 SOURCE QUALITY CONTROL

1. All materials shall be subject to test and inspection by a Testing and Inspection Company appointed by the Consultant.
2. Cost of testing will be paid from the Testing and Inspection Cash Allowance, in accordance with Section 0101.
3. Provide access to pits or quarries for the personnel of the Inspection Company.
4. Provide representative samples of materials as may be required by the Inspection Company at no additional cost to the Owner.

PART 3: EXECUTION

3.01 PUMPING AND DEWATERING

1. Keep all excavations, pits and trenches free from accumulations of water from all sources, including ground water, rain and surface water at all times.
2. To divert surface water from excavation provide berms or open trench and local sumps.

3. Local groundwater infiltration can be accommodated using conventional sump pumping techniques.
4. Maintain temporary dewatering for the duration of the construction schedule until permanent drainage systems have been completed.
6. Provide settling area as required. Do not allow silt contaminated run-off into sewers or ditches.

3.02 SITE PREPARATION

1. Slab on grade, is to be founded on imported compacted granular “B”, placed over proof rolled subgrade, below the 225mm of clear crushed stone. Prior to placing granular backfill, remove all fill material below new Slab on grade and backfill with imported Granular ‘B’ compacted to 100% standard proctor dry density over approved proofed rolled native subgrade.
2. Use smooth edge bucket for excavation.
3. Remove all topsoil, loose soils and/or other deleterious materials from the entire building site.
5. Notify the Testing Company when the excavation is completed so that exposed surfaces may be inspected.
5. Use smooth edge bucket for final 1000 mm of excavation.
6. Notify the Testing Company when the excavation is completed so that exposed surfaces may be inspected.

3.03 EXCAVATION FOR FOOTINGS

1. In general, all footings and concrete underpinning to be founded on approved undisturbed native soil as shown on the drawings or as directed on site by the geotechnical engineer. Excavations should be carried out with a smooth blade bucket to minimize disturbance to the native materials.
2. Footings are to be founded on undisturbed native soil, with a Serviceability Limit State (SLS) bearing resistance of 200 kPa (4177PSF) and an Ultimate Limit State (ULS) bearing resistance of 300 kPa (6265PSF).
4. Notify the Consultant of any unusual soil conditions encountered during excavation so that corrective action may be taken if necessary.
5. Do not excavate below the water table until provisions are made to control the in flow. Refer to the Geotechnical Investigation for recommendations.
6. Where excavations for footings are accidentally over-excavated, fill the over-

excavated portion with lean concrete fill to the founding elevation shown on the plans, at no additional cost to the Owner.

7. Provide excavations for footings of sufficient width for the construction and inspection of formwork and the satisfactory and safe execution of the work. In general, provide not less than 400 millimeters clear of all construction.
8. Stockpile site excavated materials for general landscaped use in non-sensitive locations or removal from site. **Excavated material cannot be stockpiled in areas adjacent to the existing building basement foundation walls or atop the existing services tunnels. All unused excavated materials to be removed from site.**
9. Use smooth edge bucket for final 1000 mm of excavation.
10. Trim the bottom of all excavations true to line and grade, and remove all loose, wet, soft, or unsatisfactory material. If mud slabs are required, increase depth of footing excavation by the thickness of the mud slab.
11. Notify the Testing Company when each phase of the excavation is completed so that bearing surfaces may be inspected.

3.04 PROTECTION OF EXCAVATIONS, SERVICES & ADJACENT STRUCTURES

1. Protect all footing excavations against penetration of frost and damage from moisture before, during, and after the placement of concrete.
2. Protect adjacent construction and underground services from damage resulting from the work of this Section and from frost penetration. Exercise particular care when operating in the vicinity of the existing buildings
3. Provide a 50 mm mud slabs below all footings and grade beams. Allow for additional excavation to maintain the specified footing thickness.

3.05 BACKFILL AND COMPACTION OF FOOTINGS

1. After the construction of footings, pits, walls, grade beams or piers and the approval of the work by the Consultant, backfill and compact with free draining granular 'B', to the elevations shown on the drawings.
2. Immediately prior to placing granular 'B', proof roll sub-grade under the supervision of the geotechnical consultant and remove all soft and loose materials, sub-excavate any soft spots and/or deleterious materials and replace with compacted Class 'B'. Take care not to damage underground works.
3. All backfill materials are to be free draining compacted granular material. Non-granular materials are not acceptable inside or outside of the building.
2. For foundation walls backfilled from both sides, place and compact granular 'B' in

uniform lifts not exceeding 200 millimeter (loose measurement) in depth so that the difference in height of the compacted backfill from one side of the wall to the other does not exceed 400 millimeters.

3. For foundation walls backfilled from one side, place and compact free draining granular 'B' material after installation of weeping tile and foundation water proofing and protection board, not exceeding 200 millimeter (loose measurement) in depth so that the difference in height of the compacted backfill from one side of the wall to the other does not exceed 400 millimeters up to the within 400 of the finished floor level. Proceed with exterior backfill in uniform lifts not exceeding 200 millimeter (loose measurement) in depth with free draining granular 'B' materials
4. Deposit and spread granular materials in uniform layers not exceeding 200 millimeter (loose measurement) in depth.
5. Compact all granular materials to not less than 100% of Standard Proctor Density, except as noted. Maintain optimum water content for proper compaction by the addition of water as required.
6. Compact using approved vibratory plate tampers or vibratory rollers, except when working close to silt or other materials, which may be adversely affected by vibration in which case use approved non-vibratory rollers to avoid disturbance of the sub-grade.
7. Do not compact adjacent to walls with earth on one side (basement walls) any closer than 2100mm (7'-0") with heavy equipment. Use hand controlled compaction equipment within this zone.

3.06 SUB-FLOOR GRANULAR FILL GENERAL.

1. Proof roll the exposed existing subgrade, under the direct supervision of the Testing Company. Excavate any soft or weak areas of fill as directed by the Testing Company and backfill with imported Granular 'B' compacted to 100% standard proctor dry density.
2. Place and compact granular 'B' in uniform lifts not exceeding 200 millimeter (loose measurement) in depth to raise grade to within 225 millimeter of the underside of the slab on grade.
3. Place and compact 225 millimeters of 19 millimeter clear crushed stone under the slab-on-grade.
4. Compact using mechanical vibrating plate tampers to 100% of Standard Proctor Density.
5. Take care not to damage any under floor mechanical systems or drains.
6. Grade smooth and level ready for placing the vapour barrier.

7. Remove clay, silt, dirt and construction debris from the granular layer and replace any contaminated material before the under slab vapour protection is placed.

3.08 ROUGH GRADING

1. Rough grade outside the foundation walls (where applicable) to the lines and grades shown on the final site plan.
2. Rough grade to underside of granular base shown on the site services, civil or landscape drawings below the exterior sidewalks and roadways adjacent to foundation and or retaining walls.
3. Areas to receive sod or seeding shall be rough graded to the elevation shown on the site services, civil or landscape drawings.
4. Slope ground so that water will be directed away from the building.
5. Rough graded areas shall be cleanly raked free of coarse material and left ready for final grade.

3.09 FIELD QUALITY CONTROL

1. All materials and workmanship shall be subject to test and inspection by a Testing and Inspection Company appointed by the Consultant.
2. The cost of testing except as required in Paragraph 3.5 will be paid for by the Owner in accordance with the General Conditions.
3. Material or workmanship which fails to achieve the specified standards shall be re-compacted or replaced as directed by the Consultant and additional tests made. The cost of such additional testing and the cost of remedial action shall be at no additional cost to the Owner.
4. Provide access to the founding elevation of the caissons for the inspector and take any necessary precautions for his protection.

3.10 CLEAN UP

1. At the completion of the work in this Section, remove from the site any excess materials, debris and equipment.

END OF SECTION