Project Manual for the

Construction of the

ADDITION TO NOTRE DAME CATHOLIC SCHOOL

at

140 Atlantis Road
Orillia, Ontario

for

Simcoe Muskoka Catholic District School Board
46 Alliance Boulevard
Barrie, Ontario

Owner's Project No.: P00777
SAi Project No.: 2502

Owner's RFT No.: T-26-45

snyderarchitects
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Toronto, Ontario M4M 3H3
Telephone: 416.966.5444

1 General

1.1 OWNER

.1 Owner for the Project is:

Simcoe Muskoka Catholic District School Board
46 Alliance Boulevard
Barrie, Ontario
L4M 5K3

1.2 CONSULTANTS

.1 Document Responsibility: Refer to Section 00 01 10 - Table of Contents for indication of document responsibility. Abbreviations for entity responsible for document preparation are as indicated below in parentheses.

.2 The following firms comprise the Consultant team for the Project:

.1 Architect (A)

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Telephone: 416.966.5444

.2 Designated Substance Abatement Consultant (DS)

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130 Saunders Road, Unit 13
Barrie, Ontario
L4N 9A8
Telephone: 905.624.2722

.3 Hardware Consultant (H)

Upper Canada Specialty Hardware
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East York, Ontario
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Telephone: 416.696.8358

.4 Structural Engineer (S)

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Toronto, Ontario
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Telephone: 647.964.9444

.5 Mechanical Engineer (M)

RDZ Engineers Ltd.
30 Pennsylvania Avenue, Unit 17A
Vaughan, Ontario
L4K 4A5
Telephone: 647.674.9656

.6 Electrical Engineer (E)

RDZ Engineers Ltd.
30 Pennsylvania Avenue, Unit 17A
Vaughan, Ontario
L4K 4A5
Telephone: 647.674.9656

.7 Landscape Architect (L)

HKLA
230 Westney Road, Suite 308
Ajax, Ontario
L1S 7P9
Telephone: 905.839.5599

.8 Civil Engineer (C)

Flora Designs, Inc.
1109 Britannia Road East
Mississauga, Ontario
L4W 3X1
Telephone: 647.496.8055

END OF DOCUMENT

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP — **Document Responsibility**

Division 00 - Procurement and Contracting Requirements

Introductory Information

00 01 03 Project Directory . . . . . A
00 01 10 Table of Contents . . . . . A
00 31 00 Available Project Information. . . . . A

Contracting Requirements

Supplementary Conditions & Amendments to Standard Construction Document
CCDC2-2020 Stipulated Price Contract (the "Supplementary Conditions") . . . . . Owner

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 01 - General Requirements

01 10 00 Summary of Work . . . . . Owner
01 21 00 Allowances . . . . . Owner
01 26 00 Changes in the Work. . . . . Owner
01 29 00 Payment Procedures. . . . . Owner
01 30 00 Administrative Requirements . . . . . Owner
01 32 33 Photographic Documentation . . . . . Owner
01 40 00 Quality Requirements and Inspection & Testing . . . . . Owner
01 41 00 Regulatory Requirements . . . . . Owner
01 41 10 Health & Safety Guidelines for Work in Occupied Buildings . . . . . Owner
01 42 00 References . . . . . Owner
01 50 00 Temporary Controls and Facilities. . . . . Owner
01 51 16 Temporary Fire Control . . . . . Owner
01 57 19 Temporary Environmental Controls . . . . . Owner
01 61 00 Common Product Requirements. . . . . Owner
01 70 00 Execution Requirements . . . . . Owner
01 74 00 Cleaning and Waste Management . . . . . Owner
01 77 00 Closeout Procedures. . . . . Owner
01 78 00 Closeout Submittals . . . . . Owner
01 91 29 Integrated System Testing of Fire Protection and Life Safety Systems . . . . . A

FACILITY CONSTRUCTION SUBGROUP

Division 02 - Existing Conditions

02 41 19 Selective Demolition . . . . . A

Division 03 - Concrete

03 10 00 Concrete Forming and Accessories . . . . . S
03 20 00 Concrete Reinforcing. . . . . S
03 30 00 Cast-in-Place Concrete . . . . . S
03 35 46 Concrete Topical Treatments . . . . . A

Division 04 - Masonry

04 05 00 Common Work Results for Masonry. . . . . A
04 05 10 Masonry Mortaring and Grouting. . . . . A
04 05 19 Masonry Anchorage and Reinforcing . . . . . A
04 05 23 Masonry Accessories . . . . . A
04 22 00 Concrete Unit Masonry . . . . . A

Division 05 - Metals

05 12 23 Structural Steel for Buildings . . . . . S
05 21 00 Steel Joist Framing . . . . . S
05 31 00 Steel Decking . . . . . S
05 40 00 Cold-Formed Metal Framing . . . . . A
05 50 00 Metal Fabrications . . . . . A

Division 06 - Wood, Plastics and Composites

06 10 00 Rough Carpentry . . . . . A
06 16 43 Gypsum Sheathing . . . . . A
06 20 00 Finish Carpentry . . . . . A
06 24 00 High Pressure Decorative Laminate . . . . . A
06 41 00 Architectural Wood Casework . . . . . A

Division 07 - Thermal and Moisture Protection

07 13 26 Self-Adhering Sheet Waterproofing . . . . . A
07 21 00 Thermal Insulation . . . . . A
07 21 19.13 Foamed-in-Place Urethane Insulation . . . . . A
07 26 00 Vapour Retarders . . . . . A
07 26 16 Below-Grade Vapour Retarders . . . . . A
07 27 00 Air Barriers . . . . . A
07 41 13 Metal Roof Panels . . . . . A
07 42 93.13 Extruded Aluminum Soffit Panels . . . . . A
07 42 93.23 Linear Metal Soffits . . . . . A
07 51 00 Built-Up Bituminous Roofing . . . . . A
07 62 00 Sheet Metal Flashing and Trim . . . . . A
07 72 46 Roof Walkways . . . . . A
07 81 00 Applied Fireproofing . . . . . A
07 84 00 Firestopping . . . . . A
07 91 00 Preformed Joint Seals . . . . . A
07 92 00 Joint Sealants . . . . . A
07 92 21 Sprayed Foam Sealant . . . . . A
07 95 13 Expansion Joint Cover Assemblies . . . . . A

Division 08 - Openings

08 12 13 Hollow Metal Frames . . . . . A
08 13 13 Hollow Metal Doors . . . . . A
08 14 00 Wood Doors . . . . . A
08 31 00 Access Doors and Panels . . . . . A
08 41 13 Aluminum-Framed Entrances and Storefronts . . . . . A
08 44 13 Glazed Aluminum Curtain Wall . . . . . A
08 51 13 Aluminum Windows . . . . . A
08 71 00 Finishing Hardware . . . . . H
Openings & Hardware Schedules . . . . . H
08 80 00 Glazing . . . . . A

Division 09 - Finishes

09 21 16 Gypsum Board Assemblies . . . . . A
09 30 00 Tiling . . . . . A
09 51 23 Acoustical Tile Ceilings . . . . . A
09 65 13 Resilient Base and Accessories . . . . . A
09 65 19 Resilient Tile Flooring . . . . . A
09 81 00 Acoustic Insulation . . . . . A
09 90 00 Painting and Coating . . . . . A
09 96 46 Intumescent Painting . . . . . A

Division 10 - Specialties

10 11 00 Visual Display Surfaces . . . . . A
10 14 00 Signage . . . . . A
10 14 53 Traffic Signage . . . . . A
10 28 13 Toilet Accessories . . . . . A
10 56 13 Metal Storage Shelving . . . . . A

Division 11 - Not Used

Division 12 - Furnishings
12 24 13.16 Manual Roller Window Shades . . . . . A
12 93 00 Site Furnishings. L

Divisions 13 to 19 - Not Used

FACILITY SERVICES SUBGROUP
Division 20
20 05 01 Form of Supplementary Mechanical Tender . . . . . M
20 05 05 Mechanical Work General Instructions . . . . . M
20 05 10 Basic Mechanical Materials and Methods . . . . . M
20 05 20 Mechanical Vibration Control . . . . . M
20 05 25 Mechanical Insulation . . . . . M
20 05 30 Variable Frequency Drives . . . . . M
20 05 35 Demolition and Revision Work . . . . . M
20 05 40 Mechanical Commissioning . . . . . M
20 05 50 Testing, Adjusting and Balancing . . . . . M
20 05 55 Firestopping and Smoke Seal Systems . . . . . M

Division 21 - Fire Suppression
21 20 05 Fire Extinguishers . . . . . M

Division 22 - Plumbing
22 11 00 Domestic Water Piping and Specialties . . . . . M
22 13 00 Drainage and Vent Piping and Specialties . . . . . M
22 42 00 Plumbing Fixtures and Fittings . . . . . M

Division 23 - Heating, Ventilating and Air Conditioning
23 11 23 Natural Gas Piping System . . . . . M
23 21 00 Hydronic Piping Specialties and Pumps . . . . . M
23 23 00 Refrigerant Piping, Valves and Accessories . . . . . M
23 25 00 HVAC Water Treatment . . . . . M
23 30 00 HVAC Air Distribution . . . . . M
23 33 05 Silencers . . . . . M
23 34 00 HVAC Fans . . . . . M
23 36 00 Air Terminals . . . . . M
23 57 00 Heat Exchangers. . . . . M
23 70 00 Semi-Custom Rooftop Units . . . . . M
23 73 13 Custom Indoor Air Handling Units. . . . . M
23 81 29 Variable Refrigerant Flow HVAC Systems . . . . . M
23 82 00 Radiation Units . . . . . M
23 82 40 Motorized Heaters . . . . . M

Division 24 - Not Used

Division 25 - Integrated Automation
25 20 01 Building Automation System . . . . . M

Division 26 - Electrical
26 05 00 Form of Supplementary Electrical Tender. . . . . E
26 05 01 Electrical Work General Instructions . . . . . E
26 05 21 Wires and Cables . . . . . E
26 05 28 Grounding . . . . . E
26 05 31 Splitters, Junction, Pull Boxes and Cabinets. . . . . E
26 05 32 Outlet Boxes, Conduit Boxes and Fittings. . . . . E

26 05 33 Surface Raceways . . . . . E
26 05 34 Conduits, Conduit Fastenings and Conduit Fittings . . . . . E
26 05 40 Dual Hanger System . . . . . E
26 08 10 Access Panels . . . . . E
26 08 20 Electric Heating System . . . . . E
26 08 30 Pipe Tracing System . . . . . E
26 08 40 Building Automation System . . . . . E
26 08 50 Hand Dryers . . . . . E
26 09 24 Lighting Control Devices . . . . . E
26 24 16 Panel Boards . . . . . E
26 24 17 Power Panels . . . . . E
26 27 19 Classroom Control Panel Module . . . . . E
26 27 26 Wiring Devices . . . . . E
26 28 13 Fuses . . . . . E
26 28 23 Disconnect Switches - Fused and Non-Fused . . . . . E
26 29 01 Contactors . . . . . E
26 29 10 Motor Starters . . . . . E
26 50 00 Lighting . . . . . E

Division 27 - Communications
27 11 19 Structured Cabling for Communications Systems . . . . . E
27 51 16 Public Address System . . . . . E
27 51 20 Telephone System . . . . . E
27 53 13 Clock System . . . . . E

Division 28 - Electronic Safety and Security
28 31 00 Intrusion Detection System . . . . . E
28 31 01 Fire Detection and Alarm System Remote Monitoring . . . . . E
28 46 00 Fire Detection and Alarm System . . . . . E
28 46 01 Fire Detection and Alarm System Verification . . . . . E

Division 29 - Not Used

SITE AND INFRASTRUCTURE SUBGROUP
Division 30 - Not Used

Division 31 - Earthwork
31 11 00 Clearing and Grubbing . . . . . A
31 14 00 Earth Stripping and Stockpiling . . . . . A
31 22 13 Rough Grading . . . . . A
31 23 16 Excavation . . . . . A
31 23 23 Fill . . . . . A
31 23 33 Trenching and Backfilling . . . . . A

Division 32 - Exterior Improvements
32 11 23 Aggregate Base Courses . . . . . A
32 12 16 Asphalt Paving . . . . . A
32 13 13 Concrete L
32 16 13.21 Cast-in-Place Concrete Piers . . . . . A
32 17 23 Pavement Markings . . . . . A
32 18 16.16 Engineered Wood Fiber L
32 32 53.13 Armour Stone Seating L
32 92 23 Sodding and Topsoil L
32 93 00 Planting L

Division 33 - Utilities
33 46 00 Subdrain L

Divisions 34 to 39 - Not Used

PROCESS EQUIPMENT SUBGROUP
Divisions 40 to 49 - Not Used

END OF TABLE OF CONTENTS

1 General

1.1 STATUS OF AVAILABLE PROJECT INFORMATION

.1 Available Project information means information of any type and in any form that is expressly identified as available project information relevant to Place of the Work, that have been prepared by third-parties, and are intended strictly as additional information for consideration by Bidders.

.2 Unless stated otherwise in Owner's Request for Tender documents, no available Project information forms part of the Contract Documents unless copied or transcribed into Drawings or Specifications, or is expressly listed in the agreement as a Contract Document.

1.2 USE AND RELIANCE UPON AVAILABLE PROJECT INFORMATION

.1 Available Project information is made available to Bidders to fulfill Owner's duty to disclose all relevant Project information to Bidders.

.2 Bidders shall interpret and draw their own conclusions about available Project information, including consideration of the time when it was created. Available Project information may be time sensitive. Owner and Consultant assume no responsibility for such interpretations and conclusions.

.3 Available Project information, or any part thereof, shall not be construed as contract requirements unless also reflected in Drawings or Specifications, and in case of conflict, Drawings or Specifications shall govern.

.4 Bidders, acting reasonably, may rely on available Project information in preparing their bids, subject to any qualifications stated in such available Project information and unless expressly stated otherwise.

.5 Bidders are cautioned that such documents, by their nature, cannot reveal all conditions that exist or can occur at Place of the Work.

.6 Should conditions at Place of the Work, in Consultant's opinion, be found to substantially vary from those identified in available Project information, then changes in the Work may need to be made, with appropriate adjustments being made to Contract Price and Contract Time.

.7 Direct questions pertaining to available Project information by contacting issuing organization.

1.3 PROPERTY AND TOPOGRAPHIC SURVEYS

.1 A copy of a property survey with respect to Place of the Work is being made available as part of the Bid Documents; titled as follows:
Titled: PLAN OF SURVEY, (Showing Topographic Detail) of No. 140 Atlantis Drive, PART OF LOT 5, CONCESSION 2, (Geographic Township of South Orillia) TOWNSHIP OF ORO-MEDONTE / CITY OF ORILLIA, COUNTY OF SIMCOE;
Dwg. No.: E-4152, (2 pages);
Dated: January 17, 2025;
Prepared by: Dearden and Stanton Ltd.

1.4 GEOTECHNICAL INVESTIGATION REPORTS

.1 A copy of a detailed geotechnical investigation report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Geotechnical Investigation, Proposed Addition to Notre Dame Catholic School, 140 Atlantis Drive, Orillia, Ontario;
Project No.: 2503918;
Dated: November 21, 2025;
Prepared by: GEI Consultants Canada Ltd.

.2 A copy of a detailed hydrogeological investigation report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Hydrogeological Investigation, Proposed Addition to Notre Dame Catholic School, 140 Atlantis Drive, Orillia, Ontario;
Project No.: 2503918;
Dated: December 5, 2025;
Prepared by: GEI Consultants Canada Ltd.

.3 A copy of a detailed soil characterization report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Soil Characterization Report, Proposed Addition to Notre Dame Catholic School, Orillia, Ontario;
Project No.: 2503918;
Dated: September, 2025;
Prepared by: GEI Consultants Canada Ltd.

.4 A copy of a salt impacted excess soil management technical memorandum with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Salt Impacted Excess Soil Management, Notre Dame Catholic School;
Project No.: 2503918;
Dated: May 25, 2026;
Prepared by: GEI Consultants Canada Ltd.

.5 A copy of a detailed shear wave velocity test report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Shear Wave Velocity Testing for Seismic Site Classification, Notre Dame Catholic School, 140 Atlantis Drive, Orillia, Ontario;
File No.: F-25424;
Dated: November 4, 2025;
Prepared by: Frontwave Geophysics Inc.

1.5 DESIGNATED SUBSTANCE SURVEYS AND AUDITS

.1 A copy of a designated substance audit report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Designated Substances and Hazardous Building Materials Assessment Report, P00777 - Addition & Building-Wide Renovations, Notre Dame Catholic School, 140 Atlantis Drive, Orillia, Ontario;
Project No.: 4-4250298;
Dated: January 6, 2026;
Prepared by: Safetech Environmental Limited.

.2 A copy of a designated substance audit report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Hazardous Building Materials Assessment (Pre-Construction), Mechanical Room 200 and Upper Roof Section, Notre Dame Catholic Elementary School, 140 Atlantis Drive, Orillia, Ontario;
File No.: 305470.028;
Dated: September 19, 2023;
Prepared by: Pinchin Ltd.

.3 Such reports identify locations and types of designated substances found to be present at Place of the Work, and may include recommendations for their safe removal and disposal.

.4 Conditions at Place of the Work identified in the reports are relevant only at time of survey.

.5 The condition of some building materials may have changed.

.6 Items discovered during the execution of the Work that are not itemized within the reports should be analytically tested by an accredited laboratory before further disturbance.

1.6 EXISTING UTILITY SERVICE REPORTS

.1 A copy of a fire hydrant flow test checklist with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Fire Hydrant Flow Test Checklist, 140 Atlantis Drive, Orillia, Ontario;
Dated: May 26, 2025;
Prepared by: The OFS Group.

1.7 PAST USES ASSESSMENT REPORTS

.1 A copy of a detailed past uses assessment report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
Titled: Assessment of Past Uses, Proposed Addition to Notre Dame Catholic School, Orillia, Ontario;
Project No.: 2503918;
Dated: August, 2025;
Prepared by: GEI Consultants Canada Ltd.

1.8 DOCUMENTS DESCRIBING EXISTING FACILITY

.1 Documents describing existing facility are being made available as part of the Bid Documents.

.2 These documents were prepared by others, and neither Owner nor Consultant take responsibility for the accuracy of information, nor verify they represent actual conditions at Place of the Work.

END OF SECTION

SUPPLEMENTARY CONDITIONS & AMENDMENTS TO STANDARD CONSTRUCTION DOCUMENT CCDC2 -2020 STIPULATED PRICE CONTRACT

(the "Supplementary Conditions")

AGREEMENT, DEFINITIONS, AND

GENERAL CONDITIONS

The Standard Construction Document CCDC 2 2020 for a Stipulated Price Contract, English version, consisting of the Agreement Between *Owner* and Contractor, Definitions and General Conditions of the Stipulated Price Contract, Parts 1 to 13 inclusive, governing same, together with the changes with the new *Construction Act* is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications:

AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC1 ARTICLE A-1 – THE WORK

SC1.1	A-1.3	Amend Article A-1.3 by deleting all of the words after *"Contract Documents"* and replace them with the following" "attain .1 *Substantial Performance of the Work* by the __ day of _____ in the year 20__. .2 (if applicable) *Occupancy* by the __ day of _____ in the year 20__, and .3 *Ready-for-Takeover* by the __ day of _____ in the year 20__."

SC2 ARTICLE A-3 – CONTRACT DOCUMENTS

SC2.13	A-3.1	Add the following documents to the list of *Contract Documents* in Article A-3.1: • Simcoe Muskoka Catholic District School Board's Supplementary Conditions & Amendments to Standard Construction Document CCDC2-2020 Stipulated Price Subcontract, November 2020 Version, including any Special Supplementary Conditions listed in Appendix 2 thereto • *Drawings* • *Specifications* • Performance Bond (Form 32 -Performance Bond under Section 85.1 of the *Act*) • Labour and Material Payment Bond (Form 31 – Labour and Material Payment Bond under Section 85.1 of the *Act*)

SC3 ARTICLE A-4 – CONTRACT PRICE

SC3.1	A-4.4	Delete Article A-4.4 and replace it with the following: "4.4 The *Contract Price* shall remain fixed for the duration of the *Contract Time*, subject only to adjustments as provided for in the *Contract Documents*. For certainty, and without limiting the general application of the preceding sentence, the *Contractor* assumes all risks in connection with cost increases for overhead, *Products*, *Labour*, and *Construction Equipment* prescribed by the *Contract Documents* for the performance of the *Work*, and the *Contractor* assumes all responsibility for liabilities and additional costs that may arise as a result of the *Contractor's* inclusion of any *Product, Construction Equipment, Supplier*, or *Subcontractor* in its calculation of the *Contract Price*."

SC4 ARTICLE A-5 – PAYMENT

SC4.1	A-5.1	Delete Article A- 5.1 in its entirety including all subparagraphs and replace it with the following: "5.1 Subject to the provisions of the *Contract Documents* and the *Construction Act*, the *Owner* shall: .1 make progress payments to the *Contractor* on account of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payments, .2 upon *Substantial Performance of the Work* as certified by the *Consultant*, and on the 61st day after the publication of the certificate of *Substantial Performance of the Work*, in accordance with the *Construction Act*, there being no claims for lien registered against the title to the *Place of the Work* and no written notices of lien delivered to the *Owner*, pay the *Contractor* the unpaid balance of the holdback, together with such *Value Added Taxes* as may be applicable to such payment, less any amount stated in the *Owner's Notice of Non-Payment*. .3 after *Ready-for-Takeover* has been achieved in accordance with the *Contract Documents* and the *Work* is complete, there being no claims for lien registered against the title to the *Place of the Work* and no written notices of lien delivered to the *Owner*, pay the *Contractor* any unpaid balance of the *Contract Price* in accordance with GC 5.5 – FINAL PAYMENT, together with such *Value Added Taxes* as may be applicable to such payment."
SC 4.2	A-5.2.1	Delete subparagraph 5.2.1 in its entirety and replace it with the following: ".1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at the prejudgment interest rate prescribed by the *Courts of Justice Act* (Ontario), as it may change from time to time."

SC5 *NEW* ARTICLE A-9 – CONFLICT OF INTEREST

SC5.1	A-9	Add new ARTICLE A-9 CONFLICT OF INTEREST as follows: "**ARTICLE A-9 CONFLICT OF INTEREST** 9.1 The *Contractor*, *Subcontractors* and *Suppliers* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use. 9.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*. 9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner's* conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the

		Contract. 9.4 It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor or Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors and Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor or Supplier*, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor or Supplier* against the *Contractor*, where the payment to the *Subcontractor or Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the *Owner*, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor or Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor or Supplier* and the *Contractor* has been found liable for those claims. 9.5 Notwithstanding paragraph 7.1.2 of GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT, a breach of this Article A-9 by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity."

SC6 *NEW* ARTICLE A-10 TIME OF THE ESSENCE

SC6.13	Article A-10	Add the following new Article A-10 as follows: **"ARTICLE A-10 TIME OF THE ESSENCE** 10.1 It is agreed that one of the reasons the *Contractor* was selected by the *Owner* for this *Contract* is the *Contractor's* representation and covenant that it will attain *Substantial Performance, Occupancy (*if applicable), and *Ready-for-Takeover* within the *Contract Time* stated in Article A-1 of this *Contract*. 10.2 The *Contractor* acknowledges and agrees that it is responsible to marshal its resources and those of its *Subcontractors and Suppliers* in a manner which will permit timely attainment of *Substantial Performance, Occupancy (*if applicable), and *Ready-for-Takeover*. The *Contractor* agrees that time is of the essence of this *Contract*."

SC7 DEFINITIONS

Revisions to Existing Definitions		
SC7.1	Consultant	Amend the definition of "Consultant" by adding the following to the end of the definition: "For the purposes of the *Contract*, the terms "*Consultant"*, "*Architect*" and

		"*Engineer*" shall be considered synonymous."
SC7.2	Payment Legislation/Construction Act	Delete the Definition of *Payment Legislation* and replace it with "Construction Act" as follows: "**Construction Act** *Construction Act* means the *Construction Act*, R.S.O. 1990, c. C.30, as amended, including all regulations passed under it that are enforceable as of the date of execution of this *Contract*. For certainty, the first procurement process for the *Project* (*i.e.*, the "improvement" as that term is defined in the *Construction Act*) was commenced on or after October 1, 2019."
SC7.3	Ready-for-Takeover	Amend the Definition of *Ready-for-Takeover* by deleting all the words after "as verified" and replacing them with "and approved by the *Owner*."
New Definitions		
SC7.4	Adjudication	Add the following definition: "**Adjudication** *Adjudication* means construction dispute interim adjudication as defined under the *Construction Act*."
SC7.5	Annual Holdback	Add the following new definition: "**Annual Holdback** *Annual Holdback* means the accrued *Construction Act* holdback in respect of the *Work* performed by the *Contractor* during the year immediately preceding the applicable anniversary of the *Effective Date*. For example: • For Year 1 of the *Contract*, *Annual Holdback* will be calculated based on the *Work* performed during the one-year period following the *Effective Date*. • For Year 2 of the *Contract*, the *Annual Holdback* will be calculated based on the *Work* performed between the end of Year 1 and second anniversary of the *Effective Date*."
SC7.6	Close-Out Documentation	Add the following new definition: "**Close-Out Documentation** *Close-Out Documentation* has the meaning given to it under GC 5.4.5."
SC7.7	Confidential Information	Add the following definition: "**Confidential Information** *Confidential Information* means all the information or material of the *Owner* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the *Contractor* at any time, but *Confidential Information* shall not include information that: .1 is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public; .2 the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it

		to the *Contractor* free of any obligation of confidence; .3 the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or .4 is independently developed by the *Contractor* without use of any *Confidential Information*."
SC7.8	Construction Schedule	Add the following definition: "**Construction Schedule** *Construction Schedule* means the schedule for the performance of the *Work* provided by the *Contractor*, and approved by the *Owner*, pursuant to GC 3.4.1, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*."
SC7.9	Construction Schedule Update	Add the following definition: "**Construction Schedule Update** *Construction Schedule Update* means an update to the *Construction Schedule* by the *Contractor* using Microsoft Project (or other approved scheduling software) that accurately depicts the progress of the *Work* relative to the critical path established in the *Construction Schedule* approved in GC 3.5.1 (or any approved successor *Construction Schedule*), aligns with the currently approved date for *Substantial Performance of the Work*, shows up-to-date projected major activity sequences and durations, and shows any changes or delays in anticipated completion dates of major activities in the *Work* relative to the last *Construction Schedule Update,* and includes the following minimum deliverables: (a) a record version of the updated *Construction Schedule* in .pdf format; (b) an editable copy of the updated original digital file of the *Construction Schedule* (*e.g.*, .mpp format files for Microsoft Project)."
SC7.10	Deficiency Holdback	Add the following new definition: "**Deficiency Holdback** *Deficiency Holdback* has the meaning given to it under GC 5.8.1."
SC7.11	Direct Costs	Add the following definition: "**Direct Costs** *Direct Costs* are the reasonable costs of performing the contract or subcontract including costs related to the additional supply of services or materials (including equipment rentals), insurance and surety bond premiums, and costs resulting from seasonal conditions, that would not have been incurred, but do not include indirect damages suffered, such as loss of profit, productivity or opportunity, or any head office overhead costs."
SC7.12	Effective Date	Add the following definition: "**Effective Date** *Effective Date* means the date that the first payment certificate is issued by the *Consultant* for the *Project*, as set out in such payment certificate. For certainty, notwithstanding any of the date on the first page of the *Contract*, the date the *Contract* was signed by either party, the date of any letter of award

		issued by the *Owner* to the *Contractor*, or any other date set out in or related to the *Contract,* the "date on which the contract was entered into" for the purposes of section 26(2) of the *Construction Act* is the *Effective Date*."
SC7.13	EFT	Add the following definition: "**EFT** *EFT* has the definition given to it under GC 5.3.2."
SC7.14	Excess Soil	Add the following definition: "**Excess Soil** *Excess Soil* means "excess soil" as that term is defined under section 3 of the *Excess Soil Regulation*."
SC7.15	Excess Soil Regulation	Add the following Definition: "**Excess Soil Regulation** *Excess Soil Regulation* means O. Reg. 406/19: On-Site and Excess Soil Management to the *Environmental Protection Act,* R.S.O. 1990, c. E.19."
SC7.16	Final Pre-Invoice Submission Meeting	Add the following ne definition: "**Final Pre-Invoice Submission Meeting** *Final Pre-Invoice Submission Meeting* has the meaning given to it in GC 5.5.1."
SC7.17	Force Majeure	Add the following definition: "**Force Majeure** *Force Majeure* means any cause, unknown at the date first stated on the first page of the *Contract* and beyond either party's control, other than financial difficulties, bankruptcy or insolvency, which prevents the performance by a party, or both, of any of their respective obligations under the *Contract* and the event of *Force Majeure* did not arise from a party's default and could not be avoided or mitigated by the exercise of reasonable effort or foresight. *Force Majeure* includes *Labour Disputes*; fire; unusual delay by common carriers or unavoidable casualties; delays in obtaining third-party licences, permits, agreements, or approvals (excluding approvals of any *Subcontractors* or *Suppliers* of any tier); civil disturbance; emergency acts, orders, legislation, regulations or directives of any government or other public authority; acts of a public enemy; war; riot; sabotage; blockage; embargo; lightning; earthquake; adverse weather conditions but only if substantially beyond the weather norms of the *Place of the* Work; acts of God; or declared epidemic or pandemic outbreak or other public health emergency (*e.g*. SARS, COVID-19)."
SC7.18	Install	Add the following definition: "**Install** *Install* means install and connect. *Install* has this meaning whether or not the first letter is capitalized."
SC7.19	Labour Dispute	Add the following definition: "**Labour Dispute**

		Labour Dispute means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the *Work*."
SC7.20	**Notice of Annual Release of Holdback**	Add the following definition: "**Notice of Annual Release of Holdback** *Notice of Annual Release of Holdback* means the notice of annual release of holdback (Form 6) under the *Construction Act*."
SC7.21	Notice of Non-Payment	Add the following definition: "**Notice of Non-Payment** *Notice of Non-Payment* means a notice of non-payment (Form 1.1) under the *Act*, as applicable to the circumstances."
SC7.22	OHSA	Add the following definition: "**OHSA** *OHSA* means the *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1, as amended, including all regulations thereto."
SC7.23	Overhead	Add the following definition: "**Overhead** *Overhead* means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs."
SC7.24	Payment Period	Add the following definition: "**Payment Period** *Payment Period* has the definition given to it under GC 5.2.1."
SC7.25	Pre-Invoice Submission Meeting	Add the following definition: "**Pre-Invoice Submission Meeting** *Pre-Invoice Submission Meeting* has the definition given to it under GC 5.2.1."
SC7.26	Proper Invoice	Add the following definition: "**Proper Invoice** *Proper Invoice* means a "proper invoice" as that term is defined in Section 6.1 of the *Act*, including the minimum requirements set out in Appendix "1" of the Supplementary Conditions."
SC7.27	Proper Invoice Submission Date	Add the following definition: "**Proper Invoice Submission Date** *Proper Invoice Submission Date* has the definition given to it under GC 5.2.2.1."

SC7.28	Request for Information (RFI)	Add the following definition: "**Request for Information (RFI)** *Request for Information* or *RFI* means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*."
SC7.29	Restricted Period	Add the following definition: "**Restricted Period** *Restricted Period* means the (inclusive) period of time between December 1 to January 8 and August 15 to September 15 of any given year throughout the duration of the *Contract*."
SC7.30	**Unpaid Balance of the Holdback**	Add the following new definition: "**Unpaid Balance of the Holdback** *Unpaid Balance of the Holdback* means the amount equal to the difference between the sum of all *Annual Holdback* paid to the *Contractor* prior to *Substantial Performance of the Work,* and the total *Construction Act* holdback required to be maintained under the *Contract* (*i.e.*, 10% of the value of the *Work* as actually performed under the *Contract*)."

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

Where a General Condition or paragraph of the General Conditions of the *Contract* is deleted by these amendments, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, unless stated otherwise herein, and the numbering of the deleted item will be retained, unused.

PART 1 GENERAL PROVISIONS

SC8 GC 1.1 CONTRACT DOCUMENTS

SC8.1	1.1.3	Delete GC 1.1.3 in its entirety and replace it with the following: "1.1.3 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in GC 3.13.1. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this GC 1.1.3, the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care."
SC8.2	1.1.4	Delete GC 1.1.4 in its entirety and replace it with the following: "1.1.4 Except for the obligation to complete the review prescribed in GC 1.1.3, and report the results as set out in this GC 1.1.4, the *Contractor* is not responsible for errors, omissions or inconsistencies in the *Contract Documents*. If there are errors, omissions or inconsistencies discovered by or made known to the *Contractor* as part of its review under GC 1.1.3 or at any time during the performance of the *Work*, the *Contractor* shall immediately notify the *Consultant*, and request instructions, a *Supplemental Instruction*, *Change Order*, or *Change Directive*, as the case may require, and shall not proceed with the *Work* affected until the *Contractor* has received corrected or additional information from the *Consultant*.

		The *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of care and skill described in GC 3.13."
SC8.3	1.1.5.1	Delete GC 1.1.5.1 and replace with the following: ".1 the order of priority of documents, from highest to lowest, shall be: .1 Supplementary Conditions; .2 the Agreement between the Owner and the Contractor; .3 the Definitions; .4 the General Conditions; .5 Division 01 of the *Specifications* .6 technical *Specifications;* .7 material and finishing schedules; and .8 the *Drawings*.
SC8.4	1.1.5.5	Delete GC 1.1.5.5 and replace with the following: ".5 Noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings.*"
SC8.5	1.1.5.6 to 1.1.5.8	Add the following new GC 1.1.5.6 to 1.1.5.8 as follows: ".6 Finishes in the room finish schedules shall govern over those shown on the *Drawings.* .7 Architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the *Consultant* or its sub-*Consultants* are to remain with each of the applicable drawing disciplines. .8 Should reference standards contained in the *Specifications* conflict with the *Specifications*, the *Specifications* shall govern. Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern."
SC8.6	1.1.9	Add the following to the end of GC 1.1.9: "The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* with respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment, outlets and other elements. The *Contractor* shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the *Drawings,* including *Shop Drawings* and shall become familiar with conditions and spaces affecting those matters before proceeding with the *Work.* Where site conditions require reasonable minor changes where the change requires only the additional labour two hours or less, the *Contractor* shall make such changes at no additional cost to the *Owner.* Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work.* The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The

		schedules are those portions of the *Contract Documents*, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables and/or lists.”
SC8.7	1.1.12	Add new paragraphs 1.1.12 and 1.1.13 as follows: “1.1.12 The *Consultant*, on behalf of the *Owner* shall provide the *Contractor* without charge, twelve (12) copies of the *Contract Documents*, exclusive of those required by jurisdictional authorities and the executed *Contract Documents*. Additional copies can be purchased by the *Contractor* at the *Consultant’s* cost of reproduction, handling and sales tax. 1.1.13 The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, contemplated *Change Orders*, *Change Orders*, *Change Directives*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, submittals, reports and records of meeting at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*.”

SC9 GC 1.3 RIGHTS AND REMEDIES

SC9.1	1.3.2	In paragraph 1.3.2 delete the word “No” from the beginning of the paragraph and replace it with the words: “Except with respect to the requirements set out in paragraphs 6.4.1, 6.5.4, 6.6.1 and 8.3.2, no…”

SC10 *NEW* GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

SC10.1	1.5	Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows: “**GC 1.5 EXAMINATION OF DOCUMENTS AND SITE** 1.5.1 The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a Contract with the *Owner* for the performance of the *Work*, it has investigated for itself the character of the *Work t*o be done, based on information generally available from a visit to the *Place of the Work* and to the standard set out under GC 3.14.1 and further represents and warrants and acknowledges that it considered and took into account in the *Contract Price* all reasonably known impacts and restrictions arising from the COVID-19 pandemic, including without limitation corresponding legislative changes that may impact performance of the *Project*, various weather conditions that may affect the *Work*, the availability of supplies and labour or other conditions or risks that the *Contractor* knew about or reasonably ought to have known about prior to the date of the *Contract.* The *Contractor* has assumed and does hereby assume all risk of known conditions now existing or arising in the course of the *Work* which might or could make the Work, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the *Contract* signed. 1.5.2 The *Contractor* also declares that prior to commencement of the *Work*, where in tendering for the *Work* and in entering into this *Contract*, the *Contractor* relied upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the Work, the Contractor shall review to the standard specified in GC 3.14.1, the accuracy of the information furnished by the *Owner*. If a condition is materially different than what is stated in the information furnished by the *Owner*, the *Contractor* shall, no later than five (5) *Working Days* after the first observation of such condition(s), deliver to the *Owner* and to the *Consultant* a *Notice in Writing* specifying the materially different condition and the *Contractor* shall not proceed with the affected part of the Work

		until receiving written direction from the *Owner* or the *Consultant*. Where the *Contractor* fails to provide prompt *Notice in Writing* in accordance with this GC 1.5.2, the *Contractor* expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*.

PART 2 ADMINISTRATION OF THE CONTRACT

SC11 GC 2.2 ROLE OF THE CONSULTANT

SC11.13	2.2.5	Delete paragraph 2.2.4 and replace it with the following: "2.2.4 Upon receipt of an application for payment that satisfies the requirement of a *Proper Invoice*, based on the *Consultant's* observations and evaluation of the *Contractor's* application for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 - PAYMENT, GC 5.3 - PAYMENT, GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK, and GC 5.5 - FINAL PAYMENT. If the *Consultant* determines that the amount payable to the *Contractor* differs from the amount stated in a *Proper Invoice*, the *Consultant* shall notify the *Owner* as provided in GC 5.3.1.2 and prepare a draft of the applicable *Notice of Non-Payment* for the amount in dispute."
SC11.14	2.2.6	In the first sentence of paragraph 2.2.6, delete the words "Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER".
SC11.15	2.2.12	At paragraph 2.2.12, insert the following at end of that paragraph: "If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.12 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*."

SC12 GC 2.3 REVIEW AND INSPECTION OF THE WORK

SC12.1	2.3.2	Amend paragraph 2.3.2 by adding the words "and *Owner*" after the words "*Consultant*" in the second and third lines.
SC12.2	2.3.3	Delete paragraph 2.3.3 in its entirety and replace it with the following: "2.3.3 The *Contractor* shall furnish promptly two copies to the *Consultant* and one copy to the *Owner* of all certificates and inspection reports relating to the *Work*."
SC12.3	2.3.4	In paragraph 2.3.4 add the word "review" after the word "inspections" in the first and second lines of paragraph 2.3.4.
SC12.4	2.3.5	In paragraph 2.3.5 in the first line after the word "*Consultant*", add "or the *Owner*".
SC12.5	2.3.8	Add a new paragraph 2.3.8 as follows: "2.3.8 The *Consultant* will conduct periodic reviews of the *Work* in progress, to determine general conformance with the requirements of the *Contract Documents*. Such reviews, or lack thereof, shall not give rise to any claims by the *Contractor* in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the *Place of Work*, responsibility for which belongs exclusively to the *Contractor*."

SC13 GC 2.4 DEFECTIVE WORK

SC13.1	2.4.1	Amend GC 2.4.1 by inserting ", the *Owner* and/or its agent" in the first sentence following "rejected by the *Consultant*".
SC13.2	2.4.1.1 to 2.4.1.2	Add new paragraphs 2.4.1.1 and 2.4.1.2 as follows: "2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Consultant* and to the *Owner through the Consultant* all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*. 2.4.1.2 The *Contractor* shall prioritize the correction of any defective work, which, in the sole discretion of the *Owner through the Consultant*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*."
SC13.3	2.4.2	Delete paragraph 2.4.2 in its entirety and replace it with the following: "2.4.2 The *Contractor* shall promptly pay the *Owner* for costs incurred by the *Owner*, the *Owner's* own forces or the *Owner's* other contractors, for work destroyed or damaged or any alterations necessitated by the *Contractor's* removal, replacement or re-execution of defective work."
SC13.4	2.4.4	Add new paragraph 2.4.4 as follows: "2.4.4 Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor's* sole cost, even where such failure to identify, observe or warn is negligent."

PART 3 EXECUTION OF THE WORK

SC14 GC 3.1 CONTROL OF THE WORK

SC14.1	3.1.2	Amend paragraph 3.1.2 by inserting the words "Construction Schedule" after the word "sequences".
SC14.2	3.1.3 & 3.1.4	Add new paragraphs 3.1.3 and 3.1.4 as follows: "3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceedings with any part of the affected *Work*. 3.1.4 Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the *Owner* shall have access to the site at all times to monitor all aspects of construction. Such access shall in no circumstances affect the obligations of the *Contractor* to fulfill its contractual obligations."

SC15 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

SC15.1	3.2.2.1	Delete subparagraph 3.2.2.1 and replace it with "[Intentionally left blank]".

SC15.2	3.2.3.2	Delete subparagraph 3.2.3.2 and replace it with the following: ".2 co-ordinate and schedule the activities and work of other contractors and the *Owner's* own forces, including where other contractors or the Owner's own forces are used after the *Owner* and the *Contractor* cannot reach agreement on the value of a change, with the *Work* of the *Contractor* and connect as specified or shown in the *Contract Documents*."
SC15.3	3.2.3.4	Delete the period at the end of subparagraph 3.2.3.4 and replace it with a semi-colon.
SC15.4	3.2.3.5	Add new subparagraph 3.2.3.5 as follows: ".5 Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the *Place of the Work*, including all of the responsibilities of the "constructor", pursuant to the *OHSA*."

SC16 GC 3.3 TEMPORARY WORK

SC16.1	3.3.2	In paragraph 3.3.2, in the second line after the words "where required by law", insert "or by the *Consultant*".

SC17 GC 3.4 CONSTRUCTION SCHEDULE

SC17.1	3.4.1	Delete GC 3.4.1 in its entirety and replace it with the following: "3.4.1 The *Contractor* shall: 1 within five (5) calendar days of receiving written confirmation of the award of the *Contract*, prepare and submit to the *Owner* and the *Consultant* for their review and approval, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents.* Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule. The *Contractor* shall employ construction scheduling software, being the latest version of "Microsoft Project", that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide such schedule and any successor or revised schedules in both original digital file format (*e.g.,* .mpp format for Microsoft Project), portable data file (PDF) format, and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline "**Construction Schedule**"; .2 provide the expertise and resources, such resources including manpower and equipment, as are necessary on a best efforts basis to maintain progress under the accepted baseline *Construction Schedule* or revised construction schedule accepted by the *Owner* pursuant to GC 3.4 CONSTRUCTION SCHEDULE, which includes without limitation, the *Contractor*'s use of all possible and, if necessary, extraordinary measures, to bring the progress of the *Work* into compliance with the *Construction Schedule*, such as (i) increasing the presence of its own forces at the *Place of the Work*; (ii) directing any *Subcontractors* or *Suppliers* to increase their labour forces and equipment; (iii) working overtime and extra shifts; and (iv) providing any additional supervision and coordination of the *Project*, all at the *Contractor's* own cost and expense save and except where GC 6.5.1, 6.5.2, or 6.5.3 apply; and, .3 monitor the progress of the *Work* on a weekly basis relative to the baseline

		Construction Schedule, or any revised *Construction Schedule* accepted by the *Owner* pursuant to GC 3.4 CONSTRUCTION SCHEDULE, deliver a *Construction Schedule Update* to the *Consultant* and *Owner* with each application for payment, at a minimum, or as may be reasonably required by the *Consultant* and advise the *Consultant* and the *Owner* weekly in writing of any variation from the baseline or slippage in the schedule; and, .4 if after applying the expertise and resources required under paragraph 3.4.1.2, the *Contractor* forms the opinion that the slippage in schedule reported in paragraph 3.4.1.3 cannot be recovered by the *Contractor*, it shall, in the same notice provided under paragraph 3.4.1.3, indicate to the *Consultant* if the *Contractor* intends to apply for an extension of *Contract Time* as provided in PART 6 —CHANGES IN THE WORK; and, .5 ensure that the *Contract Price* shall include all costs required to phase or stage the *Work*." 3.4.2 If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to GC 3.4.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to GC 3.4.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within 5 calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to GC 3.4.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will recover the performance of the *Work* to align with the currently approved *Construction Schedule*. 3.4.3 The *Contractor* shall not amend the *Construction Schedule* without the prior written consent of the *Owner*.. Any revisions to the *Construction Schedule* approved by the *Owner* shall not be deemed to be an extension of the *Contract Time*. All requests by the Contractor for a revision to the Construction Schedule that include an extension to the *Contract Time* must be approved by the *Owner* through an executed *Change Order*."
SC17.2	3.4.2	Add new GC 3.4.2 and GC 3.4.3 as follows:

SC18 GC 3.5 SUPERVISION

SC18.1	3.5.1	Delete GC 3.5.1 and replace it with the following: "3.5.1 The *Contractor* shall employ a competent full-time superintendent, acceptable to the *Owner* and *Consultant*, who shall be in full time attendance at the *Place of the Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the Owner and the *Consultant*. The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner's* written notification, if the superintendent's performance is not acceptable to the *Owner*. The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the superintendent referred to in this GC 3.5.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours. ."
SC18.2	3.5.2	Delete GC 3.5.2 and replace it with the following: "3.5.2 The superintendent, and any project manager appointed by the *Contractor*, shall represent the *Contractor* at the *Place of the Work* and shall have full authority to act on written instructions given by the *Consultant* and/or the *Owner*. Instructions given to the superintendent or the project manager shall be deemed to have been given to the *Contractor* and both the superintendent and any project manager shall have full

		authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to the *Contract*."
SC18.3	3.5.3 to 3.5.6	Add new GC 3.5.3, 3.5.4, 3.5.5 and 3.5.6 as follows: "3.5.3 The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement, which is approved by the *Owner*. 3.5.4 The supervisory staff assigned to the *Project* shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the *Specifications,* and have a minimum 5 years documented "Superintendent/Project Management" experience. 3.5.5 The *Consultant and Owner* shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the *Project* prior to commencement of the *Work*. 3.5.6 A superintendent assigned to the *Work* shall be "Gold Seal Certified" as per the Canadian Construction Association; or a superintendent that can demonstrate the requisite experience and success related to the *Project* to the sole satisfaction of the *Owner*."

SC19 GC 3.6 SUBCONTRACTORS AND SUPPLIERS

SC19.1	3.6.1.1	In paragraph 3.6.1.1 add to the end of the second line the words "including any warranties and service agreements which extend beyond the term of the *Contract*."
SC19.2	3.6.1.2	In subparagraph 3.6.1.2 after the words "the *Contract Documents*" add the words "including any required surety bonding".
SC19.3	3.6.2	Delete paragraph 3.6.2. in its entirety and replace it with the following: "3.6.2 The substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor's* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner.* The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule."
SC19.4	3.6.7, 3.6.8, 3.6.9 & 3.6.10	Add new paragraphs 3.6.7, 3.6.8, 3.6.9, and 3.6.10 as follows: "3.6.7 The *Contractor* represents and warrants that it has confirmed the availability of its *Subcontractors* for the *Project* and, in particular, for the performance of their respective portions of the *Work* to ensure completion of the *Project* within the *Contract Price* and the *Contract Time*. 3.6.8 The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents or *Subcontractors*. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* or the *Owner*, as the case may be, at no cost to the *Owner*. 3.6.9 Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, and upon such assignment, the *Owner* shall have no further liability to any

		party for such contract. 3.6.10 The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor* thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts and the *Contractor* shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts."

SC20 GC 3.7 LABOUR AND PRODUCTS

SC20.1	3.7.1	Amend paragraph 3.7.1 by adding the words, "…, agents, *Subcontractors* and *Suppliers*…" after the word "employees" in the first line.
SC20.2	3.7.2	Delete paragraph 3.7.2 and substitute with the following: "3.7.2 *Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, provincial and municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever. The said *Products* shall be at the sole risk of the *Contractor*. Workmanship shall be, in every respect, first class and the *Work* shall be performed in accordance with the best modern industry practice."
SC20.3	3.7.4 to 3.7.8	Add new paragraphs 3.7.4, 3.7.5, 3.7.6, 3.7.7, and 3.7.8 as follows: "3.7.4 Upon receipt of a *Notice in Writing* from the *Owner,* the *Contractor* shall immediately remove from the *Place of the Work*, tradesmen and labourers or anyone whose conduct jeopardizes the safety of the *Owner's* operations or who are considered by the *Owner* or the *Consultant* to be unskilled or otherwise objectionable. Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement. . 3.7.5 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the *Work* at the *Place of the Work*, including cooperation to attempt to avoid *Work* stoppages, trade union jurisdictional disputes and other *Labour Disputes*. Any costs arising from labour disputes shall be at the sole expense of the *Contractor.* 3.7.6 The cost for overtime required beyond the normal *Working Day* to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or *Work* that the *Contractor* elects to perform at overtime rates without the *Owner* requesting it, shall not be chargeable to the *Owner*. 3.7.7 All manufactured *Products* which are identified by their proprietary names or by part or catalogue number in the *Specifications* shall be used by the *Contractor.* No substitutes for such specified *Products* shall be used without the written approval of the *Owner* and the *Consultant*. Substitutes will only be considered by the *Consultant* when submitted in sufficient time to permit proper review and

		investigation. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission any proposed change in the *Contract Price*. The *Contractor* shall use all proprietary *Products* in strict accordance with the manufacturer's directions. Where there is a choice of proprietary *Products* specified for one use, the *Contractor* may select any one of the *Products* so specified for this use. 3.7.8 Materials, appliances, equipment and other *Products* are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In such cases, the name of a manufacturer, distributor, *Supplier* or dealer is sometimes given to assist the *Contractor* to find a source *Supplier*. This shall not relieve the *Contractor* from its responsibility from finding its own source of supply even if the source names no longer supplies the *Product* specified. If the *Contractor* is unable to obtain the specified *Product*, the *Contractor* shall supply a substitute product equal to or better than the specified *Product,* as approved by the *Consultant* with no extra compensation. Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different Product, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*."

SC21 GC 3.8 SHOP DRAWINGS

SC21.1	3.8.1	Delete paragraph 3.8.1 in its entirety and replace with the following: "3.8.1 The *Contractor* shall provide shop drawings as described in the *Contract Documents* and as the *Consultant* may reasonably request."
SC21.2	3.8.3	Delete paragraph 3.8.3 and replace it with the following: "3.8.3 The *Contractor* shall prepare a *Shop Drawings* schedule acceptable to the *Owner* and the *Consultant* prior to the first application for payment. A draft of the proposed *Shop Drawings* schedule shall be submitted by the *Contractor* to the *Consultant* and the *Owner* for approval. The draft *Shop Drawings* schedule shall clearly indicate the phasing of *Shop Drawings* submissions. The *Contractor* shall periodically re-submit the *Shop Drawings* schedule to correspond to changes in the *Construction Schedule*."
SC21.3	3.8.5	Delete paragraph 3.8.5 in its entirety and substitute the following: "3.8.5 At the time of providing *Shop Drawings*, the *Contractor* shall advise the *Consultant* in writing of any deviations in *Shop Drawings* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance of such deviation expressly in writing. Where manufacturers' literature is submitted in lieu of scaled drawings, it shall be clearly marked in ink, to indicate the specific items for which review is requested."
SC21.4	3.8.8 to 3.8.12	Add new paragraphs 3.8.8, 3.8.9, 3.8.10, 3.8.11, and 3.8.12 as follows: "3.8.8 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*. 3.8.9 Except where the parties have agreed to a different *Shop Drawings* schedule pursuant to paragraph 3.10.3, the *Contractor* shall comply with the requirements for *Shop Drawings* submissions stated in the *Specifications*. 3.8.10 The *Contractor* shall not use the term "by others" on *Shop Drawings* or other submittals. The related trade, *Subcontractor* or *Supplier* shall be stated. 3.8.11 Certain *Specifications* sections require the *Shop Drawings* to bear the seal and

		signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the *Place of the Work* and shall have expertise in the area of practice reflected in the *Shop Drawings*. 3.8.12 The *Consultant* will review and return *Shop Drawings* and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The *Contractor* shall allow the *Consultant* a minimum of 10 *Working Days* to review *Shop Drawings* from the date of receipt. If resubmission of *Shop Drawings* is required, a further 10 *Working Day* period is required for the *Consultant's* review."

SC22 *NEW* GC 3.9 USE OF THE WORK

SC22.1	GC 3.9	Add new GC 3.9 – USE OF THE WORK as follows: "**GC 3.9 USE OF THE WORK** 3.9.1 The *Contractor* shall confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and operations of employees and *Subcontractors* to limits indicated by laws, ordinances, permits, by the direction of the *Owner* or the *Consultant*, or the *Contract Documents* and shall not unreasonably encumber the *Place of the Work*. 3.9.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the *Work*. 3.9.3 The *Owner* shall have the right to enter or occupy the *Place of the Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Substantial Performance of the Work*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the *Contractor* in the performance of the *Contract* within the *Contract Time.* Such entry or occupation shall neither be considered as acceptance of the *Work* or in any way relieves the *Contractor* from its responsibility to complete the *Contract*."

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SC23 *NEW* GC 3.10 CUTTING AND REMEDIAL WORK

SC23.1	GC 3.10	Add new GC 3.10 – CUTTING AND REMEDIAL WORK as follows: "**GC 3.10 CUTTING AND REMEDIAL WORK** 3.10.1 The *Contractor* shall perform the cutting and remedial work required to make the affected parts of the *Work* come together properly. Such cutting and remedial work shall be performed by specialists familiar with the *Products* affected and shall be performed in a manner to neither damage nor endanger the *Work*. 3.10.2 The *Contractor* shall coordinate the *Work* to ensure all cutting and remedial work required is kept to a minimum. 3.10.3 Unless specifically stated otherwise in the *Specifications*, the *Contractor* shall do all cutting and making good necessary for the proper installation and performance of the *Work.* 3.10.4 To avoid unnecessary cutting, the *Contractor* shall lay out its work and advise the *Subcontractors,* when necessary, where to leave holes for installation of pipes and other work."

SC24 *NEW* GC 3.11 CLEAN UP

SC24.13	3.11.1, 3.11.2, 3.11.3, 3.11.4, 3.11.5 & 3.11.6	Add new paragraphs 3.11.1, 3.11.2, 3.11.3, 3.11.4, 3.11.5, and 3.11.6 as follows: "3.11.1 The *Contractor* shall maintain the *Work* in a safe and tidy condition and free rom the accumulation of waste products and debris, other than that caused by the *Owner*, other contractors or their employees. The *Contractor* shall remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the *Work*. 3.11.2 Before applying for *Substantial Performance of the Work*, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, other contractors or their employees, and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*. The *Contractor* shall remove products, tools, materials, *Construction Equipment,* and *Temporary Work* not required for the performance of the remaining work. 3.11.3 As a condition precedent to submitting its application for final payment, the *Contractor* shall remove any remaining products, tools, materials, *Construction Equipment*, *Temporary Work*, and waste products and debris, other than those resulting from the work of the *Owner*, other contractors or their employees. 3.11.4 The *Contractor* shall clean up garbage during and after construction and maintain the *Place of the Work* in a neat and orderly condition on a daily basis. Prior to leaving the *Place of the Work* and following completion of the *Work*, the *Contractor* shall make good all damage to the building and its components caused by the performance of the *Work* or by any *Subcontractor* or *Supplier*. The *Contractor* shall leave the *Place of the Work* in a clean and finished state; remove all *Construction Equipment* and materials; remove all paint, stains, labels, dirt, etc. from the *Place of the Work*; and touch up all damaged painted areas (if applicable). The *Contractor* shall be responsible for restoring those areas of the *Place of the Work*, impacted by the *Work*, to their original condition." 3.11.5 Without limitation to or waiver of the *Owner's* other rights and remedies, the *Owner* shall have the right to back charge to the *Contractor* the cost of damage to the site caused by transportation in and out of the *Place of the Work* by the *Contractor*, *Subcontractors* or *Suppliers,* if not repaired before final payment. 3.11.6 The *Contractor* shall dispose of debris at a location and in a manner acceptable to the *Owner* (and to the authorities having jurisdiction at the *Place of the Work* and at the disposal area) and the *Contractor* shall cover containers with tarpaulins."

SC25 *NEW* GC 3.12 EXCESS SOIL MANAGEMENT

SC25.1	GC 3.12	Add new GC 3.12 – EXCESS SOIL MANAGEMENT as follows: "**GC 3.12 EXCESS SOIL MANAGEMENT** 3.12.1 The *Contractor* shall be solely responsible for the proper management of all *Excess Soil* at the *Place of the Work* and for performance of the *Work* in compliance with the rules, regulations and practices required by the *Excess Soil Regulation* until such time as *Ready-for-Takeover* is achieved. Without restricting the generality of the previous sentence, the *Contractor*'s responsibility under this GC 3.12 includes the designation, transportation, tracking, temporary and/or final placement, record keeping, and reporting of all *Excess Soil* in connection with the Work all in compliance with the *Excess Soil Regulation*. 3.12.3 The *Contractor* shall indemnify and save harmless the *Owner*, their agents,

		officers, directors, administrators, employees, consultants, successors and assigns from and against the consequences of any and all health and safety infractions committed directly by the *Contractor*, or those for whom it is responsible at law, under the *Excess Soil Regulation*, or any environmental protection legislation, including the payment of legal fees and disbursements on a substantial indemnity basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance."

SC26 *NEW* GC 3.13 CONTRACTOR STANDARD OF CARE

SC26.1	3.13	Add a new GC 3.13 – CONTRACTOR STANDARD OF CARE as follows: "**GC 3.13 CONTRACTOR STANDARD OF CARE** "3.13.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise the standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract,* the performance of the *Contractor's* obligations, duties and responsibilities shall be interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of care, skill and diligence in respect of any *Product*s, personnel or procedures which it may recommend to the *Owner* or employ on the *Project*. 3.13.2 The *Contractor* further represents, covenants and warrants to the *Owner* that: .1 the personnel it assigns to the *Project* are appropriately experienced; .2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation; and .3 there are no pending, threatened or anticipated claims, liabilities or contingent liabilities that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*."

PART 4 ALLOWANCES

SC27 GC 4.1 CASH ALLOWANCES

SC27.1	4.1.3	In GC 4.1.3 delete the words "through the *Consultant*" and replace them with "in writing."
SC27.2	4.1.4	Delete GC 4.1.4 in its entirety and replace it with the following: "4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, by the *Consultant* at the *Owner*'s direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents.*"
SC27.3	4.1.5	Delete GC 4.1.5 in its entirety and replace it with the following: "4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the

		Contract Price by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount."
SC27.4	4.1.8 and 4.1.9	Add new GC 4.1.8 and 4.1.9 as follows: "4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work* to be paid for from cash allowances. 4.1.9 Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor."*

PART 5 PAYMENT

SC28 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

SC28.1	5.1	Delete GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER and all paragraphs thereunder, including any reference to GC 5.1 throughout the *Contract*.

SC29 GC 5.2 APPLICATIONS FOR PAYMENT

SC29.1	5.2.1	Delete GC 5.2.1 and replace it with the following: "5.2.1 Upon execution of the *Contract*, and in any event prior to the *Contractor* submitting its first application for payment, the *Owner* shall issue a purchase order to the *Contractor* for the performance of the *Contract*. The number indicated on such purchase order must be clearly identifiable on all applications for payment. Applications for payment shall be dated the last day of each month or an alternative day of each month agreed to in writing by the parties, with each month representing one payment period under the *Contract* (each a "**Payment Period**"). Within 3 calendar days of the end of each *Payment Period*, the *Contractor* will submit a draft application for payment to the *Owner* and the *Consultant*. Upon receipt of the draft application for payment, and within 7 calendar days, a representative of each of the *Contractor*, *Owner*, and the *Consultant* shall attend a meeting to discuss and review the work completed during the *Payment Period*, including quantities, if applicable (the "**Pre-Invoice Submission Meeting**"). In the event that the scheduled date for the *Pre-Invoice Submission Meeting* is not a *Working Day*, the *Pre-Invoice Submission Meeting* shall occur on the next *Working Day*. The *Contractor* shall bring with it to the *Pre-Invoice Submission Meeting* the following: .1 a copy of the draft application for payment; .2 any documents the *Contractor* is required to bring to the *Pre-Invoice Submission Meeting* as stipulated in the *Contract Documents* or as reasonably requested by the *Owner*; and .3 any other documents reasonably requested, in advance, by the *Owner* or the *Consultant*."
SC29.2	5.2.2	Delete GC 5.2.2 in its entirety and replace it with the following: "5.2.2 Applications for payment shall be given in accordance with the following requirements: .1 Within 5 calendar days following the *Pre-Invoice Submission Meeting*, the *Contractor* shall deliver its application for payment to the *Owner* and to the *Consultant* for *Work* performed during the *Payment Period* ("**Proper Invoice**

		Submission Date") subject to the following: .1 if the fifth calendar day following the *Pre-Invoice Submission Meeting*, to which an invoice relates falls on a day that is not a *Working Day*, the *Proper Invoice Submission Date* shall be deemed to fall on the next *Working Day*. .2 The application for payment must be delivered to the *Owner* and to the *Consultant* in the same manner as a *Notice in Writing* during the hours of 9:00 am to 4:00pm (EST) on the *Proper Invoice Submission Date*. Delivery to the *Owner* shall be to the following email address: **accounting@smcdsb.on.ca** .3 If an application for payment is received after 4:00 p.m. (EST) on the applicable *Proper Invoice Submission Date*, the application for payment will not be considered or reviewed by the *Owner* and *Consultant* until the next *Proper Invoice Submission Date.* Notwithstanding the foregoing, the *Owner* in its sole and absolute discretion may elect to accept an application for payment submitted after 4:00 p.m. on the applicable *Proper Invoice Submission Date*; however, such acceptance shall not be construed as a waiver of any of its rights or waive or release the *Contracto*r's obligations to strictly comply with the requirements prescribed in this subparagraph 5.2.2.3. .4 No applications for payment shall be accepted by the *Owner* prior to the *Proper Invoice Submission Date*. .5 All applications for payment shall include all of the requirements for a *Proper Invoice* prescribed by the *Construction Act* and this *Contract* and be dated the last day of the applicable *Payment Period*;"
SC29.3	5.2.3	Delete GC 5.2.3 and replace it with the following: "5.2.3 The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered and incorporated into the *Work* as of the last date of the applicable *Payment Period*. Materials may also be deemed to be supplied to an improvement, for payment purposes, when, in the *Owner's* opinion, they are placed and properly secured on the land on which the improvement is made, or placed upon land designated by the *Owner* or agent of the *Owner*, but placing the materials on the land so designated does not, of itself, make that land subject to a lien. No amount claimed shall include products delivered and incorporated into the work, unless the products are free and clear of all security interests, liens and other claims of third parties. No amount claimed shall include *Products* delivered to the *Place of the Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties."
SC29.4	5.2.4	After the word "*Consultant*" in GC 5.2.4 add the words "and the *Owner*"
SC29.5	5.2.5	After the word "*Consultant*" in GC 5.2.5 add the words "or the *Owner*".
SC29.6	5.2.6	In GC 5.2.6, delete the word "*Consultant*" and replace it with "*Owner*".
SC29.7	5.2.9	Add new 5.2.9 as follows: "5.2.9 The *Contractor* shall prepare and maintain current as-built drawings which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant*

		shall recommend to the *Owner* that the *Owner* retain a reasonable amount for the value of the as-built drawings not presented for review."

SC30 GC 5.3 PAYMENT

SC30.1	5.3.1	Delete GC 5.3.1 in its entirety, including all subparagraphs thereunder, and replace it with the following: "5.3.1 After receipt by the *Owner* and the *Consultant* of an application for payment submitted by the *Contractor* in accordance with GC 5.2 - APPLICATIONS FOR PAYMENT: .1 the *Consultant* will either: (a) issue to the *Owner* with a copy to the *Contractor*, a progress payment certificate in the amount applied for by the *Contractor* in the *Proper Invoice*, or (b) issue to the *Owner*, with a copy to the *Contractor*, a certificate for payment for an amount determined by the *Consultant* to be properly due to the *Contractor* after applying any credits, withheld amounts, or other set-offs which the *Consultant* has determined that the *Owner* is entitled to notwithstanding any notice of dispute or disagreement that the *Contractor* may have served, along with the *Consultant's* reasons why an amount other than what is claimed in the *Proper Invoice* is properly due to the *Contractor*, which finding the *Owner* may accept or amend prior to the *Owner* issuing a *Notice of Non-Payment*, if any, in accordance with GC 5.3.2; .2 the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 PAYMENT, (a) in the amount stated in the certificate for payment, or (b) in the amount stated in the certificate for payment less such amount stated in the *Owner's Notice of Non-Payment* issued pursuant to GC 5.3.3, on the 28th calendar day after receipt of a *Proper Invoice*, unless such 28th calendar day lands on a day that is other than a *Working Day*, in which case payment shall be made on the next *Working Day* after such 28th day."
SC30.2	5.3.2 to 5.3.7	Add new paragraphs 5.3.2, 5.3.3, 5.3.4, 5.3.4, 5.3.5, 5.3.6, and 5.3.7 as follows: 5.3.2 All payments to the *Contractor* shall be processed using electronic funds transfer ("**EFT**") and deposited directly to the *Contractor's* bank account unless agreed to otherwise by the *Contractor* and the *Owner* in writing. Prior to the *Contractor* submitting its first application for payment, the *Owner* and the *Contractor* shall exchange such information as is necessary to facilitate *EFT* payments. 5.3.3 In the event that the application for payment delivered by the *Contractor* pursuant to GC 5.2 - APPLICATIONS FOR PAYMENT does not include the requirements for a *Proper Invoice* or where the *Owner* disputes the amount claimed as payable in the *Proper Invoice*, then the *Owner* shall within 14 calendar days of receipt of the application for payment, issue a *Notice of Non-Payment* (Form 1.1). 5.3.4 Where the *Owner* has delivered a *Notice of Non-Payment*, the *Owner* and the *Contractor* shall first engage in good faith negotiations to resolve the dispute. If within 5 calendar days following the issuance of a *Notice of Non-Payment*, despite good faith efforts by both parties and the assistance of the *Consultant*, the *Owner*

		and the *Contractor* cannot resolve the dispute, either party may commence an *Adjudication* in accordance with the procedures set out in the *Construction Act.* Any portion of the *Proper Invoice* which is not the subject of the *Notice of Non-Payment* shall be payable within the time period set out in GC 5.3.1.2. 5.3.5 Provided that the *Owner* complies with its obligations under the *Construction Act*, and subject to any interim determination of an adjudicator in accordance with any *Adjudication*, and where applicable, a final determination made in accordance with the dispute resolution processes prescribed by this *Contract*, the *Owner* shall be entitled to claim in a *Notice of Non-Payment* a right to deduct from or, set off against, any payment of the *Contract Price*: .1 any amount expended by the *Owner* in exercising the *Owner's* rights under this *Contract* to perform any of the *Contractor's* obligations that the *Contractor* has failed to perform; .2 any damages, costs or expenses (including, without limitation, reasonable legal fees and expenses) incurred by the *Owner* as a result of the failure of the *Contractor* to perform any of its obligations under the *Contract*; .3 any other amount owing from the *Contractor* to the *Owner* under this *Contract*. 5.3.6 The amounts disputed and described under the *Notice of Non-Payment* shall be held by the *Owner* until all disputed amounts of the *Proper Invoice* have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. 5.3.7 The *Contractor* represents, warrants, and covenants to the *Owner* that it is familiar with its prompt payment and trust obligations under the *Construction Act* and will take all required steps and measures to ensure that it complies with the applicable prompt payment and trust provisions under the *Construction Act* including, without limitation, section 8.1 of the *Construction Act*. Evidence of the *Contractor's* compliance under this GC 5.3.7, including evidence demonstrating that all *EFTs* by the *Owner* to the *Contractor* are kept in a bank account in the *Contractor's* name will be made available to the *Owner* within 5 *Working Days* following receipt by the *Contractor* of a *Notice in Writing* making such request."

SC31 GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK- AND PAYMENT OF HOLDBACK

SC31.1	GC 5.4	Delete GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK in its entirety and replace it with the following: "**GC 5.4 ANNUAL RELEASE OF HOLDBACK, SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK** 5.4.1 Within 20 calendar days, and not less than 10 calendar days, prior to each anniversary of the *Effective Date*, the *Contractor* shall submit an application for the annual release of holdback. The application for the annual release of holdback shall: .1 contain all of the requirements of a *Proper Invoice*, as such requirements are applicable to the annual release of holdback; .2 set out a description of the *Work* performed in the prior one-year period; .3 provide a full accounting of all amounts invoiced to the *Owner* and paid to the *Contractor* for *Work* performed during the period one-year period, and which: (a) identifies the *Work* performed by *Subcontractors* and *Suppliers*; and

(b) if applicable, prior *Annual Holdback* amounts paid to the *Contractor*;

.4 confirmation by the surety that it has been notified of the intent to claim for annual release of holdback, and that the surety does not object; and

.5 any other documentation reasonably requested by the *Owner* to assess the application for the annual release of holdback.

5.4.2 Following receipt of the *Contractor's* application for annual release of holdback in accordance with GC 5.4.1:

.1 the *Owner* may request, and the parties shall attend, a meeting with representatives of the *Contractor* and *Consultant* to review and discuss the application;

.2 the *Owner* may request clarification or additional information from the *Contractor*, which clarification or additional information shall be provided within 2 calendar days of the *Owner*'s request; and

.3 within 14 calendar days following each anniversary of the *Effective Date*, the *Owner* shall, in accordance with the *Construction Act,* publish a *Notice of Annual Release of Holdback*, setting out the amount of the *Annual Holdback* the *Owner* intends to pay, and the date on which the *Owner* intends to make such payment.

5.4.3 Following the 60th calendar day, and no later than the 74th calendar day following publication of the *Notice of Annual Release of Holdback*, the *Owner* shall make payment of the *Annual Holdback* amount set out in the applicable *Notice of Annual Release of Holdback*.

5.4.4 When the *Contractor* considers that *Substantial Performance of the Work* has been achieved, the *Contractor* shall prepare and submit to the *Consultant* and the *Owner* a comprehensive deficiency list of items to be completed or corrected, including any incomplete *Close-Out Documentation*, and apply for a review by the *Consultant* and the *Owner* to establish *Substantial Performance of the Work*. Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.

5.4.5 Prior to, or as part of its written application for *Substantial Performance of the Work* the *Contractor* shall submit to the *Consultant* submit to the *Consultant* all closeout documentation required by the *Contract Documents*, including but not limited to, warranties, manuals, guarantees, as-built drawings and all other relevant literature from suppliers and manufacturers including, but not limited to, where applicable (the "**Close-Out Documentation**"):

.1 equipment, maintenance, and operations manuals;
.2 equipment specifications, data sheets and brochures, parts lists and assembly drawings, performance curves and other related data;
.3 line drawings, value charts and control sheets sequences with description of the sequence of operations;
.4 warranty documents;
.5 guarantees;
.6 certificates;
.7 service and maintenance reports;
.8 *Specifications*;
.9 *Shop Drawings*;
.10 coordination drawings;
.11 testing and balancing results and reports;
.12 *Commissioning* and quality assurance documentation;

.13 distribution system diagrams;
.14 spare parts;
.15 samples;
.16 existing reports and correspondence from authorities having jurisdiction in the *Place of the Work*;
.17 inspection certificates;
.18 red-lined record drawings from the construction trailer in two copies and
.19 other materials or documentation required to be submitted under the *Contract.*

5.4.6 The *Consultant* will review the *Work* to verify the validity of the *Contractor's* application for *Substantial Performance of the Work* and shall promptly, and in any event no later than 30 calendar days after receipt of the *Contractor's* complete deficiency list and application take the following steps:

.1 Prepare a final deficiency list incorporating all items to be completed or corrected, including any incomplete or unsubmitted *Close-Out Documentation*. Each item shall have an indicated value for correction or completion. In establishing such values, the *Consultant* will apply the following rules:

(a) no individual deficiency will be valued at less than two hundred dollars ($200.00); and

(b) where two copies of the red-lined record drawings have not been submitted prior to or as part of the *Contractor's* application, an amount determined by the *Consultant* within the range of one-half percent (0.5%) and one percent (1%) of the *Contract Price* will be assigned to such incomplete *Work*.

The final deficiency list complete with values is to be included with the *Consultant's* draft verification and shall be reviewed with the *Owner* prior to the *Consultant* rendering a determination in accordance with GC 5.4.6.2.

.2 Having completed the requirements set out in GC 5.4.6.1,

(a) the *Consultant* shall advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or

(b) the *Consultant* shall state the date of *Substantial Performance of the Work* in a certificate and issue a copy of that certificate to each the *Owner* and the *Contractor.*

5.4.7 Following the issuance of the certificate of *Substantial Performance of the Work* referenced in subparagraph 5.4.6.2(b):

.1 The Contractor shall publish, in a construction trade newspaper in the area of the location of the Work, a copy of the certificate of S*ubstantial Performance of the Work* referred to in GC 5.4.6.2(b) within seven (7) calendar days of receiving a copy of the certificate signed by the *Consultant*, and the *Contractor* shall provide suitable evidence of the publication to the *Consultant* and the *Owner*. If the Contractor fails to publish such notice, the Owner shall be at liberty to publish said certificate and back-charge the Contractor its reasonable costs for doing so;

.2 The *Contractor* shall complete the *Work* within forty (40) calendar days of the date certified as the date of *Substantial Performance of the Work*;

.3 Notwithstanding any other provisions of the *Contract,* no payments will be processed between *Substantial Performance of the Work* and *Ready-for-Takeover*;

		.4 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within forty (40) days of *Substantial Performance of the Work* using, without limitation, the funds retained in accordance with GC 5.8 – DEFICIENCY HOLDBACK, without prejudice to any other right or remedy and without affecting the warranty period. The cost to the *Owner* of completing the *Work* including *Owner* and *Consultant* wages and materials shall be deducted from the *Contract Price.* 5.4.8 After publication of the certificate of the *Substantial Performance of the Work*, and provided that the *Contractor* has completed performance of the *Work* within the 40 calendar days following certification of *Substantial Performance of the Work*, the *Contractor* may submit an application for payment of the outstanding *Construction Act* holdback amount, which application for payment shall: .1 include all of the requirements listed in EXHIBIT "1" - PROJECT SPECIFIC REQUIREMENTS FOR A PROPER INVOICE, as applicable to the application for payment of the holdback amount; and .2 include a statement that the *Contractor* has not received any written notices of lien or any claims for liens from any *Subcontractor* or *Supplier.* 5.4.9 The *Unpaid Balance of the Holdback* amount shall become due and payable the day immediately following the expiration of the holdback period prescribed by the *Construction Act* (in most cases being the 61st calendar day following the publication of the certificate of *Substantial Performance of the Work* referred to in GC 5.4.7.1), subject to the occurrence of any of the following: .1 the preservation of a lien in respect of the *Project* that has not been satisfied, discharged or otherwise provided for in accordance with the *Construction Act*; or .2 receipt by the *Owner* of a written notice of lien that has not been satisfied, discharged or otherwise provided for in accordance with the *Construction Act*. 5.4.10 Notwithstanding the *Owner's* obligation to make payment of the holdback amount in accordance with GC 5.4.9, the processing of such payment remains subject to the *Owner's* internal *EFT* timing limitations. The *Owner* covenants, and the *Contractor* agrees, that payment of the holdback shall be made by *EFT* at the first opportunity during the *Owner's* normal processing of *EFTs* upon the holdback becoming due in accordance with GC 5.4.9."

SC32 GC 5.5 FINAL PAYMENT

SC32.1	GC 5.5	Delete GC 5.5 in its entirety, including all subparagraphs thereunder and replace it with the following: "5.5.1 When *Ready-for-Takeover* has been achieved in accordance with GC 12.1 – READY-FOR-TAKEOVER and the *Contractor* considers the *Work* is complete, and after the *Contractor*, the *Owner*, and the *Consultant* have attended a *Pre-Invoice Submission Meeting* analogous to the requirement in GC 5.2.1 (the "***Final Pre-Invoice Submission Meeting***"), the *Contractor* may submit an application for final payment to the *Owner* and to the *Consultant*, which application for payment shall: .1 include all of the requirements set out in GC 5.2.2, including without limitation those requirements listed in APPENDIX "1" - PROJECT SPECIFIC REQUIREMENTS FOR A PROPER INVOICE that are specific to an

application for final payment; and

.2 if applicable, (a) a certificate from the *Consultant* or written confirmation from the *Owner* that the deficiencies or incomplete *Work* waived by the *Owner* pursuant to GC 12.1.2 have been fully rectified as of the date of the *Contractor's* application for final payment, and/or (b) written confirmation, signed by the *Owner* and the *Contractor,* that the *Contract Price* has been reduced by a specified amount in exchange for the *Owner* releasing the *Contractor* of its obligation to rectify the certain outstanding deficiencies and/or incomplete *Work* waived by the *Owner* pursuant to GC 12.1.2, as detailed in such written confirmation.

5.5.2 No later than 5 calendar days prior to the *Final Pre-Invoice Submission Meeting*, the *Contractor* will, if not already provided, submit to the *Consultant* all *Close-Out Documentation*.

5.5.3 Delivery of all *Close-Out Documentation* is a requirement for the *Proper Invoice* for final payment.

5.5.4 After receipt by the *Owner* and the *Consultant* of an application for payment submitted by the *Contractor* that is a *Proper Invoice* and by no later than 10 calendar days after the receipt of the *Proper Invoice*:

.1 the *Consultant* will either:

(a) issue to the *Owner* with a copy to the *Contractor*, a progress payment certificate in the amount applied for by the *Contractor* in the *Proper Invoice*, or

(b) deliver a finding to the *Owner* with reasons why an amount other than what is claimed in the *Proper Invoice* is properly due to the *Contractor*, which finding the *Owner* may accept or amend prior to issuing a *Notice of Non-Payment* (Form 1.1), if any, in accordance with GC 5.5.2;

.2 the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 PAYMENT,

(a) in the amount stated in the certificate for payment, or

(b) in the amount stated in the certificate for payment less such amount stated in the *Owner's Notice of Non-Payment* issued pursuant to GC 5.5.5,

on the 28th calendar day after receipt of a *Proper Invoice*, unless such 28th calendar day lands on a day that is other than a *Working Day*, in which case payment shall be made on the next *Working Day* after such 28th day.

5.5.5 In the event that the application for final payment delivered by the *Contractor* does not include the requirements of GC 5.5.1 (including the requirements for a *Proper Invoice*) and GC 5.5.2 or where the *Owner* disputes the amount claimed as payable in the *Proper Invoice*, then the *Owner* shall within 14 calendar days of receipt of the application for payment, issue a *Notice of Non-Payment*. Where the *Owner* has delivered a *Notice of Non-Payment*, as specified under this GC 5.5.5, the *Owner* and the *Contractor* shall first engage in good faith negotiations to resolve the dispute. If within 5 calendar days following the issuance of a *Notice of Non-Payment*, despite good faith efforts by both parties with the assistance of the *Consultant*, the *Owner* and the *Contractor* cannot resolve the dispute, either party may commence an *Adjudication* in accordance with the procedures set out in the *Construction Act*. Any portion of the *Proper Invoice* which is not the subject of the *Notice of Non-Payment* shall be payable within the time period set out in GC 5.5.4.2.

		5.5.6 Subject to the provisions of the *Construction Act* and any other rights conferred on the *Owner* at law or under this *Contrac*t to withhold payment or backcharge or set-off against payment, the *Owner* shall pay the amount payable under a *Proper Invoice* for final payment in accordance with the *Construction Act*. 5.5.7 When the *Consultant* issues certificate of completion in accordance with GC 5.5.4.1, the *Consultant* shall also issue a certificate for release of any holdback for finishing work amount. In accordance with the *Construction Act,* the *Owner* may retain any amounts which are required by law to satisfy any liens against the *Work*, in respect of any third party claims made to the *Owner* in respect of the *Contract* or the *Work*, and in respect of any claims the *Owner* may have against the *Contractor*. Subject to the foregoing, the *Owner* shall release the holdback in accordance with the *Construction Act.*"

SC33 GC 5.6 DEFERRED WORK

SC33.1	5.6.1	Delete paragraph 5.6.1 and replace with the following: "5.6.1 If because of conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, subject to its requirement to issue a *Notice of Non-Payment* under the *Construction Act*, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work. The remaining work shall be valued as deficient work as defined in GC 5.8.1."

SC34 *NEW* GC 5.8 DEFICIENCY HOLDBACK

SC34.13	5.8.1	Add new GC 5.8 – DEFICIENCY HOLDBACK as follows: "**GC 5.8 DEFICIENCY HOLDBACK** 5.8.1 Over and above the 10% holdback required pursuant to the *Construction Act*, the *Owner* will retain a total of three percent (3%) of the *Contract Price*, to be released in accordance with this GC 5.8 (the "**Deficiency Holdback**"). The Deficiency Holdback amount shall be reflected as a line item in the schedule of values to be approved by the *Owner* pursuant to GC 5.2.4. 5.8.2 Subject to GC 5.8.3, GC 7.1.4.1, and there being no claims for lien registered against title to the *Place of the Work*, the *Deficiency Holdback* shall be released to the *Contractor* on the 61st day following the publication of the certificate of *Substantial Performance of the Work*. 5.8.3 Following certification of *Substantial Performance of the Work* by the *Consultant* in accordance with GC 5.4.6.2(b), the *Owner* may retain from the *Deficiency Holdback* an amount equivalent to 200% of the aggregate value of all items identified in the *Consultant's* deficiency list established in accordance with GC 5.4.6.1. Such amount, less any amounts, fees, damages, or other costs (including additional consulting costs, legal costs, *etc.*) incurred by the *Owner* to complete or correct any of the items in the deficiency list that are not completed or corrected by the *Contractor*, shall be released by the *Owner* as part of the *Contractor's* final payment.

PART 6 CHANGES IN THE WORK

SC35 GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

SC35.1	6.1.2	Add the following to the end of GC 6.1.2: "This requirement is of the essence and it is the express intention of the parties that any claims by the *Contractor* for a change in the *Contract Price* and/or *Contract Time* shall be barred unless there has been strict compliance with PART 6 - CHANGES IN THE WORK. No verbal dealings between the parties and no implied acceptance of alterations or additions to the *Work* and no claims that the *Owner* has been unjustly enriched by any alteration or addition to the *Work*, whether in fact there is any such unjust enrichment or not, shall be the basis of a claim for additional payment under this *Contract,* an increase to the *Contract Price*, or a claim for any extension of the *Contract Time*."
SC35.2	6.1.3 to 6.1.8	Add new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7 and 6.1.8 as follows: "6.1.3 The *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface conditions, site coordination, and *Subcontractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes. 6.1.4 Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide these rates, when requested by the *Consultant*, for review and/or agreement. 6.1.5 Quotations for changes to the *Work* shall only include *Direct Costs* and be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from *Subcontractors* and *Suppliers,* submitted in a format acceptable to the *Consultant* and shall include any *Direct Costs* associated with extensions in *Contract Time.* 6.1.6 When both additions and deletions covering related *Work* or substitutions are involved in a change to the *Work*, payment, including *Overhead* and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the *Work*. 6.1.7 No extension to the *Contract Time* shall be granted for changes in the *Work* unless the *Contractor* can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the *Work.* Extensions of *Contract Time* and all associated costs, if approved, shall be included in the relevant *Change Order.* 6.1.8 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 calendar days submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time.* Should 10 calendar days be insufficient to prepare the submission, the *Contractor* shall within 5 calendar days, advise the *Consultant* in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered."

SC36 GC 6.2 CHANGE ORDER

SC36.1	6.2.1	In paragraph 6.2.1 after the last sentence in the paragraph add the following: "The adjustment in the *Contract Time* and the *Contract Price* shall include an adjustment, if any, for delay or for the impact that the change in the *Work* has on the *Work* of the

		Contractor, and once such adjustment is made, the *Contractor* shall be precluded from making any further claims for delay or impact with respect to the change in the *Work.*"
SC36.2	6.2.3 to 6.2.5	Add new paragraphs 6.2.3, 6.2.4, and 6.2.5 as follows: "6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the *Consultant*: .1 by estimate and acceptance of a lump sum; .2 by negotiated unit prices which include the *Contractor's* overhead and profit, or; .3 by the actual *Direct Cost* to the *Owner,* such costs to be the actual cost after all credits included in the change have been deducted, plus the following ranges of mark-up on such costs: .1 for *Change Orders* with a value of $0 to $15,000 the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 10% and the total *Contractor* mark-up including overhead and profit shall be 5%. .2 for *Change Orders* in excess of $15,000, the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 5% and the total *Contractor* mark-up including *Overhead* and profit shall be 3%. 6.2.4 All quotations shall include *Direct Costs* and be submitted in a complete manner listing: .1 quantity of each material, .2 unit cost of each material, .3 man hours involved, .4 cost per hour, .5 *Subcontractor* quotations submitted listing items 1 to 4 above and item 6 below. .6 mark-up. 6.2.5 The *Owner* and the *Consultant* will not be responsible for delays to the *Work* resulting from late, incomplete or inadequately broken-down valuations submitted by the *Contractor.*"

SC37 GC 6.3 CHANGE DIRECTIVE

SC37.1	6.3.6.1	Amend paragraph 6.3.6.1 by deleting the final period and adding the following: ".1 Ten percent (10%) for profit plus five percent (5%) for overhead on work by the *Contractor's* own forces up to the value of $15,000 and five percent (5%) for profit plus three percent (3%) for *Overhead* on work by the *Contractor's* own forces in excess of $15,000 and, .2 Ten percent (10%) fee on amounts paid to *Subcontractors* or *Suppliers* under subparagraph 6.3.7.9 for changes up to the value of $15,000 and five percent (5%) on changes over $15,000. Unless a *Subcontractor's* or *Supplier's* price has been approved by the *Owner,* the *Subcontractor* or *Supplier* shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (10%) for profit and five percent (5%) for *Overhead* on such actual net cost for changes in the *Work*, up to the value of $15,000 and five percent (5%) for profit and three percent (3%) for overhead on such actual net

		cost changes in the *Work* in excess of $15,000."
SC37.2	6.3.6.2	Delete paragraph 6.3.6.2 and replace it with the following: ".2 If a change in the *Work* results in a net decrease in the *Contract Price*, the amount of the credit shall be the net cost, without deduction for *Overhead* or profit."
SC37.3	6.3.7.1(4)	Delete GC 6.3.7.1(4).
SC37.4	6.3.7.7	Amend GC 6.3.7.7 by deleting the words "described in paragraph 6.3.7.1" and replacing them with "approved by the *Owner* in writing and in advance of any such expenses being incurred;"
SC37.5	6.3.7.9	Amend GC 6.3.7.9 by adding the following to the end of the paragraph: "…when specifically requested by the *Owner* or as directed by the *Consultant*;".
SC37.6	6.3.7.10	Amend GC 6.3.7.10 by adding the following to the end of the paragraph: ", provided that such amounts are not caused by negligent acts, omissions, or default of the *Contractor* or *Subcontractor*;".
SC37.7	6.3.7.13	Delete GC 6.3.7.13.
SC37.8	6.3.7.15	Delete GC 6.3.7.15.
SC37.9	6.3.7.17	Delete GC 6.3.7.17 in its entirety including all subparagraphs.
SC37.10	6.3.11	Delete GC 6.3.11 and replace it with the following: "6.3.11 The value of the *Work* performed as a result of a *Change Directive* shall not be eligible to be included in progress payments until the amount, including the method for determining the amount, of such *Change Directive* has been determined."

SC38 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

SC38.1	6.4.1	Delete paragraph 6.4.1 in its entirety and replace with the following: "6.4.1.1 Prior to the submission of the bid on which the Contract was awarded, the Contractor confirms that it carefully investigated the Place of the Work insofar as the Place of Work was available for investigation and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1 6.4.1.2 No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*.
SC38.2	6.4.2	Amend paragraph 6.4.2 by adding a new first sentence as follows: "Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, differ materially from those indicated in the *Contract Documents* or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall provide the *Owner* and the *Consultant* with *Notice in Writing* no later than five (5) *Working Days* after the first observation of such conditions." -and- amend the existing second sentence of paragraph 6.4.2 in the second line, following the

		word "materially" by adding the words "or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,".
SC38.3	6.4.3	Delete paragraph 6.4.3 in its entirety and substitute the following: "6.4.3 If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*."
SC38.4	6.4.5	Add new paragraph 6.4.5 as follows: "6.4.5 No claims for additional compensation or for an extension of *Contract Time* shall be allowed if the *Contractor* fails to give *Notice in Writing* to the *Owner* or *Consultant,* as required by paragraph 6.4.2."

SC39 GC 6.5 DELAYS

SC39.1	6.5.1	In paragraph 6.5.1 delete the words after the word "for" in the fourth line and replace them with the words "…reasonable *Direct Costs* directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."
SC39.2	6.5.2	Delete GC 6.5.2 in its entirety and replace it with the following: "6.5.2 If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was issued on account of a direct breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes by the *Owner*, *Other Contractor(s)*, or the *Consultant*, and relating to the *Work* or the *Place of the Work*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may determine. The *Contractor* shall be reimbursed by the *Owner* for reasonable *Direct Costs* directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."
SC39.3	6.5.3	Delete paragraph 6.5.3 in its entirety and replace with the following: "6.5.3 If either party is delayed in the performance of their obligations under this *Contract* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Owner* and the *Contractor* shall agree. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the parties agree to a shorter extension. Neither party shall be entitled to payment for costs incurred by such delays. Upon reaching agreement on the extension of the *Contract Time* attributable to the *Force Majeure* event, the *Owner* and the *Contractor* shall execute a *Change Order* indicating the length of the extension to the *Contract Time* and confirming that there are no costs payable by the either party for the extension of *Contract Time*. However, if at the time an event of *Force Majeure* arises a party is in default of its obligations under the *Contract* and has received a notice of default pursuant to PART 7 – DEFAULT NOTICE, this paragraph 6.5.3 shall not excuse a party from its obligation to cure the default(s). For greater certainty, the defaulting party, to the extent possible, must continue to address and cure the default notwithstanding an event of *Force Majeure*."
SC39.4	6.5.4	Delete paragraph 6.5.4 in its entirety and replace it with the following: "6.5.4 No extension or compensation shall be made for delay or impact on the *Work* unless notice in writing of a claim is given to the *Consultant* not later than ten (10) *Working Days* after the commencement of the delays or impact on the *Work*, provided however, that, in the case of a continuing cause of delay or impact on the

		Work, only one notice of claim shall be necessary."
SC39.5	6.5.6 to 6.5.8	Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows: "6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor,* or by any cause within the *Contractor's* control, then (i) firstly, at its expense, and to the extent possible, the *Contractor* shall accelerate the work and/or provide overtime work to recover time lost by a delay arising under this paragraph 6.5.6, and (ii) secondly, where it is not possible for the *Contractor* to recover the time lost by implementing acceleration measures and/or overtime work, the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, Owner's staff costs, the cost of all additional services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*. 6.5.7 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the *Owner* or *Consultant* may, by *Notice in Writing*, direct the *Contractor* to stop the *Work* where the *Owner* or *Consultant* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contact Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3. 6.5.8 No claim for delay shall be made by the *Contractor* and the *Contract Time* shall not be extended due to climatic conditions or arising from the *Contractor's* efforts to maintain the *Construction Schedule*."

PART 7 DEFAULT NOTICE

SC40 GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

SC40.1	7.1.2	In GC 7.1.2, delete the words "and if the *Consultant* has given a written statement to the *Owner* and *Contractor* which provides the detail of such neglect to perform the *Work* properly or such failure to comply with the requirements of the *Contract* to a substantial degree".
SC40.2	7.1.3.4	Add a new subparagraph 7.1.3.4 as follows: ".4 an "acceptable schedule" as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other aspect of the *Work* or the work of other contractors, and in no event shall it be deemed to give a right to extend the *Contract Time*."
SC40.3	7.1.4.1	Delete subparagraph 7.1.4.1 and replace it with the following: ".1 correct such default and deduct the cost, including *Owner's* expenses, thereof from the

		Deficiency Holdback or any payment then or thereafter due the *Contractor*."
SC40.4	7.1.4.2	Delete subparagraph 7.1.4.2 and replace it with the following: ".2 by providing *Notice in Writing* to the *Contractor*, terminate the *Contractor's* right to continue with the *Work* in whole or in part or terminate the *Contract*, and publish a notice of termination (Form 8) in accordance with the *Act*."
SC40.5	7.1.5.3	In subparagraph 7.1.5.3 delete the words: "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference"
SC40.6	7.1.6 to 7.1.10	Delete GC 7.1.6 and replace it with new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows: "7.1.6 In addition to its right to terminate the *Contract* set out herein, the *Owner* may terminate this *Contract* at any time for any other reason and without cause upon giving the *Contractor* fifteen (15) *Working Days Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred. 7.1.7 The *Owner* may suspend *Work* under this *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than thirty (30) calendar days, the *Contract* shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply. 7.1.8 In the case of either a termination of the *Contract* or a suspension of the *Work* under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall use its best commercial efforts to mitigate the financial consequences to the *Owner* arising out of the termination or suspension, as the case may be. 7.1.9 Upon the resumption of the *Work* following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* will endeavour to minimize the delay and financial consequences arising out of the suspension. 7.1.10 The *Contractor's* obligations under the *Contract* as to quality, correction, and warranty of the *Work* performed by the *Contractor* up to the time of termination or suspension shall continue after such termination of the *Contract* or suspension of the *Work*."

SC41 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

SC41.1	7.2.2	Delete paragraph 7.2.2 and replace it with the following: "7.2.2 If the *Work* is suspended or otherwise delayed for a period of 40 consecutive *Working Days* or more under a stop work order issued by a court or other public authority on account of a breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes directly by the *Owner*, the *Owner's* other contractor(s), or the *Consultant*, and relating to the *Work* or the *Place of the Work*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* Notice in *Writing* to that effect."
SC41.2	7.2.3.1	Delete subparagraph 7.2.3.1 in its entirety.
SC41.3	7.2.3.2	Delete subparagraph 7.2.3.2 in its entirety.
SC41.4	7.2.3.4	In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".
SC41.5	7.2.5	Delete paragraph 7.2.5 and replace it with the following: "7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it: .1 commences correction of the default within the specified time; .2 provides the *Contractor* with an acceptable schedule for such correction; and, .3 completes the correction in accordance with such schedule."
SC41.6	7.2.6 to 7.2.9	Add new paragraphs 7.2.6, 7.2.7, 7.2.8 and 7.2.9 as follows: "7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit. 7.2.7 The *Contractor* shall not be entitled to give notice of the *Owner's* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of: .1 the *Contractor's* failure to pay all legitimate claims promptly, or .2 the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work.* 7.2.8 The *Contractor's* obligations under the *Contract* as to quality, correction and warranty of the *Work* performed by the *Contractor* up to the effective date of termination shall continue in force and shall survive termination of this *Contract* by the *Contractor*. 7.2.9 If the *Contractor* suspends the *Work* or terminates the *Contract* as provided for in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall ensure the site and the *Work* are left in a safe, secure condition as required by authorities having jurisdiction at the *Place of*

		the Work and the *Contract Documents*."

PART 8 DISPUTE RESOLUTION

SC42 GC 8.1 AUTHORITY OF THE CONSULTANT

SC42.1	8.1.3	Delete paragraph 8.1.3 in its entirety and substitute as follows: "8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instruction as in the *Consultant's* opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by doing so neither party will jeopardize any claim the party may have."

SC43 GC 8.2 ADJUDICATION

SC43.13	8.2.2 to 8.2.7	Add new GC 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, and 8.2.7 as follows: "8.2.2 Save and except where the *Contractor* has given an undertaking, in accordance with the *Act*, to refer a dispute to *Adjudication*, prior to delivering a notice of *Adjudication* in a form prescribed by the *Act*, the parties agree to first address all disputes with at least one in-person meeting with the *Owner's* representative, the *Consultant's* representative, and the *Contractor's* representative. The parties agree that such steps will be taken to resolve any disputes in a timely and cost-effective manner. 8.2.3 Notwithstanding any other provisions in PART 8 DISPUTE RESOLUTION, the parties shall engage in *Adjudication* proceedings as required by, and in accordance with, the *Construction Act*. 8.2.4 The following procedures shall apply to any *Adjudication* the parties engage in under the *Construction Act*: .1 any hearings shall be held at a venue within the jurisdiction of the *Place of the Work* or such other venue as the parties may agree and which is acceptable to the adjudicator; .2 the *Adjudication* shall be conducted in English; .3 each party may be represented by counsel throughout an *Adjudication*; .4 there shall not be any oral communications with respect to issues in dispute that are the subject of an *Adjudication* between a party and the adjudicator unless it is made in the presence of both parties or their legal representatives; and .5 a copy of all written communications between the adjudicator and a party shall be given to the other party at the same time. 8.2.5 Any documents or information disclosed by the parties during an *Adjudication* are confidential and the parties shall not use such documents or information for any purpose other than the *Adjudication* in which they are disclosed and shall not disclose such documents and information to any third party, unless otherwise required by law, save and except the for the adjudicator. 8.2.6 If the *Contractor* fails to comply with any of the notice requirements set out in the *Contract*, including the time limits set out in any of the following:

		.1 GC 6.4 – CONCEALED OR UNKNOWN CONDITIONS; .2 GC 6.5 – DELAYS; .3 GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE; .4 PART 8 DISPUTE RESOLUTION .5 GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES .6 GC 9.3 – ARTIFACTS AND FOSSILS; or .7 GC 9.5 - MOULD in respect of any claim or dispute, the *Contractor* shall have no entitlement whatsoever (including to an increase in the *Contract Price*, or an extension of *Contract Time*) in the context of an *Adjudication* under the *Construction Act* and waives the right to make any such claims or disputes in an *Adjudication*. This GC 8.2.6 shall operate conclusively as an estoppel and bar in the event such claims or disputes are brought in an *Adjudication* and the *Owner* may rely on this GC 8.2.6 as a complete defence to any such claims or disputes. 8.2.7 The parties hereby acknowledge and agree, .1 that counterclaims, claims of set-off or the exercise or use of other contractual rights that permit the *Owner* to withhold, deduct or retain from monies otherwise owed to the *Contractor* under the *Contract* may be referred to, and included as part of, *Adjudications* under the *Construction Act*; .2 that disputes related to the termination or abandonment of the *Contract*, as well as any disputes that arise or are advanced following the termination or abandonment of the *Contract*, shall not be referred to *Adjudication* under the *Construction Act*; .3 that notice(s) of *Adjudication,* with respect to any dispute or claim relating to the *Project,* shall not be given, and no *Adjudication* shall be commenced following *Contract* completion, *Contract* abandonment, or termination of the *Contract*; .4 that any *Adjudication* between the *Contractor* and a *Subcontractor* or a supplier that relates to an *Adjudication* between the *Owner* and the *Contractor* shall be joined together to be adjudicated by a single adjudicator, provided that the adjudicator agrees to do so, and the *Contractor* shall include a provision in each of its contracts that contain an equivalent obligation to this GC 8.2.7.4; and .5 that, other than where the *Contractor* is obliged to commence an *Adjudication* pursuant to an undertaking under the *Construction Act,* neither the *Owner* nor the *Contractor* shall commence an *Adjudication* during the *Restricted Period*. 8.2.8 The parties acknowledge and agree that no *Adjudication*, arbitration, action, suit or other proceeding may be brought by the *Contractor* against the *Owner* in respect of a claim for an increase to the *Contract Price* as set out in GC 6.6, before the *Consultant* has issued its findings in respect of same, pursuant to GC 6.6.5. For greater clarity and without limiting the foregoing, the amount applied for in each *Proper Invoice* shall not include any amounts pertaining to the *Contractor's* claim for an increase in *Contract Price* unless and until the *Consultant* has issued a written notice to the *Contractor* regarding the validity of such claim, as provided for in GC 6.6.5. However, nothing in this GC 8.2.8 shall prevent a *Contractor* from commencing an *Adjudicatio*n where, pursuant to the *Construction Act*, the *Contractor* is required to give an undertaking to a *Subcontractor* to commence an *Adjudication* following delivery of a *Notice of Non-Payment*."

SC44 GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

SC44.1	8.3.1	Amend paragraph 8.3.1 by changing part of the second line from "shall appoint a *Project Mediator*" to "may appoint a *Project Mediator,* except that such an appointment shall only be

		made if both the *Owner* and the *Contractor* agree."
SC44.2	8.3.4	Amend paragraph 8.3.4 by changing part of the second line from "the parties shall request the *Project Mediator"* to "and subject to paragraph 8.3.1 the parties may request the *Project Mediator".*
SC44.3	8.3.6 to 8.3.9	Delete paragraphs 8.3.6, 8.3.7 and 8.3.8 in their entirety and replace them with the following new GCs 8.3.6, 8.3.7, 8.3.8, and 8.3.9: "8.3.6 The dispute may be finally resolved by arbitration under the Rules for Arbitration of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, provided that both the *Contractor* and the *Owner* agree. If the *Contractor* and the *Owner* agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the *Place of the Work*. 8.3.7 Prior to delivering a notice of *Adjudication* in a form prescribed by the *Act*, the parties agree to first address all disputes by attending at least one meeting with the *Owner*'s representative, the *Consultant*'s representative, and the *Contractor*'s representative, prior to commencing an *Adjudication*. The parties agree that such steps will be taken to resolve any disputes in a timely and cost effective manner. If a resolution to the dispute(s) is not made at such a meeting, any party who plans to commence an *Adjudication* shall provide the other party with 5 *Working Days' Notice in Writing* of its intention to issue a notice of *Adjudication*. 8.3.8 Other than where the *Contractor* is obliged to commence an *Adjudication* pursuant to an undertaking under the *Construction Act*, neither the *Owner* nor the *Contractor* shall commence an *Adjudication* during the *Restricted Period*. 8.3.9 Where either party has delivered a notice of *Adjudication* in a form prescribed by the *Act*, the procedures and rules set out under the *Construction Act* and the regulations thereto shall govern the *Adjudication*."

PART 9 PROTECTION OF PERSONS AND PROPERTY

SC45 GC 9.1 PROTECTION OF WORK AND PROPERTY

SC45.1	9.1.1.1	Delete subparagraph 9.1.1.1 in its entirety and substitute the following: ".1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;"
SC45.2	9.1.2	Delete paragraph 9.1.2 in its entirety and substitute as follows: "9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the *Contract Documents*, or that are inferable from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1."
SC45.3	9.1.5	Add new paragraph 9.1.5 as follows: "9.1.5 With respect to any damage to which paragraphs 9.1.3 or 9.1.4 apply, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger."

SC46 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

SC46.1	9.2.1	Amend GC 9.2.1 by inserting the following to the end of the paragraph: "For the purposes of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, *Excess Soil* shall not be considered a 'toxic and hazardous substance'."
SC46.2	9.2.5.5	Add a new subparagraph 9.2.5.5 as follows: ".5 in addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials."
SC46.3	9.2.6	Amend GC 9.2.6 by adding the following words after the word "responsible" in the second line: "or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,".
SC46.4	9.2.8	Amend GC 9.2.8 by adding the following words after the word "responsible" in the second line: "or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,".
SC46.5	9.2.10	Add new paragraph 9.2.10 as follows: "9.2.10 The *Contractor*, *Subcontractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow work to proceed to the end of any current work week only shall be permitted. All such toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the *Place of the Work*."

SC47 GC 9.4 CONSTRUCTION SAFETY

SC47.1	9.4.1	Delete GC 9.4.1 in its entirety and replace it with the following: "9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the *OHSA*, including, but not limited to those of the "constructor", and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*. The *Contractor*'s health and safety program documentation shall be made available for review by the *Owner* or *Consultant* immediately upon request. Without limiting the foregoing, the *Contractor* shall be solely responsible for construction safety in respect of the *Consultant*, *Subcontractors* and *Suppliers*, the *Owner's* own forces, *Other Contractors*, and all persons attending the *Place of the Work* during the course of the *Project*."

SC47.2	9.4.2	Amend GC 9.4.2 by adding the following words after "and the *Contractor*": ", *Subcontractors* and *Suppliers*".
SC47.3	9.4.3	Amend GC 9.4.3 by adding the following words after "and the *Contractor*": ", *Subcontractors* and *Suppliers*".
SC47.4	9.4.4	Delete GC 9.4.4 and replace it with the following: "9.4.4 The *Owner* undertakes to include in its contracts with other contractors and in its instructions to its own forces the requirement that the other contractor or its own forces, as the case may be, comply with the policies and procedures of and the directions and instructions from the *Contractor* with respect to occupational health and safety and related matters."
SC47.5	9.4.5	Delete GC 9.4.5 in its entirety and replace it with the following: "9.4.5 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*: .1 a current WSIB clearance certificate; .2 copies of the *Contractor*'s insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*; .3 documentation setting out the *Contractor*'s in-house safety programs; .4 a copy of the Notice of Project filed with the Ministry of Labour naming itself as "constructor" under the *OHSA*; and . 5 copies of any documentation or notices to be filed or delivered to the authorities having jurisdiction for the regulation of occupational health and safety at the *Place of the Work*;"
SC47.6	9.4.6 to 9.4.12	Add new GC 9.4.6, 9.4.7, 9.4.8, 9.4.9, 9.4.10, 9.4.11, and 9.4.12 as follows: "9.4.6 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, trustees, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under *OHSA* and any other occupational health and safety legislation in force at the *Place of the Work* including the payment of legal fees and disbursements on a solicitor and client basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance. 9.4.7 If the *Owner* is of the reasonable opinion that the *Contractor* has not taken such precautions as are necessary to ensure compliance with the requirements of paragraph 9.4.1, the *Owner* may take any remedial measures which it deems necessary, including stopping the performance of all or any portion of the *Work,* and the *Owner* may use its employees, the *Contractor*, any *Subcontractor* or any other contractors to perform such remedial measures. 9.4.8 The *Contractor* shall file any notices or any similar document required pursuant to the *Contract* or the safety regulations in force at the *Place of the Work*. This duty of the *Contractor* will be considered to be included in the *Work* and no separate payment therefore will be made to the *Contractor*. 9.4.9 Unless otherwise provided in the *Contract Documents*, the *Contactor* shall develop, maintain and supervise for the duration of the *Work* a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, at a minimum, respond fully to the applicable

		safety regulations and general construction practices for the safety of persons or property, including, without limitation, any general safety rules and regulations of the *Owner* and any workers' compensation or occupational health and safety statutes or regulations in force at the *Place of the Work*. 9.4.10 The *Contractor* shall provide a copy of the safety program described in GC 9.4.9 hereof to the *Consultant* for delivery to the *Owner* prior to the commencement of the *Work*, and shall, ensure, as far as it is reasonably practical to do so, that every employer and worker performing work in respect of the *Project* complies with such program. 9.4.11 The *Contractor* shall arrange regular safety meetings, and shall supply and maintain, at its own expense, at its office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the authorities having jurisdiction at the *Place of the Work*, including, without limitation, articles necessary for administering first-aid to any person and an emergency procedure for the immediate removal of any inured person to a hospital or a doctor's care. 9.4.12 The *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations.".”

PART 10 GOVERNING REGULATIONS

SC48 GC 10.1 TAXES AND DUTIES

SC48.1	10.1.2	Amend paragraph 10.1.2 by adding the following sentence to the end of the paragraph: "For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes. The *Contractor* shall provide a detailed breakdown of Additional taxes if requested by the *Owner* in a form satisfactory to the *Owner*."
SC48.2	10.1.3	Add new paragraph 10.1.3 as follows: "10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph."

SC49 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

SC49.1	10.2.5	Amend paragraph 10.2.5 by adding the words "Subject to paragraph 3.4" at the beginning of the paragraph. -and- Add the following to the end of the second sentence:

		"…and no further *Work* on the affected components of the *Contract* shall proceed until these directives have been obtained by the *Contractor* from the *Consultant*."
SC49.2	10.2.6	Amend paragraph 10.2.6 by adding the following sentence to the end of the paragraph: "In the event the *Owner* suffers loss or damage as a result of the *Contractor's* failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the *Contractor*."
SC49.3	10.2.7	Amend paragraph 10.2.7 by inserting the words "which changes were not, or could not have reasonably been, known to the *Owner* or to the *Contractor*, as applicable, at the time of bid closing, did not arise as a result of a public emergency or other *Force Majeure* event, and are not related to changes in duties, tariffs, or other import costs," to the second line, after the words "authorities having jurisdiction".
SC49.4	10.2.8	Add new paragraph 10.2.8 as follows: "10.2.8 The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates."

SC50 GC 10.4 WORKERS' COMPENSATION

SC50.1	10.4.1	Delete paragraph 10.4.1 and replace with the following: "10.4.1 Prior to commencing the *Work*, and with each and every application for payment thereafter, including the *Contractor's* application for payment of the holdback amount following *Substantial Performance of the Work* and again with the *Contractor's* application for final payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation in force at the *Place of the Work*, including payments due thereunder."

SC51 GC 11.1 INSURANCE

SC51.1	11.1	Delete entirety of GC 11.1 and replace with the following: "**GC 11.1 INSURANCE** 11.1.1 Without restricting the generality of GC 12 – INDEMNIFICATION, the *Contractor* shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 – INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the *Work* until the expiration of the warranty periods set out in the *Contract Documents*. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements. .1 **General Liability Insurance** General liability insurance shall be in the name of the *Contractor,* with the *Owner*

		and the *Consultant* named as Additional insureds, with limits of not less than $10,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, *Subcontractors* and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit, umbrella, or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover,* on an ongoing basis for a period of 6 years following *Ready-for-Takeover*. Where the *Contractor* maintains a single, blanket policy, the Addition of the *Owner* and the *Consultant* is limited to liability arising out of the *Project* and all operations necessary or incidental thereto. The policy shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation and of change or amendment restricting coverage. .2 **Automobile Liability Insurance** Automobile liability insurance in respect of licensed vehicles shall limits of not less than $5,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, covering all licensed vehicles *owned* or leased by the *Contractor*, and endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation, change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor.* .3 **Aircraft and Watercraft Liability Insurance** Where determined necessary by the *Contractor*, acting reasonably, aircraft and watercraft liability insurance will be obtained in accordance with the provisions of paragraph 11.1.3. Aircraft and watercraft liability insurance with respect to owned or non-owed aircraft and watercraft if used directly or indirectly in the performance of the *Work*, including use of Additional premises, shall be subject to limits of not less than $2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, including loss of use thereof and limits of not less than $2,000,000.00 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. **.4 Property and Boiler and Machinery Insurance** (1) Builder's Risk property insurance shall be in the name of the *Contractor* with the *Owner* and the *Consultant* named as Additional insureds. The policy shall insure against all risks of direct physical loss or damage to the property insured which shall include all property included in the *Work*, whether owned by the *Contractor* or the owner or owned by others, so long as the property forms part of the *Work*. The property insured also includes all materials and supplies necessary to complete the work, whether installed in the work temporarily or permanently, in storage on the project site, or in transit to the project site, as well as temporary buildings, scaffolding, falsework forms, hoardings, excavation, site preparation and similar work. The insurance shall be for not less than the sum of the amount of the contract price and the full value of products that are specified to be provided by the owner for incorporation into the work, if applicable, with the deductible of $10,000.00 payable by the contractor. The insurance shall include the foregoing and, otherwise, shall not be less than the insurance required by IBC Form 4042 or its equivalent replacement provided that the IBC Form 4042 shall include the latest Addition of the relevant CCDC endorsement form. The coverage shall be based on a completed value form and shall be maintained continuously

		until ten (10) days after the date of the final certificate of payment. (2) Boiler and machinery insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as Additional insureds, for not less than the replacement value of the boilers, pressure vessels and other insurable objects forming part of the *Work*. The insurance provided shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously from commencement of use or operation of the property insured and until 10 days after the date of the final certificate for payment. (3) The policies shall allow for partial or total use or occupancy of the *Work.* (4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of the *Contract Time,* relative to the extent of the loss or damage, as determined by the *Owner*, in its sole discretion. (5) The *Contractor* shall be entitled to receive from the *Owner*, in Addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. In Addition, the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*. (6) In the case of loss or damage to the *Work* arising from the work of other contractors, or the *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. **.5 Contractors' Equipment Insurance** "All risks" contractors' equipment insurance covering construction machinery and equipment used by the *Contractor* for the performance of the *Work*, excluding boiler insurance, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner.* The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance of his equipment, the *Owner* agrees to waive the equipment insurance requirement. 11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the *Contractor's* responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY. 11.1.3 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required to waive the course of construction insurance requirement. 11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and provide evidence of same to the *Contractor*. The *Contractor* shall

		pay the costs thereof to the *Owner* on demand, or the *Owner* may deduct the amount that is due or may become due to the *Contractor*. 11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*."

SC52 *NEW* GC 11.2 CONTRACT SECURITY

SC52.13	GC 11.2	Add new GC 11.2 – CONTRACT SECURITY as follows: "**GC 11.2 CONTRACT SECURITY** 11.2.1 The *Contractor* shall, prior to the execution of the *Contract*, furnish a performance bond and labour and material payment bond which meets the requirements under paragraph 11.2.2. 11.2.2 The performance bond and labour and material payment bond shall: .1 be issued by a duly licensed surety company, which has been approved by the *Owner* and is permitted under the *Construction Act*, .2 be issued by an insurer licensed under the *Insurance Act* (Ontario) and authorized to transact a business of suretyship in the Province of Ontario; .3 shall be in the form prescribed by the *Construction Act*; .4 have a coverage limit of at least 50 per cent of the *Contract Price*, or such other percentage of the *Contract Price* as stated in the *Contract Documents*; .5 extends protection to *Subcontractors*, *Suppliers,* and any other persons supplying labour or materials to the *Project*; and .6 shall be maintained in good standing until the fulfillment of the *Contract*, including the warranty period set out in paragraph 12.3.1. 11.2.3 It is the intention of the parties that the performance bond shall be applicable to all of the *Contractor's* obligations in the *Contract Document* and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The *Contractor* represents and warrants to the *Owner* that it has provided its surety with a copy of the *Contract Documents* prior to the issuance of such bonds. 11.2.4 Without limiting the foregoing in any way, the bonds shall indemnify and hold harmless the *Owner* for and against costs and expenses (including legal and *Consultant* services and court costs) arising out of or as a consequence of any default of the *Contractor* under this *Contract*. 11.2.4 The *Contractor* shall be responsible for notifying the surety company of any changes made to the *Contract* during the course of construction. 11.2.5 The premiums for bonds required by the *Contract Documents* shall be included in the *Contract Price*. 11.2.6 Should the *Owner* require additional bonds by the *Contractor* or any of his *Subcontractors*, after the receipt of bids for the *Work*, the *Contract Price* shall be increased by all direct costs attributable to providing such bonds. The *Contractor* shall promptly provide the *Owner*, through the *Consultant*, with any such bonds that may be required."

PART 12 OWNER TAKEOVER

SC53 GC 12.1 READY-FOR-TAKEOVER

SC53.1	12.1.1	Delete GC 12.1.1 in its entirety and replace it with the following: "12.1.1 *Ready-for-Takeover* shall be achieved when all of the following has occurred, as verified and approved by the *Owner*: .1 *Substantial Performance of the Work* has been achieved, as certified by the *Consultant*; .2 a permit for occupancy of the *Place of the Work* has been obtained from the authorities having jurisdiction; .3 the *Work* to be performed under the *Contract* has satisfied the requirements for deemed completion in accordance with Section 2(3) of the *Construction Act*, .4 final cleaning and waste removal, as required by the *Contract Documents*; .5 the *Contractor* has delivered to the *Consultant* and the *Owner* all inspection certificates from authorities having jurisdiction with respect to any component of the *Work* which has been completed; .6 subject only to GC 12.1.2, the entire *Work* has been completed to the requirements of the *Contract Documents*, including completion of all items on the punch list prepared at the time of *Substantial Performance of the Work* and the *Work* is being used for its intended purpose, and is so certified by the *Consultant*; .7 subject only to GC 12.1.2, the *Contractor* has submitted to the *Owner* and the *Consultant* in a collated and organized matter, all *Close-Out Documentation* and any other materials or documentation required by the *Contract Documents*; .8 subject only to GC 12.1.2, all *Products*, systems and components of the *Project* have been commissioned and certified for operation and accepted by the *Owner* and *Consultant*, and .9 subject only to GC 12.1.2, the *Contractor* has submitted to the *Owner* and the *Consultant* full and complete as-built drawings and *Specifications* revised by the *Contractor* to reflect the as-built state of the *Work*, clearly showing changes to the *Drawings* and *Specifications* from the original *Contract Documents*, all of which have been approved by the *Owner* acting reasonably."
SC53.2	12.1.2	Delete GC 12.1.2 in its entirety and replace it with the following: "12.1.2 The *Owner* may, in its sole, absolute, and unfettered discretion, waive compliance with a requirement, or a part thereof, for achieving *Ready-for-Takeover* set out in GC 12.1.1.6 to 12.1.1.9 (inclusive). Where the *Owner* exercises the discretion afforded under this GC 12.1.2, the *Contractor* shall be required to comply with GC 5.5.1.2 as part of its application for final payment and the *Owner* and the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for completing the *Work*."
SC53.3	12.1.3	Delete GC 12.1.3 in its entirety and replace it with the following: "12.1.3 When the *Contractor* considers the *Work Ready-for-Takeover*, it shall submit a

		written application to the *Owner* and the *Consultant* for review."
SC53.4	12.1.4	In GC 12.1.4, delete the words "list and" from the second line.
SC53.5	12.1.5	Delete GC 12.1.5 in its entirety and replace it with the following: "12.1.5 Following the confirmation of the date of *Ready-for-Takeover* by the *Consultant* and as confirmed by the *Owner*, the *Contractor* may submit a final application for payment in accordance with GC 5.5 – FINAL PAYMENT."
SC53.6	12.1.6	Delete GC 12.1.6 in its entirety.

SC54 GC 12.2 EARLY OCCUPANCY

SC54.1	GC 12.2	Delete GC 12.2 – EARLY OCCUPANCY BY THE OWNER in its entirety, including all subparagraphs thereunder and replace it with the following: "12.2.1 The Owner reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the Project even though the Work may not have reached Substantial Performance of the Work, provided that such taking possession and use will not unduly interfere, in any material way, with the progress of the Work. The taking of possession or use of any such portion of the Project shall not be deemed to be the Owner's acknowledgement or acceptance of the Work or Project nor shall it relieve the Contractor of any of its obligations under the Contract. 12.2.2 Whether the Project contemplates Work by way of renovations in buildings which will be in use or be occupied during the course of the Work or where the Project involves Work that is adjacent to a structure which is in use or is occupied, the Contractor, without in any way limiting its responsibilities under this Contract, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures."

SC55 GC 12.3 WARRANTY

SC55.1	12.3.2	Delete from the first line of paragraph 12.3.2 the word "The" and replace it with the words "Subject to GC 1.1.3, the…"
SC55.2	12.3.7 to 12.3.12	Add new paragraphs 12.3.7 to 12.3.12 as follows: "12.3.7 Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor's* obligations as set out in GC 12.3 WARRANTY. 12.3.8 The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing: .1 the proper name of the *Owner*; .2 the proper name and address of the *Project*; .3 the date the warranty commences, which shall be at the "*Ready-for-Takeover*" unless otherwise agreed upon by the *Consultant* in writing. .4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and .5 the signature and seal (if required by the governing law of the *Contract*)

		of the company issuing the warranty, countersigned by the *Contractor*. 12.3.9 Should any *Work* be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement. 12.3.10 The *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor's* portion of the *Work.* 12.3.11 The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* are obtained and available for the direct benefit of the *Owner.* In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that party's contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the *Owner* under the *Contract Documents*. 12.3.12 The *Contractor* shall commence or correct any deficiency within 2 *Working Days* after receiving a *Notice in Writing* from the *Owner* or the *Consultant*, and shall complete the *Work* as expeditiously as possible, except in the case where the deficiency prevents maintaining security or where basic systems essential to the ongoing business of the *Owner* and/or its tenants cannot be maintained operational as designed. In those circumstances all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the *Contractor*, the *Owner* is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the *Contractor's* expense."

PART 13 INDEMNIFICATION AND WAIVER

SC56 GC 13.1 INDEMNIFICATION

SC56.1	GC 13.1	Delete GC 13.1 – INDEMNIFICATION in its entirety and replace it with the following: "13.1.1 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, their respective partners, trustees, officers, directors, agents and employees and the *Consultant* from and against any and all claims, liabilities, expenses, demands, losses, damages, actions, costs, suits, or proceedings (hereinafter called "claims"), whether in respect of claims suffered by the *Owner* or in respect of claims by third parties, that directly or indirectly arise out of, or are attributable to, the acts or omissions of the *Contractor*, its employees, agents, *Subcontractors*, *Suppliers* or any other persons for whom it is in law responsible (including, without limitation, claims that directly or indirectly arise out of, or are attributable to, loss of use or damage to the *Work*, the *Owner's* property or equipment, the *Contractor's* property or equipment or equipment or property adjacent to the *Place of the Work* or death or injury to the *Contractor's* personnel). 13.1.2 The *Owner* shall indemnify and hold the *Contractor*, its agents and employees harmless from and against claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*. 13.1.3 The provisions of GC 13.1 - INDEMNIFICATION shall survive the termination of the *Contract,* howsoever caused and no payment or partial payment, no

		issuance of a final certificate of payment and no occupancy in whole or in part of the *Work* shall constitute a waiver or release of any of the provisions of GC 13.1 13.1.4 Notwithstanding the provisions of GC1.1 - CONTRACT DOCUMENTS, GC 1.1.6, GC13.1 - INDEMNIFICATION shall govern over the provisions of GC 1.3.1 of GC1.3 – RIGHTS AND REMEDIES."

SC57 GC 13.2 WAIVER OF CLAIMS

SC57.1	13.2.1	In paragraph 13.2.1 in the third line after the word "limitation" add the words "claims for delay pursuant to GC 6.5 DELAYS" -and- add the words "(collectively "**Claims**")" after "*Ready-for-Takeover*" in the fourth line.
SC57.2	13.2.1.1	In subparagraph 13.2.1.1, in each instance change the word "claims" to "Claims" and change the word "claim" to "Claim".
SC57.3	13.2.1.2	In subparagraph 13.2.1.2 change the word "claims" to "Claims".
SC57.4	13.2.1.3	Delete subparagraph 13.2.1.3 in its entirety.
SC57.5	13.2.1.4	In paragraph 13.2.1.4 change the word "claims" to "Claims".
SC57.6	13.2.2.1	In paragraph 13.2.2.1 delete the words "in paragraphs 13.2.1.2 and 13.2.1.3" and replace them with "in paragraph 13.2.1.2" -and- change the word "claims" to "Claims" in both instances and change the word "claim" to "Claim".
SC57.7	13.2.3	Delete paragraph 13.2.3 in its entirety.
SC57.8	13.2.4	Delete paragraph 13.2.4 in its entirety.
SC57.9	13.2.5	Delete paragraph 13.2.5 in its entirety.
SC57.10	13.2.6	In paragraph 13.2.6 change the word "claim" to "Claim" in all instances in the paragraph.
SC57.11	13.2.8	In paragraph 13.2.8 change "The party" to "The *Contractor* -and- change the word "claim" to "Claim" in all instances in the paragraph.
SC57.12	13.2.9	In paragraph 13.2.9 delete the words "under paragraphs 13.2.1 or 13.2.3" and replace them with "under paragraph 13.2.1" -and- change both instances of the words "the party" to "the *Contractor*". Change the word "claim" to "Claim" in all instances in the paragraph.

SC58 *NEW* PART 14 OTHER PROVISIONS

SC58.13	14.1	Add new PART 14 – OTHER PROVISIONS as follows:

		"**PART 14 OTHER PROVISIONS** **GC 14.1 OWNERSHIP OF MATERIALS** 14.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner.* The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*."
SC58.14	14.2	Add new GC 14.2 – CONSTRUCTION LIENS as follows: **"GC 14.2 LIENS** 14.2.1 Notwithstanding any other provision in the *Contract*, the *Consultant* shall not be obligated to issue a certificate, and the *Owner* shall not be obligated to make payment, subject to the *Owner*'s requirement to issue a *Notice of Non-Payment* (Form 1.1) to the *Contractor*, if at the time such certificate or payment was otherwise due: .1 a claim for lien has been registered against the *Project* lands by a *Subcontractor* or a *Supplier* that has not been vacated or discharged by the *Contractor* in accordance with the requirements of this *Contract*, or .2 if the *Owner* or a mortgagee of the *Project* lands has received a written notice of a lien that has not been resolved by the *Contractor* through the posting of security or otherwise. 14.2.2 In the event a construction lien arising from the performance of the *Work* is registered or preserved against the *Project* lands by a *Subcontractor* or a *Supplier*, or a written notice of a lien is given or a construction lien action is commenced against the *Owner* by a *Subcontractor* or a *Supplier*, then the *Contractor* shall, at its own expense: .1 within 10 calendar days of registration of the construction lien, vacate or discharge the lien from title to the premises (i.e. the *Place of the Work*). If the lien is merely vacated, the *Contractor* shall, if requested, undertake the *Owner*'s defence of any subsequent action commenced in respect of the lien, at the *Contractor*'s sole expense; .2 within 10 calendar days of receiving notice of a written notice of a lien, post security with the Ontario Superior Court of Justice so that the written notice of a lien no longer binds the parties upon whom it was served; and .3 satisfy all judgments and pay all costs arising from such construction liens and actions and fully indemnify the *Owner* against all costs and expenses arising from same, including legal costs on a full indemnity basis. 14.2.3 In the event that the *Contractor* fails or refuses to comply with its obligations pursuant to paragraph 14.2.2, the *Owner* shall, at its option, be entitled to take all steps necessary to address any such construction liens including, without limitation and in addition to the *Owner's* rights under paragraph 13.2.4, the posting of security with the Ontario Superior Court of Justice to vacate the claim for lien from title to the *Project* lands, and in so doing will be entitled to a full indemnity from the *Contractor* for all legal fees, security, disbursements and other costs incurred and will be entitled to deduct same from amounts otherwise owing to the *Contractor*. 14.2.4 In the event that any *Subcontractor* or *Supplier* registers any claim for lien with respect to all or part of the *Place of Work*, the *Owner* shall have the right to withhold, in addition to the statutory holdback, the full amount of said claim for lien plus either: (a) $250,000 if the claim for lien is in excess of $1,000,000 or (b)

			25% of the value of the claim for lien and to bring a motion to vacate the registration of said claim for lien and any associated certificate of action in respect of that lien, in accordance with Section 44 of the *Act*, by paying into court as security the amount withheld.
		14.2.5	Nothing in this GC 14.2 serves to preclude the *Contractor* from preserving and perfecting its lien in the event of non-payment by the *Owner*."

APPENDIX 1
to the Supplementary Conditions

Project-specific requirements for a "*Proper Invoice*"

To satisfy the requirements for a *Proper Invoice*, the following criteria, as may be applicable in each case, must be included with the *Contractor's* application for payment:

.1 the written bill or request for payment must be in writing;

.2 the *Contractor*'s name and current address;

.3 the *Contractor*'s HST registration number;

.4 the date the application for payment was prepared by the *Contractor*;

.5 the period of time in which the services or materials were supplied to the *Owner*;

.6 the purchase order number provided by the *Owner*;

.7 reference to the provisions of the *Contract* under which payment is being sought (e.g. GC 5.3 –PAYMENTS for progress payments, GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK GC 5.5 – FINAL PAYMENT for final payment, etc.);

.8 a description, including quantities where appropriate, of the services or materials, or a portion thereof, that were supplied and form the basis of the *Contractor's* request for payment;

.9 the amount the *Contractor* is requesting to be paid by the *Owner*, set out in a statement based on the schedule of values approved under GC 5.2.4, separating out any statutory or other holdbacks, set-offs and HST;

.10 a sworn Statutory Declaration in the form CCDC 9A-2018, only for second and subsequent progress payments;

.11 a current Workplace Safety Insurance Board clearance certificate;

.12 a pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Specifications* (or equivalent Construction Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;

.13 a separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15, 16, and 17 of the *Specifications* (or equivalent Construction Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;

.14 invoices and other supporting documentation for all claims against the cash allowance;

.15 a current, acceptable, and up to date *Construction Schedule Update*;

.16 if requested by the *Owner*, a current and valid certificate(s) of insurance as required under GC 11.1 – INSURANCE;

.17 the name, title, telephone number and mailing address of the person at the place of business of the *Contractor* to whom payment is to be directed;

.18 a current, up to date, and approved *Shop Drawing* log;

.19 in the case of the *Contractor's* application for final payment, in addition to the foregoing requirements (as applicable):

(a) any *Close-Out Documentation*, together with complete and final as-built drawings;

(b) the *Contractor's* written request for release of the *Deficiency Holdback* including a statement that no written notices of lien have been received by it;

(c) the *Contractor's* written certification that there are no outstanding claims, pending claims or future claims from the *Contractor* or their *Subcontractors* or *Suppliers*; and

(d) sufficient evidence of the *Contractor's* compliance with GC 3.11.

END OF AMENDMENTS TO CCDC 2 - 2020

1 SUMMARY OF WORK

.1 The project is:

.1 Addition to Notre Dame Catholic School. Site located at 140 Atlantis Drive, Orillia, Ontario.

.2 The school will be occupied during construction and the project includes phased localized demolition and construction.

.2 Work by Owner comprises the following:

.1 Installation of Owner equipment and furnishings unless otherwise indicated on the drawings and specifications.

.3 The words 'by others' when used in the Specifications or on the Drawings shall not mean by someone other than the Trade Contractor. The only means by which something shown or specified shall be indicated as not being in the Contract is by the use of the initials 'NIC' or the words 'Not In (the) Contract' or 'By Owner'.

.4 Construction Schedule:

.1 Final Occupancy of the Addition is to be achieved by August 11, 2028 and Substantial Performance by August 20, 2028.

.2 Note that the Work identified as Phase 1 is intended to be completed during the first summer instructional break, after June 29, 2027 or after tender award, whichever is sooner, to August 31, 2027. The contractor shall ensure that all exiting, underground site services, life safety systems, plumbing, electrical and mechanical systems that serve the existing school are fully operational and ready for use no later than August 20, 2027, and the existing school must be ready for full Use and Occupancy on August 31, 2027.

.3 Academic activities at the school facility will be ongoing during the school year while the addition is under construction. Work in the existing school facility during the school year shall follow the requirements of Section 01 41 00 – HEALTH & SAFETY GUIDELINES FOR WORK IN OCCUPIED BUILDINGS.

.4 The on-site Daycare will be operational throughout all three phases of construction. Work in the area of the Daycare is to take place after hours only and shall follow the requirements of Section 01 41 00 – HEALTH & SAFETY GUIDELINES FOR WORK IN OCCUPIED BUILDINGS.

2 WORK RESTRICTIONS

.1 Contractor's Use of Site

.1 Use of site is restricted to the areas designated on the drawings for execution of the Work. Do not unreasonably encumber site with materials or equipment. Move stored products or equipment which interfere with operations of Owner, or other contractors. Obtain and pay for use of off-site additional storage, or work areas as required by the Work.

.2 Hours of Work

.1 Hours of work for this Contract are generally confined to regular daily business hours of 7:00am to 5:00pm, Monday to Friday. Where required by sequencing of the Work, portions of the Work may be required to be performed outside of regular daily business hours, or on weekends, but

shall be performed at such times at no additional cost to the Owner.

.2 Once the building is occupied, Contractor access to the building to perform Work to Correct deficiencies or to perform warranty is restricted and work must be done after hours. School day start time is 7:00AM and end of day time is 4:00PM.

3 OFF SITE WORK

.1 All work beyond property lines, adjacent to the site, is included in Contract unless noted otherwise.

END OF SECTION

1 GENERAL

.1 Refer **General Conditions of Contract (CCDC2 – 2020) – GC 4.1 CASH ALLOWANCES.**

.2 Include all allowances listed below in the Bid Price.

.3 Expend Cash Allowances as directed by the Consultant.

.4 Each Cash Allowance will be adjusted to actual cost as defined hereunder and Contract Price will be amended accordingly by written order.

.5 Prepare Cash Allowance schedule jointly with Consultant and Owner to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed.

.6 Progress payments for work and material authorized under Cash Allowances will be made in accordance with GC 5.3 of the contract.

.7 Only when the Total Value of the Cash Allowances is exceeded will the Contractor be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.8 Include progress payments on accounts of Work authorized under Cash Allowances in Consultant's monthly certificate for payment in accordance with the Conditions of the Contract (CCDC 2 – 2020).

.9 Prepare schedule jointly with Consultant and Contractor to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed

2 MATERIAL ALLOWANCES (SUPPLY ONLY)

.1 Material cash allowance shall include and provide payment for:

.1 Net cost of material.
.2 Applicable duties and taxes.
.3 Delivery to the Place of the Work.
.4 Handling at the Place of the Work, including unloading, uncrating, storage and hoisting.
.5 Protection from damage by elements or otherwise.
.6 Overhead and profit.

.2 Include in the Bid Price, in addition to the material cash allowance, costs for the following:

.1 Labour for installation and finishing.
.2 Other expenses required to complete installation.
.3 Overhead and Profit.

3 ASSEMBLY ALLOWANCES (SUPPLY AND INSTALL)

.1 Assembly cash allowance shall include and provide payment for:

.1 Net cost of material.
.2 Applicable duties and taxes.
.3 Delivery to the Place of the Work.
.4 Handling at the Place of Work, including unloading, uncrating, storage and hoisting.

.5 Protection from damage by elements or otherwise.
.6 Labour installation and finishing.
.7 Other expenses to complete installation.
.8 Overhead and profit.

.2 Include in the Bid Price any overhead and profit or related General Contractor costs.

4 ALLOWANCE AMOUNTS

.1 The Total Cash Allowance to be included in the Stipulated Price is Three Hundred Fifty-Three Thousand, Five Hundred and Sixty Dollars ($353,560) in Canadian funds.

.2 The Cash Allowance shall cover the following (in general):
.1 Finish Hardware – supply and installation of all finish hardware for wood and hollow metal doors. Supply of finish hardware for aluminum doors - installation by others. Supply of finish hardware for teacher's closet doors - installation by others.
.2 Interior Wayfinding Signage – supply and installation of new interior signage throughout the building addition.
.3 Natural Gas (utility company charge for incoming gas service work and gas meter replacement)
.4 Hydro Pole Re-Work. Note: general contractor is to coordinate all hydro pole work with the Hydro authority.
.5 Electrical Safety Authority - review of drawings and specifications by the ESA.
Electrical Note: General inspection fees are not to be part of this fee. The Contractor is to determine general inspection fees and include in tender price.

.3 Unexpended amounts of Cash Allowances may be reallocated to other work at the sole discretion of the Consultant and Owner.

END OF SECTION

1 CHANGES IN THE WORK

.1 Change to the work not involving an adjustment in Contract Price or Contract Time and Cash Allowance authorizations will be done through a Supplemental (Site) Instruction: as issued by the Consultant, consistent with the intent of the Contract Documents.

.2 Changes to the work involving an adjustment in Contract Price or Contract Time shall be in accordance with **the General Conditions of the Contract (CCDC 2 - 2020) GC 6.1 - OWNER'S RIGHT TO MAKE CHANGES**

END OF SECTION

1 APPLICATIONS FOR PAYMENT

.1 Applications for payment on account shall be made in accordance with the **General Conditions of the Contract (CCDC 2 - 2020) PART 5 PAYMENT**.

.2 The second and all subsequent applications for payment shall include a statement based on the Schedule of Values and a standard Workers Compensation Certificate of Clearance.

2 SCHEDULE OF VALUES

.1 Submit Schedule of Values in spreadsheet form acceptable to the Consultant.

.2 Identify on each Schedule of Values, the following information:
- .1 Date of Issue
- .2 Project name
- .3 Owner's name
- .4 Contractor's name
- .5 Payment period
- .6 Payment certificate number

.3 Items of work listed shall include, but not be limited to, separate line items for the following:
- .1 General Accounts
- .2 Mobilization
- .3 Supervision
- .4 Bonds and Insurance
- .5 Permits and Licenses
- .6 Operations and Maintenance Manuals/As-Built Drawings
- .7 All trades or portions of the Work, generally in chronological order
- .8 Provision of other Products and/or services
- .9 Cash Allowance expenditures
- .10 Changes in the Work

.4 The total Contract amount for each trade or portion of the Work shall be listed beside each item.

.5 For the purposes of monthly payments, the following values shall be assigned for Operation and Maintenance Manuals and Contractor created Redline and Final electronic As-Built Drawings.
- .1 Architectural Maintenance Manuals: $2500.00
- .2 Architectural Redline As-Built Drawings: $2500.00
- .3 Structural Redline As-Built Drawings: $2500.00
- .4 Mechanical Maintenance Manuals: $2500.00
- .5 Mechanical Redline and Electronic As-Built Drawings: $2500.00
- .6 Electrical Maintenance Manuals: $2500.00
- .7 Electrical Redline and Electronic As-Built Drawings: $2500.00
- .8 Civil Redline As-Built Drawings: $2500.00

.6 The Values of the Work shall be listed as to the aggregate percentage and dollar value completed, under the following major headings:
- .1 Initial Contract Amounts for each line item
- .2 Progress to Date,
- .3 Percent Complete,

.4 Current Holdback Applied,
.5 Current Invoice less Holdback
.6 Current Invoice,
.7 Previous Billings,
.8 Contract Balance

.7 Work shall be sub-totaled under original Contract amounts, Cash Allowance expenditures, and Changes to the Work.

.8 Final totals shall identify:
.1 Total amount
.2 Holdback deducted
.3 Holdback released
.4 Amount invoiced to date
.5 Net amount
.6 HST
.7 Amount due this Certificate

END OF SECTION

1 PROJECT MANAGEMENT & COORDINATION

.1 Project Coordination

.1 The Contractor is responsible for the overall coordination of the Work. Coordinate the work of all subcontractors, and provide such assistance as is necessary, including but not limited to;

.1 Providing site dimensions and layout,
.2 Providing temporary facilities and controls,
.3 Scheduling subcontractors work to prevent conflicts,
.4 Scheduling and administering regular sub-trade scheduling and coordination meetings throughout progress of the Work.
.5 Scheduling and administering regular sub-trade safety meetings throughout progress of the Work.
.6 Coordinate construction sequences and schedules including all components of the Work, including all Divisions with interdependent responsibilities.

.2 The Contractor shall provide and facilitate production of interference drawings for coordination of the Work. Provide such interference drawings to the Consultant for review.

.2 Project Supervision

.1 Provide full time supervision in accordance with **General Conditions of Contract (CCDC 2 - 2020) GC 3.5 SUPERVISION.**

.2 Supervision shall be provided until Total Completion is achieved and the deficiencies have been completed or otherwise agreed with the Owner.

.3 The supervisor shall be responsible for the overall day-to-day coordination on site between all subcontractors, and provide such assistance as is necessary, including but not limited to;

.1 Layout,
.2 Rough carpentry work for blocking, strapping, nailers, etc.

.3 Project Meetings

.1 Attend all regular bi-weekly project progress meetings throughout progress of work.

.2 Consultant shall chair regular bi-weekly project progress meetings and shall record and distribute same to Owner, Contractor and Sub-consultants. Contractor shall forward to appropriate subcontractors.

.3 The Contractor shall be called upon to report on progress of the work at each bi-weekly progress meeting. At a minimum, they shall submit within 2 day prior to the meeting, written documentation with status of the following:

.1 2 week review of work completed
.2 2 week look ahead schedule for work upcoming
.3 Shop Drawings and Submittals Log
.4 RFI and RFCO status logs
.5 PCN and CO status logs

.4 The Contractor shall chair separate Sub-Trade bi-weekly project progress

meetings between the Contractor and all Sub-trades, and shall record and distribute same to Owner, and Consultants.

.4 Project Site Administration

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Project manual.

.3 Addenda and Bid Revisions.

.4 Reviewed shop drawings.

.5 Change orders and other Contract modifications.

.6 Field test and inspection reports.

.7 Approved schedules.

.8 Manufacturer's installation and application instructions.

1 SCHEDULES

.1 Construction Progress Schedule.

.1 Provide construction schedule in accordance with the **General Conditions of the Contract (CCDC 2 - 2020) GC 3.4 – CONSTRUCTION SCHEDULE.** Schedule must utilize "critical path" method.

.2 Indicate separate line for each trade or operation of the Work. Arrange trades in chronological order for commencement of that part of the Work. Critical Path work to be clearly identified.

.3 Identify projected major milestones in the course of the Work such as:

.1 Completion of soils removals
.2 Completion engineered fill placement
.3 Completion of foundations
.4 Completion of structural frame
.5 Completion of roof membrane
.6 Completion of rough-in of mechanical services
.7 Completion of rough-in of electrical services
.8 Completion of site services
.9 Completion of roofing
.10 Completion of each major finish item
.11 Building closing in
.12 Major inspections by building officials
.13 Required testing
.14 Substantial Performance
.15 Final Cleaning
.16 Owner set-up
.17 Deficiency Correction, etc.
.18 Each major portion work not listed above that impacts critical path.
.19 Detailed workplan to achieve completion of Phase 1 Work by August 31, 2027.

.2 Submittal Schedule

.1 Provide schedule for submittal of all Shop Drawings, Product Data and Samples.

.2 Provide complete list of all manufactured products to be used in the course of the Work, including those amended by addenda.

.3 Submission of Schedules

.1 Submit one copy of each schedule to the Consultant for review, prior to first progress billing. Amend schedule as required.

.2 Submit 4 copies of each subsequent issue of schedules to the Consultant.

.3 Update schedule on a regular basis or as requested by the Consultant.

2 SUBMITTAL PROCEDURES

.1 Submit to Consultant, all items specified for review, with reasonable promptness and in orderly sequence so as to not cause delay in the 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 The Contractor shall schedule a minimum of 10 working days in order for the Consultants to review each submission. This shall also apply to subsequent resubmissions.

.3 Do not proceed with work affected by the submittal until review is complete.

.4 Review all submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, and dated by the Contractor will be returned without review.

.5 Verify field measurements and affected adjacent work are coordinated.

.6 Contractor's responsibility for errors and omissions in submission, or deviations from requirements of Contract Documents, is not relieved by Consultant's review of submittals.

.7 Keep one reviewed copy of each submission on site.

.8 Shop Drawings

.1 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 3.8 SHOP DRAWINGS**.

.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 the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of the Work, the Contractor shall state such in writing to the Consultant within five (5) business days of receipt of the reviewed shop drawings. The Contractor shall not proceed with the Work requiring adjustment in price without prior approval by the Consultant. The Owner will not be responsible for any resulting delays in construction because of delayed notice.

.4 Make changes to shop drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those requested. Any work completed for adjustments without Consultant prior approval is at the Contractor’s expense and as such, the Owner will not be subject to increased costs to the contract.

.5 Shop drawings shall be submitted electronically wherever possible. Files shall be in PDF format only.

.6 Shop drawings submitted by FAX, or as copies of FAX transmissions are not acceptable as shop drawings, and will not be reviewed.

.7 Reproductions of Consultants' drawings are not acceptable for the purpose of creating Shop Drawings. Any drawings submitted for review which contain drawings or any parts of drawings produced by the Consultant, will be rejected. The Owner will not take responsibility for any resulting delays in construction as a result of the above.

.8 Shop drawings not submitted in the scale type of the contract documents (ie; metric for metric drawings) will not be reviewed.

.9 Product Data Sheets

.1 Manufacturer's standard schematics, catalogue sheets, diagrams, schedules, performance charts, illustrations and other descriptive data are acceptable in lieu of shop drawings, where specified.

.2 Product Data Sheets are acceptable provided they conform to the following:

.1 Information not applicable to project has been deleted.
.2 Supplement standard information to provide additional information applicable to project.
.3 Show dimensions and clearances required.
.4 Show performance characteristics and capacities.
.5 Show wiring diagrams, when requested, and controls.

.3 Submit product data sheets or brochures for requirements requested in specification Sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.4 Submit Product Data Sheets.

.5 Product data sheets submitted by FAX, or as copies of FAX transmissions will not be accepted.

.10 Return of Submissions

.1 If shop drawings or data sheets are rejected, noted copy will be returned and resubmission of corrected shop drawings or data sheets through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

.11 Samples

.1 Submit samples for review, in duplicate, in sizes requested in respective specification sections. Label samples as to origin and intended use in the Work.

.2 Where colour, pattern or texture is criteria, submit full range of samples.

.3 Deliver samples prepaid to Consultant's office.

.4 Notify the Consultant in writing, at the time of submission of deviations in samples from requirements of Contract Documents.

.5 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If adjustments affect the value of the Work, the Contractor shall state such in writing to the Consultant within five (5) business days of receipt of the reviewed shop drawings. The Contractor shall not proceed with the Work requiring adjustment in price without prior approval by the Consultant. The Owner will not be responsible for any resulting delays in construction because of delayed notice. Any work completed for adjustments without Consultant prior approval is at the Contractor's expense and as such, the Owner will not be subject to increased costs to the contract.

.6 Make changes in samples, which the Consultant may require, consistent with Contract Documents.

.7 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on project.

.12 Submission Requirements

.1 Accompany submissions with transmittal letter containing:

.1 Date,
.2 Project title and number,
.3 Contractor's name and address,
.4 Drawing/page numbers of each shop drawing or data sheet,
.5 Identification (ie. "Structural Steel Shop Dwgs."), and
.6 Number of copies submitted.

.2 Submissions shall include (where applicable) :

.1 Date and revision date,
.2 Project title and number,
.3 Name of Contractor, Subcontractor(s), Supplier/Manufacturer,
.4 Identification of product or material,
.5 Relation to adjacent structure or materials,
.6 Field dimensions, clearly identified as such,
.7 Reference standards (CSA, CGSB, ASTM, etc.), and
.8 Contractor's stamp, initialed or signed, certifying review of submission, and verification of field measurements.

.13 Distribution of Submittals after Review

.1 Distribute copies of shop drawings and product data which carry Consultant's stamp as follows (where applicable):

.1 Job site file (Record documents),
.2 General Contractor's office,
.3 Subcontractors, and
.4 Suppliers or Fabricators.

END OF SECTION

1 GENERAL

.1 Provide construction photographs in accordance with procedures and submission requirements specified in this section.

.2 Photographs shall be taken using a digital camera.

.3 Photographs shall be named and grouped by date using the following file name format: **Notre_Dame_ Catholic_School_Addition_P00777** - YYYY_MM_DD (##).jpeg

2 PROGRESS PHOTOGRAPHS

.1 Provide 1 digital set of construction photographs, documenting progress of the Work. Submit one digital set with each monthly progress draw.

.2 Submit progress photographs with each monthly progress draw, and at the following milestones;

.1 Completion of excavation and pouring of footings, including founding elevation of underside of footing excavation.
.2 Completion of foundations prior to backfilling.
.3 Completion of structural frame.
.4 Completion of rough-in of mechanical and electrical services before concealment.
.5 Completion of roofing membrane.
.6 Completion of each major portion of Work.
.7 Completion of each major finish item.

.3 Orientation of Photographs: provide photos from a minimum of 4 general viewpoints, as well as specific views as required by milestones specified above, and as determined by Consultant prior to first Progress Draw.

3 FINAL PHOTOGRAPHS

.1 Submit full digital set of construction photographs taken during course of Work with Operations & Maintenance Manuals at the completion of the project.

.2 Orientation of Photographs: provide final photos as follows:

.1 General viewpoints as defined above,
.2 Views of all exterior elevations,
.3 One view from each street,
.4 Views of site showing parking areas and play surfaces,
.5 Interior views of all major spaces,
.6 One set of views of a typical room,
.7 Specific views as determined by Consultant (Max. 48 views).

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES
- .1 Requirements for quality of work.
- .2 Requirements for material inspection and testing.
- .3 Requirements for determination of defective materials and work.

1.2 REFERENCE STANDARDS
- .1 CSA A23.1; Concrete Materials and Methods of Concrete Construction.
- .2 CSA A23.2; Methods of Test for Concrete.
- .3 CSA S16.1; Limit States Design of Steel Structures.
- .4 CSA W47.1; Certification of Companies for Fusion Welding of Steel Structures.
- .5 CSA W59; Welded Steel Construction (Metal Arc Welding).
- .6 CISC; Code of Standard Practice for Structural Steel.
- .7 OPSS; Ontario Provincial Standard Specifications.

1.3 REGULATORY REQUIREMENTS
- .1 Products and services provided to complete the Work shall meet or exceed requirements of specified standards, municipal by-laws, building codes and referenced documents.

1.4 INDEPENDENT INSPECTION AND TESTING
- .1 Independent Inspection and Testing Consultants will be engaged by the Owner for the purpose of inspecting and/or testing individual portions of the Work. The initial cost of such services will be borne by the Owner.

1.5 RESPONSIBILITIES
- .1 Inspection and Testing Consultants
  - .1 Inspection and Testing Consultants shall;
    - .1 Provide inspection and testing specified,
    - .2 Inform the Contractor, Consultant and Owner upon observance of materials, systems, or procedures not in compliance with the specifications, and
    - .3 Submit complete reports to the Contractor, Consultant and Owner in a timely manner.

- .2 Contractor
  - .1 Contractor shall:
    - .1 Provide access to the Work for Inspection/Testing Consultants, and
    - .2 Inform the Inspection/Testing Consultants in advance of day and time required for inspection and tests.
  - .2 It is the responsibility of the General Contractor to ensure the quality control requirements of the Contract are implemented.
  - .3 Costs for any additional inspections resulting from contractor's failure to correct deficient work in previous inspections will be borne by the General Contractor.

- .4 Consultant
  - .1 The Consultant will make final decisions on changes to the scope of work of inspection and testing that may affect the Contract Price.

.2 When informed of any material procedure or test result that does not meet or exceed the specifications, the Consultant will respond to resolve the issue.

1.6 ACCESS TO WORK

.1 Allow inspection & testing company's access to the Work, as well as off-site manufacturing and fabrication plants.

1.7 REPORTS

.1 Submit three copies of inspection and test reports to the Consultant.

.2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

.3 Submit one copy of inspection and test reports to the Building Official having jurisdiction, where required by that official.

.4 The cost of tests beyond those called for in the Contract Documents or beyond those required by the law of the Place of Work shall be appraised by the Consultant and may be authorized as recoverable at the discretion of the Consultant and agreed by the Owner.

1.8 EARTHWORK

.1 All earthwork shall be subject to inspection and testing as specified herein. Inspection and Testing shall include.

.1 Inspection of excavation for foundations.
.2 Inspection of subgrade and granular fill materials.
.3 Inspection of backfill operations.
.4 Inspection and testing of backfill compaction.
.5 Inspection of trenching and bedding associated with underground services.
.6 Inspection and testing of fill and compaction associated with underground services.

1.9 CAST-IN-PLACE CONCRETE

.1 All cast-in-place concrete shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Verification of materials delivered to site.
.2 Slump tests.
.3 Sampling of cylinders, and compressive strength tests.

1.10 MASONRY MORTAR

.1 All masonry mortar shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Visual inspection of all materials.
.2 Sampling and testing of mortar cubes.

1.11 STRUCTURAL STEEL

.1 All structural steel shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Confirmation that materials supplied meet specifications.

.2 Shop inspection during fabrication of steel.
.3 Checking welders' CWB Certification.
.4 Checking fabricated members against design member shapes.
.5 Checking fabricated members against allowable sweep and camber.
.6 Checking fabricated members against specified camber.
.7 Visual inspection of all welded connections including spot-checking of joint preparation and fit-up.
.8 Non-destructive testing of welding.
.9 Sample checking that tolerances are not exceeded during erection including fit-up of field-welded joints.
.10 Inspection of field cutting.
.11 Inspection and testing of all field bolted connections.
.12 Visual inspection of all welds securing steel deck to structural steel.
.13 Visual inspection of all bearing plate locations.

1.12 AIR/VAPOUR BARRIERS
.1 All building envelope air/vapour barrier components shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Visual inspection of total membrane for defects.
.2 Visual inspection of all transition membranes.

1.13 SPRAY APPLIED FOAM INSULATION
.1 Requires full time inspection while work is being done to confirm installation methods are being followed and thicknesses are being achieved.

1.14 ROOFING
.1 All roofing shall be subject to inspection as specified herein. Inspection and Testing shall include:
.1 Inspection of all roofing materials to verify compliance with specifications.
.2 Inspection of roofing application.

1.15 ASPHALT PAVING
.1 All asphalt paving shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Inspection and compaction testing of all granular base courses.
.2 Marshal Density testing of asphalt material.
.3 Compaction testing of all courses of asphalt paving.

2 PRODUCTS

(RESERVED)

3 EXECUTION

3.1 INSPECTION AND TESTING - GENERAL
.1 Furnish test results and mix designs as may be requested.

3.2 INSPECTION AND TESTING - PROCEDURES
.1 Notify the appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or 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 the Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store, cure and inspect test samples.

3.3 QUALITY OF THE WORK

.1 Quality of the Work shall be first class, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required work is such as to make it impractical to produce required results.

.2 Do not employ any unfit person or anyone unskilled in their required duties. The Consultant reserves the right to require the dismissal from the site, of workers deemed incompetent, careless, insubordinate or otherwise objectionable.

3.4 DEFECTIVE MATERIALS AND WORK

.1 **Refer to General Conditions of Contract GC 2.4 of CCDC 2-2020**.

.2 Where evidence exists that defective work has occurred, or that work has been carried out incorporating defective products, the Consultant may have independent tests, inspections, or surveys performed in order to determine if work is defective. Tests, inspections, or surveys carried out under these circumstances will be provided at the Contractor's expense in the event of defective work. Where tests incorporate a number of samples, payment will be assessed, by the Consultant, based on the ratio of conforming to non-conforming results. This does not include re-testing of soil compaction during placement, unless where evidence exists that failure to meet required compaction is because of non-conformance with the Contract documents or by negligence of the contractor.

END OF SECTION

1 GENERAL

1 SECTION INCLUDES
- .1 Codes and Standards.
- .2 Authority Having Jurisdiction.
- .3 Health and Safety Guidelines for Work in Occupied Buildings.
- .4 Permits and Fees.
- .5 Relics, Antiquities and Human Remains.

2 CODES AND STANDARDS
- .1 Codes
  - .1 All construction shall conform to the Ontario Building Code, the National Building Code (NBC) and the National Fire Code (NFC) latest editions including all supplements and amendments.
  - .2 Conform to all other codes, by-laws and regulations as specified within individual sections of the specifications.
- .2 Industry Standards
  - .1 Industry Standards are specified within individual sections as applicable to those portions of the Work. The latest editions of all industry standards shall be the standards for which quality of work shall be assessed.
  - .2 Comply with all relevant codes, standards and industry-accepted practices, as specified herein, or as applicable to the Work.

3 AUTHORITIES HAVING JURISDICTION
- .1 The Chief Building Official of the Municipality of the Place of the Work, is the primary Authority Having Jurisdiction for compliance with all codes, by-laws and regulations as they apply to all construction.
- .2 Other Authorities Having Jurisdiction may be required to review and approve certain portions of the Work. The Chief Building Official of the Municipality of the Place of the Work, will determine the requirements for such involvement.

4 HEALTH AND SAFETY GUIDELINES FOR WORK IN OCCUPIED BUILDINGS
- .1 In addition to all Occupational Health and Safety Act and Regulations for Construction Projects (2000) (Ontario Regulation 213/91, amended by Reg. 631/94, & Reg. 145/00) and by all authorities having jurisdiction, when applicable the Contractor shall conform with requirements of Section 01 41 10 - SMCDSB Health and Safety Guidelines for Work in Occupied Buildings.

5 PERMITS AND FEES
- .1 No construction work may commence without a valid, posted Building Permit unless authorization otherwise is granted by the Authority Having Jurisdiction.
- .2 The Owner is responsible for obtaining all necessary information and applying for the Building Permit, including payment of associated fees. Contractor is responsible for obtaining the building permit.
- .3 The Contractor is responsible for applying for, and obtaining all necessary permits, licenses, or certificates required by the Work.

.4 Authorities Having Jurisdiction may levy fees for issuing permits, licenses, or certificates under their jurisdiction. The Contractor shall pay all such fees as required, and shall include the cost of such fees in their Contract Price.

.5 Furnish certificates and permits from other Authorities Having Jurisdiction when so requested by the Consultant.

.6 Prior to commencement of construction, post the Building Permit at the Place of the Work.

6 RELICS, ANTIQUITIES AND HUMAN REMAINS

.1 Comply with the General Conditions of the Contract with respect to relics, antiquities, and human remains.

.2 Isolate and protect human remains, relics, antiquities, items of historical, archeological or scientific interest such as cornerstones, commemorative plaques, inscribed tablets and other similar objects found during the course of the Work.

.3 If such items are discovered in the course of construction, stop work in the immediate vicinity and give immediate notice to the Consultant as to the nature of the discovery, and await written instructions before proceeding with work in the area.

.4 Resume work only after the conclusion of any inspection and evaluation by experts engaged by the Owner, and only after being given permission to do so.

.5 Relics, antiquities and items of historical or specific interest remain the Owner's property.

END OF SECTION

Note: the health and safety guidelines in this section are applicable additional requirements of the contract when construction is occurring in school building during the occupied time of the full week proceeding Labour Day weekend to the end of the first full week in July.

1 WORK SITE LOCATION

.1 Hours of operations for the construction in unoccupied areas may occur during the regular work week hours with the following exception, odor based construction activities such as; painting, rubber base, carpet, epoxy flooring etc shall be limited to Fridays from 4pm to Saturday at 12 midnight. (This allows for a 36-hour time period for off gassing.)

.2 Hours of operations for occupied areas requiring access through the occupied areas may only occur from 4pm to 7am Monday to Friday and 4pm Friday to 7am Monday with the following exception, odor based construction activities such as; painting, rubber base, carpet, epoxy flooring etc shall be limited to Fridays from 4pm to Saturday at 12 midnight. (This allows for a 36-hour time period for off gassing.)

.3 Work during school hours must be approved by the appropriate Board Authority and the School Principal / designate. All construction and maintenance activities shall be confined to the areas of the school under construction. Fire exits shall be maintained at all times and physical barriers will be used to isolate the construction work from school staff and students.

.4 The contractor must co-operate and co-ordinate all construction activities, which may interfere with the school, with the school Principal / designate. All noise related construction activities that would affect the staff and students' abilities to properly concentrate on school related activities is to be limited to 4pm to 8am daily.

.5 It is the responsibility of the Contractor to clearly demark the work site borders and areas not to be used by usual occupants of the building or grounds. The Contractor must at all times erect and maintain adequate fencing or barriers around all excavations, pits, and in other places of danger.

.6 The Contractor must be responsible for all sub-trades, including payment of the same, necessary to produce a complete installation.

.7 Power and water may be available from the site where approved, but these facilities shall not be altered for the Contractor's use.

.8 The Contractor shall obtain approval from the Capital Projects Officer for location of temporary buildings, temporary office, storage sheds and workshops as required by the work throughout the period of construction. The contractor must remove temporary buildings upon completion of the work and restore the property to the condition as found on commencement of the work.

.9 The Contractor and their employee(s) must be aware of the location of the school's Health & Safety Board containing the following information: Designated Substance Reports, MSDS Sheets and general Health & Safety information. The contractor must provide a First Aid Kit and the name of the Safety Representative and stretcher for use by contractor employees.

.10 The Contractor must not use school property as an office, for the purpose of hiring staff or conducting business or personal affairs on any project.

2. COMMUNICATION

.1 The Site Supervisor and Principal / designate shall have communication meetings at the start of each day for the purpose to review the construction activities planned for that day.

.2 The Board's Capital Projects Officer will follow-up with the Principal / designate regularly to review the communication between the Site Supervisor and the Principal / designate and to review construction activities.

.3 The Principal / designate will communicate work activities to the school staff and students as required.

.4 The Principal / designate is the single point of contact for reporting of Health and Safety incidences from staff. Upon receipt of notification of an incidence the Principal / designate shall perform an investigation with the School Health & Safety Representative. Following the investigation, the Principal / designate and the School Health and Safety Representative will decide either to evacuate or relocate staff and students from the area of concern. Following this, the Principal / designate will report the findings to the contractor's site supervisor and the Board's Capital Projects Officer. If the belief is that, there is an immediate danger to the Health and Safety of staff and students the Principal / designate may direct the contractor's site supervisor to terminate construction activities until such time that all parties believe the workplace is safe. The reporting structure to the Board is as follows, the Principal / designate shall report directly to the Board's Capital Projects Officer who will in turn report the incidence to the Board's Health and Safety Officer. If the Board's Capital Projects Officer is not reachable the Principal /designate is to contact the Assistant to the Controller of Planning & Facilities at extension 351. From this point the Board's Capital Projects Officer or the Assistant Manager of Facilities Services will be notified of the incidence.

3. SCHOOL USE OF FACILITIES

.1 The school regular hours of operations are from 7am to 4pm Monday to Friday.

.2 The school is encouraged to hold off any after-hours use of facilities adjacent to the area of work until completion of the construction contract. That said it is understood that the school needs to continue to provide activities beyond the regular school day and thus after-hours school use of facilities in the building will be permitted from Monday to Thursday. The school must be aware and accept that after-hours use may be interrupted by construction activities.

.3 The Principal / designate will communicate after hours use of facilities activities to the Contractor's site supervisor at the communication meetings described in 2.1 of 2. COMMUNICATION. It is anticipated that the Contractor will co-operate with the school to make the facilities available and safe for the use of extra-curricular activities such as sports tournaments, school dances, school productions etc.

.4 Staff are encouraged to work from home for after-hours work until completion of the construction contract.

.5 External Groups are not permitted to use the facilities after hours until completion of the construction contract.

4. OPERATION OF VEHICLES ON BOARD PROPERTY

.1 Prior written approval must be obtained from the School Principal / designate when bringing vehicles on to school property during schools hours. Trucks and all other vehicles shall proceed with caution with a maximum 10 km/h on school property. All trucks must be equipped with automatic back-up alarms. If a back-up alarm is not available than a Flag person must be provided.

.2 Trades persons vehicles must be parked in designated parking areas with signage to indicate “Contractor Parking Only”. All trades personnel are to back their vehicles into the spaces.

5. TOOLS AND EQUIPMENT

.1 The Contractor’s equipment/tools must be in safe working condition, including required guards on tools and equipment and grounding devices. Operating manuals and maintenance records shall be available on request for all powered equipment.

6. MATERIAL STORAGE

.1 Contractor material and equipment must be stored in a safe manner in designated materials storage areas. These areas shall be protected at minimum with snow fencing sufficiently secured by metal posts.

.2 Oxygen and acetylene cylinders must be chained in the vertical position or be secured on a welding cart designed for this purpose. If not on a cart, the cylinder regulator must be removed and the cylinder cap on. Full and empty tanks are to be stored in separate fenced areas and signage provided to indicate their presence.

.3 Propane tanks that are not in use must not to be stored in school buildings. Propane cylinders shall not be changed indoors. Workers using propane must have Technical Standards Safety Authority (T.S.S.A.) Certification and provide proof to the Board upon request.

.4 Open cans of varsol, thinners and other volatile products are not permitted in the building. For storage and dispensing restrictions, refer to Item 8. “FLAMMABLE LIQUIDS “.

.5 Paint cans must be sealed when not in use and stored in construction areas.

7. NATURAL GAS PIPING

.1 All work related to natural gas systems must be completed by a licensed gas fitter. This work may not occur while the building is occupied.

8 FLAMMABLE LIQUIDS

.1 Flammable liquids must be stored in appropriate ULC approved metal safety containers with a flame arrestor and spring-loaded cap. The contractor is responsible for the provision of proper storage containers and/or steel cabinet designed for that purpose. One day's supply of flammable liquid may be used without a steel flammable storage cabinet. However, dispensing containers for flammable liquids must be as described above and containers and dispensing

equipment must be bonded and grounded. Dispensing must be done using mechanical ventilation or be done outdoors. Equipment and dispensing methods must confirm to CSA B376-M1980 and Ontario Regulation 213/851.

9 CONTROLLED PRODUCTS (WHMIS)

.1 All controlled products must be WHMIS labeled before being brought onto Board property. Material Safety Data Sheets for all controlled products must be available on site. The contractors are responsible for training their employees in the safe use and handling of all controlled products and proof of training must be provided as part of the Pre-Qualification.

10 SAFETY EQUIPMENT

.1 The contractors are responsible to ensure that all employees wear safety equipment, as required, to work in a safe manner. Contractors must ensure that their employees are trained in the use of this equipment.

11 FIRE SAFETY

1 The contractor is responsible for providing fire extinguishers in the repair / renovation / construction areas and for ensuring that employees are trained in the use of extinguishers.

.2 The following persons contact numbers shall be added to the school's Fire Plan – Emergency Contacts list; the Board's Capital Projects Officer, the contractor's Site Supervisor and the contractor's emergency line.

12 CIGARETTES, ALCOHOL AND ILLEGAL DRUGS

.1 Smoking is not permitted on Board property. Consuming alcohol or illegal drugs on Board property is strictly prohibited. Persons appearing to be under the influence of alcohol or illegal drugs will be asked to leave the work site. The contractor must ensure that employees asked to leave are provided transportation home.

13 HOUSEKEEPING

.1 Contractors must keep work site areas clean and tidy. Nails in lumber must be removed. Materials must be laid down and piled safely and garbage must be placed in proper waste containers.

.2 The contractor must survey the site at the end of each day and remove any garbage that has not been removed as described in 13.1.

14 LADDERS, SCAFFOLDS, SWING STAGES, VERTICAL MAN-LIFTS

.1 The contractors are responsible for training their employees in inspecting, erecting, and using scaffolds, ladders, swing stages and vertical man-lifts. Ladders must extend 3 feet beyond the upper support. Ladders must be held by a worker on the ground or tied off if over 10 feet high. Formal training must be given to workers on the proper use of scaffolds, swing stages and vertical man-lifts if used on the job. Equipment operating manuals and the required Professional Engineering documents must be available on site and produced upon request.

15 ASBESTOS

.1 Prior to commencement of any work affecting the structure of the building, the Contractor shall review the asbestos report for the building (available through the Board's Capital Projects Officer.) The Contractor shall evaluate the potential

presence of asbestos in the specific work zone. If asbestos is present, the Board's Capital Projects Officer shall be notified immediately, and no work is to proceed until any materials containing asbestos have been dealt with in accordance with the Occupational Health and Safety Act and the Board's Asbestos Management Program.

16 PERMITS AND REGULATIONS

.1 The Contractor shall obtain any required permits and conform to any existing applicable codes, such as the Canadian Standards Association, Underwriter's Laboratories of Canada, Ontario Fire Code, Ontario Building Code, Ontario Electrical Code, Ministry of Labour, and all local Bylaws and any other applicable regulatory requirements.

.2 The Contractor shall record all electrical work performed on a daily basis.

17 INJURIES

.1 Each Contractor or sub-contractor is responsible for responding to, providing treatment and transporting to medical services their injured employees. Response must include first aid to the injured person, hospital aid, securing the site and notification as required under the Occupational Health and Safety Act. Emergency Response Plans should be in place for all emergencies and pull stations used to clear the building if required. Someone on site must be certified in Standard Care First Aid. The School Principal / designate or the Board's Capital Projects Officer shall be notified of any emergency or worker injury.

18 SUPERVISION AND RESPONSIBILITY

.1 The Contractor shall supervise and direct the work of all persons engaged in the work, including sub-contractors and those who supply materials and the contractor will be fully responsible for full compliance with the terms of the contract by all such persons. All construction shall be performed as specified and in a manner conforming to the best trade practices.

19 DEFECTIVE MATERIAL AND WORKMANSHIP

.1 The Contractor shall promptly remove from the building all used materials and materials condemned by the Board, as failing to conform to the contract, whether incorporated in the work or not.

20 CUTTING, PATCHING, DIGGING AND FITTING

.1 The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit to it, receive or be received by work of other contractors, shown upon or reasonably implied by the contract documents and he shall make good after them. Any costs or expenses caused by poorly coordinated or ill-timed work shall be borne by the party responsible therefore.

.2 The Contractor shall not endanger any existing work or building by cutting, digging or otherwise.

.3 Any work requiring the use of welders, torches etc. requires a Hot Work Permit issued by the Board's Plant Services Dept. This permit shall be coordinated through the Board's Capital Projects Officer.

21 VENTILATION

.1 Contractor to ensure that HVAC systems are run in occupied mode 24hrs per day 7 days a week until completion of the construction contract. Contractor to make all necessary arrangements for running of the HVAC systems through the Board's Capital Projects Officer.

.2 Filter changes to the HVAC systems must be increased in frequency to bi-weekly changes until the work of the contract is complete.

.3 The Board will provide the filter changes in 21.2 to occupied areas of the school. The contractor is responsible for the filter changes in 21.2 in all unoccupied areas.

22 DUST CONTROL

.1 The contractor shall provide appropriate polyethylene plastic curtains between new construction and corridors to prevent dust penetration and provide doormats and take other appropriate precautions in these rooms to prevent dirt being tracked into the school. These areas must be sealed tight with tape or other suitable material to provide a dust and vapor tight enclosure.

.2 Fresh air returns from construction areas shall be sealed tight or temporary filter system provided while dust-causing work is being performed.

.3 The contractor shall provide suitable dust control for all exterior construction activities.

.4 Dust control measures must be used when sweeping of floors in construction areas.

23 SIGNAGE

.1 Signage shall be provided by the contractor on the occupied side of every door and entry into construction areas. Signage shall indicate "Construction Zone – Authorized Personnel Access Only" or similar wording.

.2 Construction signage shall also be provided by the contractor for any exterior site work activities. The signage shall indicate "Construction Zone – Authorized Personnel Access Only" or similar wording.

.3 In addition to items 23.1 and 23.2, the contractor shall also provide for and maintain all required construction signage by the Ministry of Labour.

24 BUSSING AND TRANSPORTATION ROUTES

.1 No construction activity may occur during student drop-off and pick-up times. The Site supervisor shall obtain the bussing schedule from the school Principal / designate.

.2 All fire and emergency access routes shall be maintained free and clear of any obstructions 24hrs per day 7 days a week. These access routes shall also be maintained and accessible to allow for snow removal by Board retained snow removal contractors.

.3 The school is responsible for ensuring that the routes (described in 24.2) are clear is limited to ensuring that they are kept clear of staff, student, visitor and school

delivery vehicles.

.4 The Board shall arrange for normal snow clearing of the parking areas and the fire and emergency access routes. The Contractor is responsible for controlling dust mud build- up of these routes.

25 SECURITY

.1 The school must be left in a safe and secure condition at the end of every day. The Contractor is responsible for arming the building at the end of each day if school staff are not present.

.2 The Contractor shall be solely responsible for loss or damage of his/her tools, equipment or any materials on Board property.

.3 The Contractor shall ensure the work zone is clearly delineated with appropriate barricades to prevent unauthorized access.

.4 The Contractor shall key all door cylinders in door entries to construction areas with a construction key different than that of any keying dedicated to the building. One key shall be provided to the following Board personnel; Principal / designate, Vice-Principal / designate, Board's Capital Projects Officer and the Custodian-in-Charge. Duplication of the construction keys is not permitted by Board personnel unless consent is provided jointly by the contractor and Board's Capital Projects Officer.

.5 All doors and entries into construction zones shall remain locked at all times to prevent unauthorized entry into these spaces.

.6 The Principal / designate, Vice-Principal / designate and Custodian in Charge shall access construction areas for emergency purposes only. The Board's Capital Projects Officer is entitled access to these areas to perform site review and inspection activities.

.7 Access to all construction areas shall be made directly from the exterior only unless it is agreed to with the Principal / designate / designate and/or the Board's Capital Projects Officer that access is required through the occupied spaces.

26 WASHROOMS/TOILETS

.1 The Contractor shall provide and maintain in a sanitary condition, washrooms and toilets for the use of all persons at the work site, and upon completion of the work, remove it and contents, and leave its site in a neat, clean and sanitary condition. Workers shall use designated washrooms as designated by their employer.

.2 School washrooms/toilets are not to be used by any trades persons.

27 SAFE EXCAVATION/DRILLING PRACTICES

.1 Prior to work commencing the Contractor shall adhere to the following the procedures;

.1.1 Obtain ground locates of the following utilities, but not limited to, water, electrical, gas, Bell, fiber optics, ground source heating lines. Locates are to be physically identified on the ground with paint or flags and the Contractor shall obtain a certificate by the Locate Contractor with a sketch

map identifying these locates. A copy of such is to be provided to the School Board and it is obligatory that the School Board's Capital Projects Officer review the site to confirm the presence of the paint identification markings, flags etc. prior to the work commencing.

.1.2 The Locate/certificate shall not go beyond the expiry date. In the event that the certificate expires the contractor shall obtain new locates and follow the procedures described in 27.1.1

.1.3 The contractor shall provide minimum 48hrs notice of the work activities to the School Board's Capital Projects Officer and the contractor shall provide a schedule of the work.

.2 The Contractor shall be knowledgeable of all Safe Digging regulations for each Utility Company.

END OF SECTION

Abbreviations listed, when used in the Contract Documents, shall have the following meanings:

ABBREVIATION	MEANING
AA	ALUMINUM ASSOCIATION
AAMA	ARCHITECTURAL ALUMINUM MANUFACTURERS` ASSOCIATION
AASHO	AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
ACI	AMERICAN CONCRETE INSTITUTE
AGA	AMERICAN GAS ASSOCIATION
AIA	AMERICAN INSTITUTE OF ARCHITECTS
AIMA	ACOUSTICAL & INSULATING MATERIALS ASSOCIATION
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
AMCA	AIR MOVING AND CONDITIONING ASSOCIATION INC.
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING & AIR CONDITIONING ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWI	ARCHITECTURAL WOODWORK INSTITUTE (USA)
AWMAC	ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA
AWS	AMERICAN WELDING SOCIETY
CCA	CANADIAN CONSTRUCTION ASSOCIATION
CCRC	CANADIAN CODE FOR RESIDENTIAL CONSTRUCTION
CEC	CANADIAN ELECTRICAL CODE
CFUA	CANADIAN FIRE UNDERWRITERS ASSOCIATION
CGA	CANADIAN GAS ASSOCIATION
CGSB	CANADIAN GENERAL STANDARDS BOARD
CIQS	CANADIAN INSTITUTE OF QUANTITY SURVEYORS
CISC	CANADIAN INSTITUTE OF STEEL CONSTRUCTION
CITC	CANADIAN INSTITUTE OF TIMBER CONSTRUCTION
CLA	CANADIAN LUMBERMEN`S ASSOCIATION
CMHC	CANADA MORTGAGE & HOUSING CORPORATION
COFI	COUNCIL OF FOREST INDUSTRIES OF BRITISH COLUMBIA
CPCI	CANADIAN PRESTRESSED CONCRETE INSTITUTE
CRCA	CANADIAN ROOFING CONTRACTORS ASSOCIATION
CSA	CANADIAN STANDARDS ASSOCIATION
CSC	CONSTRUCTION SPECIFICATIONS CANADA
CSI	CONSTRUCTION SPECIFICATIONS INSTITUTE (USA)
CSPI	CORRUGATED STEEL PIPE INSTITUTE
CSSBI	CANADIAN SHEET STEEL BUILDING INSTITUTE
CUA	CANADIAN UNDERWRITERS` ASSOCIATION
CWB	CANADIAN WELDING BUREAU
CWC	CANADIAN WOOD COUNCIL
DND	DEPARTMENT OF NATIONAL DEFENCE, CANADA
FM	FACTORY MUTUAL ENGINEERING CORPORATION
FS	FEDERAL SPECIFICATION (USA)
IES	ILLUMINATING ENGINEERING SOCIETY
IGMAC	INSULATED GLASS MANUFACTURERS ASSOCIATION OF CANADA
LTIC	LAMINATED TIMBER INSTITUTE OF CANADA
MIA	MARBLE INSTITUTE OF AMERICA
MPMDD	MODIFIED PROCTOR MAXIMUM DRY DENSITY
NAAMM	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (USA)
NBFU	NATIONAL BOARD OF FIRE UNDERWRITERS

NBC	NATIONAL BUILDING CODE OF CANADA
NBS	NATIONAL BUREAU OF STANDARDS (USDC)
NEMA	NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NHLA	NATIONAL HARDWOOD LUMBER ASSOCIATION (USA)
NLGA	NATIONAL LUMBER GRADES AUTHORITY
NRC	NATIONAL RESEARCH COUNCIL
OBC	ONTARIO BUILDING CODE
OHSA	OCCUPATIONAL HEALTH AND SAFETY ACT
OPSS	ONTARIO PROVINCIAL STANDARD SPECIFICATIONS
PCA	PORTLAND CEMENT ASSOCIATION
PCI	PRESTRESSED CONCRETE INSTITUTE
SDI	STEEL DECK INSTITUTE
SPMDD	STANDARD PROCTOR MAXIMUM DRY DENSITY
SSPC	STEEL STRUCTURES PAINTING COUNCIL
TTMAC	TERRAZZO, TILE & MARBLE ASSOCIATION OF CANADA
ULC	UNDERWRITERS LABORATORIES CANADA
UL	UNDERWRITERS LABORATORIES (USA)
USAS	UNITED STATES OF AMERICA STANDARDS INSTITUTE
WSIB	WORKPLACE SAFETY AND INSURANCE BOARD

END OF SECTION

1 REFERENCES

.1 Occupational Health and Safety Act and Regulations for Construction Projects (2000) (Ontario Regulation 213/91, amended by Reg. 631/94, & Reg. 145/00).

.2 National Fire Code of Canada (2005)

.3 Ontario Fire Code (2005)

.4 Ontario Building Code (2006)

2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities, facilities and controls in order to execute the work expeditiously. Remove from site all such work after use.

3 VEHICULAR ACCESS & PARKING

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary access roads where indicated or required, and provide snow removal during period of work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads. Maintenance shall include regular snow removal if not provided under separate contract, and regular power washing to remove mud and dirt.

.4 Where site access for construction vehicles necessitates use of public roads, remove mud and dirt from such roads where contaminated by construction vehicles.

.5 Traffic Control: Provide and maintain flag persons, traffic signals, barricades and flares, lights, or lanterns as required to perform the work and protect the public.

.6 Construction Parking

.1 Parking for construction equipment vehicles will be limited to the site or immediate areas of work.

.2 Parking for Contractors' and Sub-contactors' personal vehicles will be limited to Construction Site provided it does not constitute a safety hazard nor disrupt the performance of Work.

4 TEMPORARY UTILITIES

.1 Temporary Electricity and Lighting

.1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power such as pole line and underground cables to approval of local power supply authority.

.3 Electrical power and lighting systems installed under this contract can be used for construction requirements provided that guarantees are not affected thereby. Make good damage. Replace lamps which have been used more than a period of 3 months.

.4 Provide temporary lighting in all areas of construction, to the minimum requirements of the Occupational Health and Safety Act, and minimum requirements specified herein.

.2 Temporary Water Supply

.1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.

.2 Permanent water supply system installed under this contract can be used for construction requirements provided that guarantees are not affected thereby. Make good damage.

.3 Temporary Heating and Ventilating

.1 Provide and maintain all temporary heat and ventilation necessary during construction, including cost of installation, fuel, operation, attendance and maintenance. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior approval is given by Consultant.

.2 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.

.3 Maintain minimum temperature of 10°C or higher where construction is in progress and maintain until acceptance of structure by Consultant.

.4 Ventilating

.1 Prevent hazardous accumulation 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.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for a time after cessation of work process, to assure removal of harmful elements.

.5 Maintain strict supervision or operation of temporary heating and ventilating equipment.

.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.

.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.6 The permanent HVAC systems of the building, or portions thereof, may not be used during construction.

5 CONSTRUCTION FACILITIES

.1 Field Office

.1 Provide minimum 3000mm x 10,000mm field office and furnish with desk, drawing layout table, filing cabinet, and coat hooks.

.2 Provide minimum 750 Lx lighting level.

.3 Heat and cool to maintain 22°C inside temperature.

.4 Provide 2 operable windows for cross ventilation, or air condition.

.5 Provide meeting table and seating for minimum 12 persons.

.2 Temporary Communication

.1 Provide and pay for temporary communication systems to be installed in Field Office.

.2 Provide hard wire and wireless internet access.

.3 Cellular telephones are acceptable. Pay telephone is not acceptable.

.3 Equipment, Tools and Materials Storage

.1 Provide adequate weather tight enclosures with raised floors, for storage of materials, tools, and equipment, which are subject to damage by weather.

.2 Temporary enclosures required by sub-trades as workshops shall be provided by those trades.

.4 Site Storage and Overloading

.1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.

.2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

.5 Sanitary Facilities

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances. Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition. Where portable toilet facilities are provided, empty and sanitize such facilities on a weekly basis, or more frequently if required.

.2 Permanent new facilities shall not be used by the Contractor.

6 CONSTRUCTION SAFETY MEASURES

.1 The Contractor agrees that the Board is not to be understood as the employer to any Contractor nor to such Contractor's personnel or staff for any work, services, or supply of any products or materials that may be awarded as a result of this Call for Bid document. The Contractor herewith agrees to be the "Constructor" as defined in the Occupational Health and Safety Act.

.2 Observe all construction safety measures as required by the General Conditions of the Contract, Act and Regulations for Construction Projects (2000) (Ontario Regulation 213/91, amended by Reg. 631/94, & Reg. 145/00) and by all authorities having jurisdiction, provided that in case of conflict or discrepancy, the more stringent requirements shall apply.

.3 Provide applicable spare safety equipment such as helmets, safety glasses, and harnesses, and enforce their use by Consultants, the Owner, their representatives and any authorized visitors to the site.

.4 Provide and maintain fences, gates and locks, covered walkways, guard rails, barriers, night lights, and appropriate warning signage as required for the protection of the public, and of public and private property; as required by the General Conditions of the Contract, the Occupational Health and Safety Act and Regulations for Construction Projects, and by all authorities having jurisdiction. Erect and maintain sturdy railings around shafts, and the like, to protect workers and the public from injury.

.5 Workplace Hazardous Materials Information System

.1 Comply with all requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets.

.2 Include copies of all WHMIS data sheets in Operations and Maintenance Manuals.

7 CONSTRUCTION AIDS

.1 Falsework

.1 Design and construct falsework in accordance with CSA S269.1.

.2 Scaffolding

.1 Design, construct and maintain scaffolding in accordance with CSA S269.2.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

.3 Hoisting

.1 Provide, operate and maintain hoists or cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists or cranes shall be operated by qualified operator.

8 TEMPORARY BARRIERS & ENCLOSURES

.1 Construction Isolation Fencing

.1 Erect isolation fencing around perimeter of construction areas to protect the public, workers, and the public from injury.

.2 Construction Isolation Fencing shall consist of:

.1 Temporary modular welded wire mesh fencing, minimum 1828 x 2440mm high, by CanFence Rentals Ltd., or equivalent.

.2 Provide lockable gates within hoarding / fencing for access to site by workers and vehicles.

.3 Provide barriers around trees and planting beds designated to remain. Protect from damage.

.4 Enclosure of Structure

.1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed.

.2 Erect enclosures to allow access for installation of materials and working inside enclosure.

.3 Erect enclosures to withstand wind pressure and snow loading.

.4 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work area for temporary heat.

.5 Dust Control

.1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, or finished areas of Work.

.2 Dust screens shall consist of, as a minimum, 0.15mm thick fire retardant polyethylene sheets secured to appropriate framing and sealed at all joints and at perimeter to prevent migration of dust

.1 Poly sheet: Polytarp, Super Six by Polytarp Products or approved alternative.

.3 Maintain and relocate protection until such work is complete.

.4 Provide dust catching walk-off matting, at all construction entrances.

.6 Security Measures

.1 Where progress of construction reaches point where building exterior is fully enclosed, provide construction cylinders for doors, and secure building against intrusion. Where installation of fixtures and equipment, or storage of materials and equipment, inside the building has begun prior to installation of exterior windows and doors, provide temporary plywood enclosures for window and door openings to prevent intrusion until permanent closures are in place.

.2 Extent of security services shall be at the sole discretion of the Contractor (except as noted in item .3 below) and all costs incurred shall be paid for by

the Contractor. Note that the fit, finish and new appearance of the finished building will not be compromised to accommodate temporary security provisions. Materials, products, finishes, etc. damaged due to vandalism are to be restored and/or replaced to an as-new condition.

.3 Commencing at a date which is four (4) months prior to the scheduled date for Substantial Performance, Contractor shall arrange and pay for the provision of “after hours” manned security at the project site. Security shall provide surveillance and oversite of the building and site areas, during all times when the Contractor’s construction personnel are not in attendance. Continue services until time of substantial completion.

.7 Site Signs and Notices

.1 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 Consultant.

.2 No other signs or advertisements of any description except notices regarding safety and instruction, shall be put up around the building, or site, without the approval of the Consultant.

9 TEMPORARY CONTROLS

.1 Drainage

.1 Refer to Section 01 57 19 – Temporary Environmental Controls and Site Grading and Servicing Drawings.

.2 Tree and Plant Protection

.1 Refer to Section 01 57 19 – Temporary Environmental Controls and Landscape Drawings.

END OF SECTION

1 REFERENCES

.1 National Building Code of Canada (2005)

.2 National Fire Code of Canada (2005)

.3 Ontario Fire Code (2007)

.4 Guidelines for Maintaining Fire Safety during Construction in Existing Buildings, (10/31/88) Ontario Ministry of the Solicitor General, Office of the Fire Marshal.

.5 Ontario Building Code (Regulation 350/06)

2 FIRE SAFETY

.1 Fire Fighting Equipment

.1 Provide and maintain in working order, ULC labelled, 9kg 4A 60BC type fire extinguishers, and locate in prominent positions to approval of authorities having jurisdiction.

.2 Fire Department Access

.1 Provide and maintain fire access routes as designed, as soon as construction sequence will allow. Access routes must have compacted granular subbase, and base in place before superstructure of building may proceed.

.2 Construction activities must not obstruct access routes designated for fire department equipment. If necessary that existing access be obstructed or deleted, alternative access, acceptable to the fire department, must be provided prior to commencement of construction, in accordance with Ontario Building Code location and design criteria for required access routes.

.3 Control of Combustible Materials

.1 The stockpiling of construction materials adjacent to the existing building must be carefully controlled in accordance with the Ontario Fire Code. Materials stored, and their proximity to, equipment used in construction may create a fire hazard. Control of combustibles on a construction site is regulated under the Occupational Health and Safety Act.

.4 Hot Work

.1 Conform to the requirements of the Occupational Health and Safety Act – Regulations for Construction Projects.

.2 Provide all necessary guards and barriers to protect workers, property, and the public when performing hot work such as torching, cutting or coring. Protect all adjacent combustible materials.

.3 Provide a "Fire Watch" for a minimum of 3 hours after each instance of discontinuing hot work.

END OF SECTION

1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

2 SUBMITTALS

.1 Submittals: in accordance with Submittal Procedures.

.2 Prior to commencing construction activities or delivery of materials to Site, submit Environmental Protection Plan for review and approval by Consultant Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan: include:

.1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan;

.2 Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from Site;

.3 Name(s) and qualifications of person(s) responsible for training site personnel;

.4 Descriptions of environmental protection personnel training program;

.5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial and Municipal laws and regulations;

.6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on Site;

.7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff;

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas;

.9 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance;

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris;

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off-site;

.12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on Site; identifies intended actions to prevent introduction of such materials into air, water or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials;

.13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water and water used in flushing of lines;

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands;

.15 Pesticide treatment plan: to be included and updated, as required.

3 FIRES

.1 Fires and burning of rubbish on Site is strictly prohibited.

4 DISPOSAL OF WASTES

.1 Burying of rubbish and waste materials on Site is strictly prohibited.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

5 DRAINAGE & EROSION CONTROL

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Storm Water Pollution Prevention Plan (SWPPP) may be substituted for erosion and sedimentations control plan.

.3 Provide temporary drainage and pumping as necessary to keep excavations and Site, free from water.

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.6 Provide and maintain temporary drainage and pumping as necessary to keep excavations and site free from excess water.

.7 Provide silt fencing at site perimeters and where required by local authorities to prevent contamination of adjoining properties from silt and water drainage.

6 TREE AND PLANT PROTECTION

.1 Protect existing trees and plants on all adjacent properties, where in close proximity to construction activities, or where construction access passes within 3m of trees or plants, whether indicated on drawings or not.

.2 Conform to all local By-Laws regarding tree preservation and protection.

.3 Protect existing trees and plants on site as indicated.

.4 Restrict tree removal to those designated by Consultant. Wrap in burlap trees and shrubs adjacent to construction work, storage areas and trucking lanes. Encase trees and shrubs with protective wood framework from grade level to height of 2134mm.

.5 Protect roots to minimum 1m beyond dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones of protected trees. Minimize stripping of topsoil and vegetation.

.6 The Minimum Tree Protection Zone will be the drip line. Within this tree protection zone there will also be no construction activity including but not limited to no root cutting, no alteration or disturbance to existing grades of any kind, no changes to the grade by adding fill, excavating or scraping, no storage of construction materials or equipment, no stockpiling of soil, debris or construction waste, & no movement or storage of heavy vehicles or equipment. Tree protection barriers must be included and priced as part of the project. For short term project (up to 2 months), standard T-bars and plastic safety fence can be used. For a longer term project, use 10 gauge chain link fence and standard T-bars. In all cases, standard T-bars should not be spaced more than 6 to 7 feet apart. These protection barriers must be erected before the project starts, must be maintained throughout the project, and taken down when final inspection and signoffs are completed.

7 WORK ADJACENT TO WATERWAYS/DRAINAGE DITCHES

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid construction materials across waterways.

.6 Avoid indicated spawning beds constructing temporary crossings of waterways.

8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

9 HISTORICAL / ARCHAEOLOGICAL ARTIFACTS

.1 In the event that buried archaeological remains are encountered on the property during construction activities, the Heritage Operations Unit of the Ministry of Tourism and Culture be notified immediately.

.2 In the event that human remains are encountered during construction, the proponent should immediately contact both the Ministry of Tourism and Culture, and the Registrar or Deputy Registrar of Cemeteries at the Cemeteries Regulation Unit, Ministry of Government Services, (416) 326-8404.

10 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan. Contractor shall, after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.2 Consultant will issue stop order of Work until satisfactory corrective action has been taken.

.3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

END OF SECTION

1 PRODUCT OPTIONS

.1 Provide products specified under individual specification sections. Where Specification lists two or more products, or two or more manufacturers of the same product, the Contractor may select one of the listed products or manufacturers. Confirm selection of products and manufacturers when requested by the Consultant.

.2 When only one product or manufacturer is listed in the specifications, it is intended that only that product or manufacturer is acceptable.

2 PRODUCT SUBSTITUTION PROCEDURES

.1 Substitution Procedures During Construction

.1 Products may only be substituted during the Construction period for one or more of the following reasons:

.1 Insolvency of the product manufacturer.

.2 Inability of the manufacturer to provide the product(s) in the timeframe required to maintain the construction schedule.

.3 Product specified has been discontinued.

.4 Substitution proposed offers better performance than that specified, at no additional cost.

.5 Substitution offers equivalent performance to that specified, at a reduced cost to the Owner (reduction in Contract Price).

.2 Items 2.1.1.2, and 2.1.1.3 will require a letter from the manufacturer, confirming their inability to provide the products specified, or inability to meet the schedule.

.3 Items 2.1.1.4, and 2.1.1.5 will be at the discretion of the Owner.

3 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements, and identify lead times for supply of all Products. If lead times in supply of Products may affect the Construction Schedule, notify the Consultant in order that appropriate action may be authorized in ample time to prevent delay in performance of the Work.

.2 The Contractor shall order Products and materials in a timely fashion so as to ensure that delivery of such Products and materials shall coincide with the Construction Schedule. Failure of the Contractor or their Subcontractors to order Products and materials in a timely fashion, shall not be cause for substitution in accordance with the criteria set out under Article 2 – Product Substitution Procedures.

.3 In the event of failure to notify the Consultant of Product delivery problems at the commencement of the Work, and should it appear that the Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available Products of similar character of their choosing, at no increase in Contract Price.

4 REFERENCE STANDARDS

.1 Within the specifications, reference standards are identified. Conform to these standards, in whole or part, as specifically requested.

.2 If there is question as to whether any product or system is in conformance with applicable standards, the Consultant reserves the right to have such products or systems tested to prove or disprove conformance.

.3 The cost for such testing will be borne by the Contractor in the event of non-conformance.

.4 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date of issue is specifically noted.

5 PRODUCT TRANSPORTATION & DELIVERY

.1 Transportation and delivery costs of Products required in the performance of the Work, are included in the Contract Price.

.2 Transportation and delivery costs of Products supplied by the Owner will be paid for by the Owner. Unload, handle, and store such Products on site.

.3 Products must be appropriately crated, skidded, boxed, shrink-wrapped, or otherwise packaged to protect such products from damage during shipment. Products which arrive at the site in a damaged condition must be rejected and returned to the supplier/manufacturer for immediate replacement.

.4 Advise the Owner 30 days in advance of anticipated delivery dates for materials and equipment supplied by the Owner.

6 PRODUCT STORAGE, HANDLING AND PROTECTION

.1 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.

.2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store paints in a heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged Products at own expense and to the satisfaction of the Consultant.

7 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in the specifications, install or erect Products in accordance with manufacturer's printed instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between the specifications and manufacturer's instructions, so that Consultant may establish correct course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to require removal, replacement where necessary, and re-installation at no increase in Contract Price.

8 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 the affected specification Section.

.4 Space anchors within limits of load limit or shear capacity and ensure that 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.

.7 Obtain Consultant's approval before using explosive actuated fastening devices.

9 QUALITY OF MATERIALS

.1 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Products relying on uniformity of colour and pattern for appearance, such as resilient flooring, carpeting, fabrics, and vinyl wallcovering, shall be from one dye lot for the project. All products delivered to the site must be labeled as to dye lot, or production run number, as well as production date.

.3 Defective products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should any dispute arise as to the quality or fitness of Products, the Consultant may request additional testing based upon the requirements of the Contract Documents, to confirm acceptability of products or materials. Refer to Article 10 - Defective Materials and Work, and Section 01 40 00.

.5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.

.6 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.

10 DEFECTIVE MATERIALS AND WORK

.1 Where evidence exists that defective work has occurred, or that work has been carried out incorporating defective products, the Consultant may have independent tests, inspections, or surveys performed in order to determine if work is defective.

.2 Tests, inspections, or surveys carried out under these circumstances will be made at the Contractor's expense in the event of defective work, or at the Owner's expense where work is in conformance. Where tests incorporate a number of samples, payment will be assessed, by the Consultant, based on the ratio of conforming to non-conforming results. This does not include re-testing of soil compaction during placement, where evidence exists of non-conformance with the Contract documents, but rather only if re-testing is called for after completion of compaction.

12 WARRANTIES & GUARANTEES

.1 Guarantee and warrant all products and labour forming part of the Work for minimum one year unless extended warranties are otherwise specified herein.

.2 Guarantee and warrant products and assemblies for the specified periods of time where in excess of the Contract Warranty, as specified within their respective sections. The following list of extended warranties shown here are for information. All extended warranties must be supplied whether listed below or not. Refer to Specifications inclusive for requirements.

.1 Finish Carpentry – Section 06 20 00 – 5 years
.2 Exterior Soffit and Ceiling System – Section 07 40 25 – 5 years
.3 Built-Up Bituminous Roofing – Section 07 51 00 – 2 years & 10 years
.4 Sheet Metal Flashing and Trim – Section 07 62 00 – 5 years
.5 Joint Sealants – Section 07 92 00 – 5 years
.6 Wood Doors – Section 08 14 16 – 3 years
.7 Aluminum-Framed Entrances and Storefronts – Section 08 41 13 – 5 years, 10 years on finish and performance
.8 Glazed Aluminum Curtain Wall – Section 08 44 13 – 5 years, 10 years on sealed glazing units.
.9 Aluminum Windows – Section 08 51 00 – 10 years
.10 Glazing – Section 08 80 00 – 5 years, 10 years on sealed glazing units.
.11 Waterproof (Epoxy) Flooring – Section 09 90 00 – 2 years
.12 Painting – Section 09 91 00 – 2 years
.13 Washroom Accessories – Section 10 28 13 – 10 years

.14 Window Coverings (including Motorized Roller Shades – Section 12 21 23 – 3 years
.15 Packaged Rooftop HVAC Units – Section 23 74 43 – 5 years & 10 years
.16 Indoor AHU – Section 23 73 13 – 5 years & 10 years
.17 Variable Refrigerant Flow HVAC System – Section 28 31 29 – 5 years
.18 Variable Frequency Drives – Section 25 05 11 – 5 years
.19 Facilities Management System – Section 25 40 11 – 1 year & 4 years
.20 Lighting Equipment – Section 26 51 13 – 5 years
.21 Digital Occupancy & Daylight Control Systems – Section 26 51 16 – 5 years
.22 Telecommunications Network Installations – Section 27 31 40 – 1 year & 15 years
.23 Public Address System – Section 27 41 16 – 1 year
.24 Security System – Section 28 16 16 – 5 years
.25 Fire Alarm System (Addressable) – Section 28 31 25 – 1 year
.26 Asphalt Paving – Section 32 12 16 – 2 years
.27 Concrete Paving – Section 32 13 13 – 2 years
Concrete Curbs and Gutters – Section 32 16 13 – 2 years
.28 Sodding and Topsoil – Section 32 93 10 – 2 years.
.29 Planting – Section 32 93 10 – Owner has option to extend Contractor's Warranty for 1 additional year.

.3 Warranties and Guarantees shall commence at Date of Substantial Performance of the Contract as certified by the Consultant.

.4 Warranties and Guarantees shall be original copies, printed on company letterhead, or on a standard company warranty certificate, bearing the name of the company.

.5 Warranties and Guarantees shall indicate:
.1 Name of the Principal (the Manufacturer/Subcontractor),
.2 Name of the Obligee (the Owner),
.3 Name and address of Project,
.4 Commencement date (Date of Substantial Performance),
.5 Duration of warranty or guarantee,
.6 Clear statement of what is included, and what if any exclusions there are, and
.7 Signature of Principal's representative having signing authority.

END OF SECTION

1 EXAMINATION

.1 Acceptance of Conditions

.1 The General Contractor shall examine all existing or pre-determined conditions, prior to commencing work in that area, and report to the Consultant all conditions unacceptable for work to proceed. Commencement of work shall imply acceptance of conditions as is.

.2 Subcontractors shall examine all existing or pre-determined conditions affecting their portion of the Work, prior to commencing such work, and report to the Contractor all conditions unacceptable for work to proceed. Commencement of work shall imply acceptance of conditions as is.

2 PREPARATION

.1 Field Engineering

.1 Locate, confirm and protect control points prior to starting the Work. Preserve permanent reference points during construction.

.2 Establish reference lines and elevations. Locate and lay out by instrumentation.

.2 Records

.1 Maintain a complete, accurate log of control points and survey work as work progresses.

3 CUTTING AND PATCHING

.1 Submit a written request in advance, for approval of cutting or alteration which affects:

.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight-exposed elements.
.5 Work of Owner or separate contractor.

.2 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.3 After uncovering, inspect conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

.4 Perform cutting, fitting and patching, including excavation and fill, to complete the Work. Perform work to avoid damage to other work.

.5 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.6 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.

.7 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire stopping material, full thickness of construction element.

.8 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.9 Provide all openings greater than 200mm in non-structural elements of work for penetrations of mechanical and electrical work. Mechanical and Electrical Subcontractors shall provide all sleeves and locations for sleeves. The cost of all cutting and patching required by Mechanical and Electrical Subcontractors shall be paid for by those trades.

.10 Ensure that all cutting and patching work, including that by Mechanical and Electrical Subcontractors, is properly performed by the respective trades skilled in that line of work. Restore work with new products in accordance with Contract Documents.

4 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of mechanical and electrical equipment, fixtures and devices indicated or specified, are to be considered as approximate. Final location of such items will be determined on site, based on integration with structural and architectural elements, and as required by coordination with other trades. In the event of a conflict, final determination of location of these items rests with the Consultant.

.2 Prepare and submit for review by the Consultant, interference field drawings, to indicate relative position of various services and equipment, at the following locations as a minimum:

.1 Under all rooftop mechanical units.
.2 At locations of all major ductwork, piping, and conduit crossovers.
.3 Where ductwork passes under major structural elements.

.3 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.

.4 Request a review of items by Consultant once rough-in is underway, prior to final installation, and obtain approval for actual locations.

5 CONCEALMENT

.1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas, except where indicated otherwise.

.2 In existing building, all pipes shall be enclosed in shafts. All conduit shall be placed in accordance with approved conduit shop drawings.

6 LIGHTING FIXTURES AT SUSPENDED CEILINGS

.1 Ensure that secure support is provided for lighting fixtures by suspended ceilings, or by separate hangers, or by both.

.2 Coordinate the ceiling system and lighting fixture installations to provide adequate support.

.3 Submit affidavits with acceptable design information confirming that the installation of the suspended ceiling system and/or separate fixture hangers will provide adequate support for the lighting fixtures without exceeding specified deflection tolerances for the ceiling system.

.4 Conform to current requirements of the Electrical Safety Authority (ESA).

7 EXISTING SERVICES

.1 Where work involves the interruption of, or connection to existing services, carry out such work as directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.

.2 Before commencing work, establish location and extent of service lines in area of work and notify Consultant of findings.

.3 Submit schedule to, and obtain approval from Consultant for any shutdown or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.5 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.6 Remove abandoned service lines to distance of 1821mm from foundations. Cap or otherwise seal lines at cut-off points as directed by Consultant.

.7 Record locations of maintained, re-routed and abandoned service lines.

8 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no increase in Contract Price.

.2 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

.3 Protect finished surfaces with overlays of protective materials such as Kraft paper, cardboard, or plywood, as required for individual applications to provide adequate protection.

END OF SECTION

1 GENERAL

.1 Conduct cleaning and disposal operations to comply with local ordinances and environmental protection legislation.

.2 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.

.3 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

2 CLEANING DURING CONSTRUCTION

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste material and debris from the work areas and deposit in waste container at the end of each working day.

.3 Vacuum clean interior areas prior to start of finishing work. Maintain areas free of dust and other contaminants during finishing operations.

.4 Individual Subcontractors are responsible for the daily clean-up and removal of debris related to, or generated by, their own work. The overall responsibility for project cleanliness rests with the Contractor.

3 WASTE MANAGEMENT

.1 Audit, separate and dispose of construction waste generated by new construction or by demolition of existing structures in whole or in part, in accordance with Ontario Regulations 102/94 and 103/94 made under the Environmental Protection Act.

.2 Fires, and burning of rubbish or waste on site is prohibited.

.3 Burying of rubbish or waste materials, except as specified herein, is prohibited.

.4 Disposal of waste or volatile materials such as mineral spirits, oil, gasoline or paint thinner into ground, waterways, or sewer systems is prohibited.

.5 Empty waste containers on a regular basis to prevent contamination of site and adjacent properties by wind-blown dust or debris.

4 FINAL CLEANING OPERATIONS

.1 Immediately following Date of Substantial Performance, and prior to Owner occupancy of the building or portion of the building affected by the Work, conduct full and complete final cleaning operations.

.2 Final cleaning operations shall be performed by an experienced professional cleaning company, possessing equipment and personnel sufficient to perform full building cleaning operations.

.3 Remove all surplus products, tools, construction machinery and equipment not required for the performance of remaining work, and thereafter remove any remaining materials, equipment, waste and debris.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.6 Cleaning operations shall include the removal of all stains, spots, scuff marks, dirt, dust, remaining labels, adhesives or other surface imperfections.

.7 Remove all paint spots or overspray from all affected surfaces.

.8 Clean and polish all glass and mirrors. Replace broken, scratched or disfigured glazing. Remove remaining manufacturer's and safety "X" labels.

.9 Clean and polish all finished metal surfaces such as enameled or stainless steel, chrome, aluminum, brass, and bronze.

.10 Clean and polish all vitreous surfaces such as plumbing fixtures, ceramic tile, porcelain enamel, or other such materials.

.11 Clean all ceramic tile surfaces in accordance with the manufacturer's instructions, and apply final coat of sealer where specified.

.12 Clean inside of all millwork and cabinetry.

.13 Vacuum, clean and dust behind grilles, louvres and screens.

.14 Sealing and waxing of resilient floor surfaces shall be done by Contractor in accordance with manufacturer’s written instructions. Coordinate final cleaning and scheduling of sealing and waxing.

.15 Broom clean and spray wash all exterior paved surfaces.

.16 Remove dirt and other disfiguration from exterior surfaces.

.17 Clean all roofs, gutters, downspouts, areaways, drywells, and drainage systems.

.18 Clean all equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

END OF SECTION

1 INSPECTION AND DECLARATION PROCEDURES

.1 Arrange for, conduct and document final inspections, close-out and commissioning at the completion of the Work in accordance with the Conditions of the Contract (CCDC 2 - 2020), Divisions 00 & 01, Specifications, and as described herein this Section.

2 SUBSTANTIAL PERFORMANCE

.1 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK**

.2 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 5.8 DEFICIENCY HOLDBACK**

.3 In addition to but not limited to Items 2.1 and 2.2, the following Authorities Having Jurisdiction reports shall accompany the Contractor's application for Substantial Performance, when applicable. These items must be complete in all respects, and all verification certificates and reports having been submitted and approved by the Consultants

.1 Building and Fire Department Occupancy Permits or Final Inspection Report with notice of “Approval to Occupy”
.2 Gas fired appliances inspection,
.3 Plumbing Inspection,
.4 Domestic Water Quality Test Report,
.5 Sprinkler dry and/or wet test verification letter stamped and signed by sprinkler design Engineer,
.6 Fire Detection and Alarm verification (include legible technicians worksheets),
.7 Emergency Lighting verification,
.8 Lighting Control System,
.9 Public Address System,
.10 Video Surveillance System,
.11 Intrusion Detection System,
.12 Electrical distribution system inspection,
.13 Power Panels,
.14 Power Boards,
.15 ESA Hydro Certificate,
.16 TSSA Elevator Certification,
.17 Airflow & Hydronic Testing and Balancing Report,
.18 Equipment Start-up and Commissioning Reports.

3 DEFICIENCY REVIEWS POST SUBSTANTIAL PERFORMANCE

.1 Following the issuance of the Certificate of Substantial Performance and prior to the Contractor's application for Final Payment and release of any monies retained as "Finishing Holdback", the Contractor shall continue to complete unfinished work and correct deficiencies. At the request of the Contractor, the Consultants shall conduct up to two general deficiency reviews during this period.

.2 The Final Deficiency Review will be undertaken only if the Contractor has inspected the Work, and states in writing that the unfinished work noted in their application for Substantial Performance has been 100% completed.

.3 Should further review by Consultants be required due to failure of the Work to comply with Contract Documents or the criteria set out herein, the Owner will deduct amount of Consultant's compensation for re-inspection services from monies owed to the Contractor.

4 DEFICIENCY HOLDBACK

.1 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 5.8 DEFICIENCY HOLDBACK**

5 LIEN PERIOD AND RELEASE OF BASIC HOLDBACK

.1 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK - PAYMENT OF HOLDBACK**

.2 Commencement of Lien Periods

.1 The day following the date of publication of Certificate of Substantial Performance shall be the date of commencement of the Construction Lien Period prior to release of basic holdback, unless required otherwise by lien statute of the Place of the Work.

.2 At the expiry of the Construction Lien period, the Contractor shall make application for Release of Basic Holdback.

.3 The Consultant shall prepare the Certificate for Payment for release of basic holdback, and promptly upon receipt of the necessary documentation, issue the Certificate for Payment to the Owner.

6 FINAL INSPECTION AND PAYMENT

.1 Refer **General Conditions of the Contract (CCDC 2 - 2020) GC 5.5 FINAL PAYMENT**

.2 Submit a signed statement stating following have been performed:

.1 Work has been reviewed for compliance with Contract Documents,
.2 All deficiencies have been corrected,
.3 All unfinished work has been completed, and
.4 Work is complete and ready for Final Inspection.

.3 When items noted above are completed, the Owner, the Consultants, and the Contractor will perform a final inspection of the Work.

.4 If the Work is deemed incomplete, complete outstanding items and request a re-inspection.

.5 If the Work is deemed to be complete, the Consultant will issue a Final Certificate for Payment.

END OF SECTION

1 OPERATION AND MAINTENANCE MANUALS

.1 General

.1 Prepare Operation and Maintenance Manual during the course of construction and have completed prior to Date of Substantial Performance.

.2 Submission

.1 Maintain one copy of the Operation and Maintenance Manual volume(s) for periodic review and comment, as requested by the Consultant during the course of construction.

.2 Submit two (2) final hard copies and one (1) USB device with PDF version of all documents of the final completed volume(s) with the application for Substantial Performance.

.3 Format

.1 Bind data in commercial quality, 219 x 279mm, "D" ring binders, having clear cover and spline pockets.

.2 Identify each binder on the cover and spline with the following:

OPERATION & MAINTENANCE MANUALS
School Name and Project
VOLUME____OF ___

.3 Provide table of contents and index tab sheets for each volume. Itemize and tabulate contents.

.4 Provide drawings with reinforced punched binder tab, or insert into clear sleeves in folded format. Group drawings as to content, and index for quick reference.

.4 Contents - Each Volume

.1 Table of Contents: provide title of Project, Date of submission and names:

.1 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;

.2 Schedule of products and systems, indexed to content of volume.

.2 For each product or system: List names, addresses and telephone numbers of sub-contractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Operation and Maintenance Manuals shall contain, as a minimum, the following information:

.1 List of Contents; cross-referenced to each Volume.
.2 Contact information for maintenance and repairs
.3 Warranty and guarantee certificates
.4 Equipment start-up and troubleshooting instructions
.5 Equipment schematics & diagrams
.6 Catalogue of all maintenance materials and quantities
.7 Complete list of Contractor, Subcontractors and suppliers, indicating name, address, telephone & fax numbers, email addresses, name of contact person and description of work done.
.8 Complete list of products used in the work, indicating product name and manufacturer for each listing.
.9 Copy of Finish Hardware List, complete with all amendments and revisions, if applicable.
.10 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of Colour Schedule.
.11 All “reviewed” shop drawings.
.12 Maintenance instructions for all finished surfaces.
.13 Brochures and cuts of all equipment and fixtures.
.14 Operating and maintenance instructions for all equipment.
.15 All Warranties and Guarantees required by the Specifications for this Work.

.5 Refer to Mechanical Specifications for more specific mechanical data required beyond the description of this paragraph.

.6 Refer to Electrical Specifications for more specific electrical data required beyond the description of this paragraph.

.7 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.8 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

2 AS-BUILT DRAWINGS

.1 Record information on a clean set of black line opaque drawings. Consultant will provide two (2) complete sets of printed project drawings, (one complete CADD set on disc) and two (2) complete sets of specifications for the purpose of recording as-built conditions.

.2 Maintain as-built drawings on site and update as construction progresses. Allow periodic review by Consultant as requested.

.3 Record information concurrently with construction progress. Do not conceal work until required information is 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 As-Constructed Topographic Survey. All topographic information is to be based on the fixed bench mark. eg. top of a fire hydrant, iron bar etc.
Include the following:
- .1 Property boundary.
- .2 Topographic lines at 0.5metre intervals within the property and extending 1.0metre into all adjacent properties.
- .3 All trees located and sized.
- .4 Sidewalks, curbs and complete road width of asphalt as well as extent of all other asphalt areas and curbs.
- .5 All perimeter and on-site fencing.
- .6 Fire hydrants.
- .7 Hydro and other utility poles and transformers, junction boxes, pedestals, etc.
- .8 Manholes and catch basins with underside of inverts.
- .9 Watercourse if applicable.
- .10 Location of street services: storm (including invert elevations), sanitary (including invert elevations), water, Bell, gas, cable TV, etc.
- .11 Locate all easements if applicable.
- .12 Geodetic elevation

.6 Provide PDF and CADD file.

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, shutdown, 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 all test and balancing reports

.15 Additional requirements: As specified in individual specification sections.

4 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 Additional Requirements: as specified in individual specifications sections.

5 MAINTENANCE MATERIALS, SPARE PARTS & TOOLS

.1 Provide spare parts in quantities specified in individual specification sections. Provide identical items to those installed in the Work.

.2 Provide maintenance materials in quantities specified in individual specification sections. Provide identical items of same manufacturer, dye lot or production run as items in the Work.

.3 Provide special tools in quantities specified in individual specification sections, and tag items identifying their function and equipment or products to which they are associated.

.4 Receive and catalogue all items. Check inventory and include approved listings in Operations and Maintenance Manual.

.5 Obtain receipts for delivered products and submit prior to Substantial Performance.

.6 Quality

.1 Spare parts, maintenance materials and special tools provided shall be new, not damaged or defective, and of the same quality and manufacture as products provided in the Work.

.2 If requested, furnish evidence as to type, source and quality of Products provided.

.3 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.7 Delivery, Storage, And Handling

.1 Deliver all materials required as maintenance materials, spare parts or special tools, to the site, include shipping costs, and store as directed.

.2 Store spare parts, maintenance materials and special tools in a manner to prevent damage, or deterioration.

.3 Store in original and undamaged containers with manufacturer's seals or labels intact.

.4 Store materials subject to damage from severe climatic changes in a climate-controlled, weatherproof enclosure.

.5 Store paints and freezable materials in a moderately heated and ventilated room.

6 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Start date for all warranties are to be the Date of Substantial Performance, regardless if put into use.

.5 Verify that documents are in proper form, contain full information, and are notarized. Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

END OF SECTION

1 General

1.1 Provide Integrated System Testing in accordance with CAN/ULC-S1001 Integrated System Testing of Life Safety and Fire Protection Systems.

1.2 Provide an Integrated Testing Plan (ITP) including a full overview of all integration points of life safety and fire protection systems. The ITP will be submitted for review by the Consultants and Authority Having Jurisdiction. Upon the successful completion of the ITP and all the respective systems, the Integrated System Testing Coordinator (ITC) will provide a schedule to the Consultants and Authority Having Jurisdiction and all required participating members for the ITP to be implemented.

1.3 The ITC will review all drawings, specifications, sequence of operations and methodology prepared by the Consultants, as well as all relevant information like contractor's shop drawings and manufacturer requirements.

1.4 The ITP shall be coordinated with all Subcontractors, manufacturers and suppliers involved in systems requiring functional testing.

1.5 The ITC will implement the ITP and will sign each integrated test form, complete with signatures from each participating member of the integrated systems.

1.6 The ITC shall witness all integrations and not rely on the CAN/ULC-S537 Verification Inspection Report for fire protection system integration testing. The ITC shall however attend the verification to validate the testing.

1.7 The ITC will provide all work and ITP including functional documentation, prescribed in CAN/ULC-S1001.

1.8 The ITC will provide PDF and digital media copy of the ITP and Integrated System Report (ITR) for the Owner's use, re-testing and reproduction purposes.

1.9 The systems requiring functional testing include Divisions 14, 20, 21, 22, 23, 25, 26, 27 and 28

2. Products

2.1. NOT USED

3. Execution

3.1. TESTING AND PLANNING

3.1.1. The Integrated Testing Process must include following;

- .1 Planning phase by the testing coordinator
- .2 Integrated testing plan review by the Consultants
- .3 Integrated testing plan review by the authority having jurisdiction
- .4 Review of Sequence of operations
- .5 System documentation
- .6 Integrated System Testing Plan consisting of;
  - .1 Project Description
  - .2 Project contacts
  - .3 Overview and description of each integrated system
  - .4 System integrations & functional objective of each integrated system
  - .5 Integration matrix of all integrated system complete with integration type, Normal mode and off-normal mode.
  - .6 Test protocols and procedures of each integrated system

.7 Notifications
.8 Personnel safety
.9 Phased occupancies
.10 Pre-testing documentation check-list
.11 Testing forms
.12 Ongoing Integrated System Testing forms
.13 Integrated System Testing Completion form, and
.14 Integrated testing notes

3.2. RESPONSIBILITIES

3.2.1. Contractor:

.1 Engage the services of the ITC as a Subcontractor.
.2 Coordinate with the ITC for schedule and witness testing.
.3 Participate in the ITP and provide function testing of equipment within the mechanical, electrical and fire protection contract packages.
.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.
.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

3.2.2. Mechanical Subcontractor:

.1 The mechanical subcontractor shall confirm all required mechanical systems are complete and fully operational, prior to the ITC commencing the functional testing.
.2 Provide system reports such as, but not limited to; air balancing reports, TSSA inspection reports, start-up reports, commissioning reports, verification reports. The subcontractor shall further provide written letter confirming all mechanical systems are installed and operating as intended by the contract documents and sequence of operations.
.3 Participate in the ITP and provide function testing of equipment within the mechanical contract package.
.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.
.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

3.2.3. Fire Protection Subcontractor:

.1 The fire protection subcontractor shall confirm all required fire protection systems are complete and fully operational, prior to the ITC commencing the functional testing.
.2 Provide system reports such as, but not limited to; NFPA 13 letter, NFPA 20, letter, above ground sprinkler piping letter, below ground sprinkler letter, system designer letter, start-up reports, commissioning reports, verification reports. The subcontractor shall further provide written letter confirming all fire protection systems are installed and operating as intended by the contract documents and sequence of operations.
.3 Participate in the ITP and provide function testing of equipment within the fire protection contract package.
.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.
.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

3.2.4. Electrical Subcontractor:

.1 The electrical subcontractor shall confirm all required electrical systems are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Provide system reports such as, but not limited to; ESA Inspection Certificate, Fire Alarm Verification, TSSA Inspection, Generator Start-up report, commissioning reports, and verification reports. The subcontractor shall further provide written letter confirming all electrical systems are installed and operating as intended by the contract documents and sequence of operations.

.3 Participate in the ITP and provide function testing of equipment within the electrical contract package.

.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

3.2.5. Equipment Manufacturers:

.1 Where required, shall confirm all respective required systems are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Participate in and be present for the ITP and provide function testing of equipment within the respective contract package.

3.2.6. Elevator Manufacturers:

.1 Shall confirm all respective required systems are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Participate in and be present for the ITP and provide function testing of equipment within the respective contract package.

3.2.7. Fire Alarm Subcontractor:

.1 Shall confirm all respective required systems are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Participate in and be present for the ITP and provide function testing of equipment within the respective contract package.

3.2.8. Consultants:

.1 Shall review the ITP, and upon review, accept the ITP as the agreed ITP for implementation.

.2 The Consultants are responsible for design. Upon an unsuccessful test, the failure will be documented and provided to the respective Consultant for review and action.

.3 Participate in the ITP and provide function testing of equipment within the electrical contract package.

3.3. NOTIFICATIONS OF TESTING IMPLEMENTATION PROCESS

3.3.1. The ITC shall work with the Contractor, Owner, Subcontractors, Consultants and the Authority Having Jurisdiction to provide a schedule for the implementation of the ITP.

3.3.2. The ITC shall provide notification to the integrated testing participants seven (7) days prior to the date and time for the implementing of the ITP.

3.3.3. In the event of building occupants, the ITC shall provide at a minimum, fourth-eight (48) hour notice of the implementation of the integrated testing. Notification shall be provided via written notices posted at each building entrance.

3.4. TESTING IMPLEMENTATION PROCESS

3.4.1. Implementation of the integrated test shall follow all job site and personnel safety requirements set out in the contract and Contractor’s requirements.

3.4.2. The ITC shall define;

.1 Personnel Safety protocols

.2 Special hazards

.3 Team communications, and

.4 Occupant notification of emergencies.

3.4.3. The integrated system test shall follow the methodology and process outlined in CAN/ULC-S1001 as the requirement for this project.

.1 Provide the final ITP to the Consultant fourteen (14) days prior to scheduled implementation and test.

3.4.4. The respective subcontractors and manufacturers are responsible to start-up and function test their respective systems, for observation and witnessing by the ITC. The ITC will record the results and the respective subcontractor and manufacturer will restore the system to a normal condition. Upon successful testing the subcontractor and manufacturer will initial the respective integrated testing form for their respective test.

3.4.5. Upon a failure of a test, the ITC will document the failure and continue with the testing of other integrations. The respective subcontractor and manufacturer will document the failure, notify they Consultant and correct the failure under the direction of the Consultant.

.1 The ITC will re-test the unsuccessful integration after the correction has been documented and verified.

3.4.6. Upon a failure of a device (such as a smoke detector), the subcontractor may immediately replace the device and the ITC may continue to test the integration. The device failure maybe documented, but shall not result in a failed integrated test.

3.4.7. Upon successfully completing the ITP, the ITC shall provide the ITR to the Owner.

3.5. QUALITY CONTROL

3.5.1. The ITC subcontractor must meet the following criteria to be considered acceptable for this project:

.1 Subcontractor experienced with working with contractors for functional testing, fire alarm verification, sprinkler system testing, annual inspections and maintenance of fire and life safety systems.

.2 Subcontractor knowledgeable and with experience of the respective Codes and Standards of the particular project, including but not limited to; Building Codes, Fire Codes, ULC Standards, CSA Standards, and NFPA Standards

.3 Subcontractor must be a member in good standing of the Canadian Fire Alarm Association (CFAA).

.4 Subcontractor must be independent from the fire protection and life safety system installation providers on the project in accordance with ULC Certification Bulletin 2020-08.

.5 Subcontractor must be operating in the province of Ontario for at least five years.

.6 Subcontractor shall provide satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and servicing of the systems.

3.6. ACCEPTABLE ITC SUBCONTRACTORS

3.6.1. Acceptable subcontractors to be selected from the list below. Local branches of these companies operating in the vicinity of this project are acceptable.

.1 ITC Solutions

.2 Troy Life and Fire Safety

.3 Control Tech Systems

.4 Lonergan Engineering

.5 Guardian Fire Consulting Group

.6 CFMS

.7 Vintage Fire and Life Safety Ltd.

3.6.2. Other firms may be considered as acceptable subcontractors provided they submit to the Consultant, at least one week prior to bid closing, documentation confirming their compliance with the required Quality Control criteria.

END OF SECTION

1 General

1.1 REFERENCES

.1 CSA Z783-12 (R2021): Deconstruction of Buildings and Their Related Parts.

1.2 SEQUENCING

.1 Schedule deconstruction activities to minimize disruption to existing facility operations.

.2 Verify deconstruction schedule with Consultant prior to commencement of the Work.

.3 Protect existing facility occupants from dust and from any danger arising from deconstruction operations. Refer to Section 01 50 00.

1.3 SPECIAL PROCEDURE SUBMITTALS

.1 Submit 3 copies of each photograph taken of existing conditions to Consultant.

1.4 QUALIFICATIONS

.1 Demolition Supervisor: An individual experienced in building deconstruction, capable of ensuring deconstruction is carried out safely, expeditiously and without unnecessary damage to materials and surfaces that are designated to remain.

1.5 FIELD CONDITIONS

.1 Inspect and photograph existing adjacent surfaces and assemblies.

.2 Record conditions and stability in a manner suitable for evaluation of possible damage caused by deconstruction operations.

.3 Approximate locations of existing facility services may be indicated on Drawings. Owner and Consultant assume no responsibility for accuracy of such information.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Permits and Fees: Include tipping charges and other related fees necessary for completion of deconstruction operations.

.2 Utilities: Obtain approval from authorities having jurisdiction prior to commencing deconstruction operations.

.3 Hazardous Waste: Conform to authorities having jurisdiction.

2.2 EQUIPMENT

.1 Deconstruction: Appropriate equipment for type of deconstruction being contemplated.

.2 Do not use heavy equipment for making openings in existing walls or in confined spaces where damage to other parts of the Work or adjacent property may result.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify locations and construction of structures to be demolished.

.3 Verify construction and details of other existing and adjacent property.

.4 Verify location of utility and facility services.

.5 Undertake x-ray investigations of existing building elements designated for selective demolition to determine locations of concealed components, utility services, and facility services.

3.2 PREPARATION

.1 Erect shoring, bracing, and other temporary structures to prevent collapse, settlement, and movement of property. Refer to Section 01 50 00.

.2 Provide and maintain dust protection screen as specified in Section 01 50 00.

.3 Provide and maintain weather enclosures as specified in Section 01 50 00.

.4 Barricade access by unauthorized persons to areas in which deconstruction is in-progress.

.5 Post danger signs in conspicuous locations to warn persons deconstruction is in-progress.

.6 Erect protection to ensure safe access that must be maintained to existing areas still occupied by public.

.7 Protect adjacent property from damage caused by deconstruction operations.

.8 Remove flammable and contaminated materials, and refuse from area before deconstruction operations commence.

.9 Arrange for disconnection, capping, and plugging of facility services that may be affected by deconstruction operations.

3.3 DECONSTRUCTION

.1 Perform deconstruction work in an expeditious and safe manner.

.2 Conform to CSA Z783.

.3 Confine deconstruction operations to only those areas required.

.4 Prevent and contain spread of dust.

.5 Do not drop debris more than one storey unless in an enclosed chute. Lower large components carefully, under control and fully supported at all times.

.6 Withdraw or flatten protruding nails as deconstruction operations proceed.

3.4 SALVAGE

.1 Carefully remove materials scheduled for salvage to CSA Z783.

.2 Clean and prepare salvaged items for use by others.

.3 Store salvaged materials in secure locations, protected from damage.

.4 Items not scheduled for salvage become property of Contractor.

3.5 CLEANING

.1 Leave Place of the Work in a clean and orderly condition, ready for use by others.

.2 Remove debris as specified in Section 01 74 00, and in accordance with authorities having jurisdiction.

.3 Remove protections, barricades, and other temporary constructions on completion of deconstruction operations.

.4 Make Good property and materials damaged during deconstruction operations.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 20 00 – Concrete Reinforcing

.2 Section 03 30 00 – Cast-In-Place Concrete

.3 Section 03 35 10 – Concrete Finishing

.4 Section 03 41 23 – Precast Concrete Stairs

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 Canadian Standards Association (CSA International):

.1 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-O86, Engineering Design in Wood.

.3 CSA O121, Douglas Fir Plywood.

.4 CSA O151, Canadian Softwood Plywood.

.5 CSA O153, Poplar Plywood.

.6 CAN/CSA-O325.0, Construction Sheathing.

.7 CSA O437 Series, Standards for OSB and Waferboard.

.8 CSA S269.1, Falsework for Construction Purposes.

.9 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 Quality Assurance

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Engage a professional engineer licensed to practice and insured in the Province of Ontario to be responsible for design and installation of all formwork, falsework and re-shoring.

2 PRODUCTS

2.1 Design Requirements

.1 Design in accordance with CSA S269.1 and CSA S269.3

.2 Structural design of formwork, falsework and re-shoring will not be reviewed by the Consultant.

2.2 Materials

.1 Formwork materials: in accordance with CSA S269.1

.1 For concrete without special architectural features, use wood and wood product formwork materials in accordance with CSA-O121, CAN/CSA-O86, CSA O437 Series and/or CSA-O153 as appropriate.

.2 For concrete with special architectural features, use formwork materials in accordance with CSA-A23.1/A23.2.

.3 Rigid insulation board: in accordance with CAN/ULC-S701.

.4 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.

.1 Spiral pattern not to show in hardened concrete unless specifically noted on the architectural drawings.

.5 Form ties:

.1 For concrete not designated in the Contract Documents as 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm (1”) diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.2 Form liner:

.1 Architectural Finish:

.1 Plywood: high density overlay Douglas Fir in accordance with CSA O121.

.2 Non-Architectural Finish:

.1 Plywood: in accordance with CSA O151.

.2 Waferboard: in accordance with CAN/CSA-O325.0.

.3 Form release agent: non-toxic, biodegradable and low VOC.

.4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC (volatile organic compound) content, free of kerosene, with viscosity between 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.5 Falsework materials: in accordance with CSA-S269.1.

.6 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.7 Void Form: Cellular cardboard with minimum compressive strength of 62 kPa (9 psi) designed to carry weight of wet concrete and loads associated with placing concrete and also designed to disintegrate and create an air space below the fully hardened concrete.

.8 Compressible Material: Ceramar by W. R. Meadows or equivalent.

3 EXECUTION

3.1 Fabrication and Erection

.1 Conform to CSA A23.1 and the following:

.1 Fabricate and erect falsework in accordance with CSA S269.1.

.2 Verify lines, levels and centres before proceeding with formwork / falsework and ensure dimensions agree with the Drawings.

.3 Do not use earth forms unless specifically noted on the structural Drawings or approved by the Consultant.

.4 Refer to architectural Drawings for concrete members requiring architectural exposed finishes.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide Site drainage to prevent washout of soil supporting mud sills and shores.

.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2. Cambers required for hardened concrete are shown on the Drawings and are measured relative to member supports.

.8 Align form joints and make watertight.

.1 Keep form joints to minimum.

.9 Locate horizontal form joints for exposed columns 2400 mm (8’-0”) above finished floor elevation.

.10 Use 25 mm (1”) chamfer strips on external corners and/or 25 mm (1”) fillets at interior corners, joints, unless specified otherwise in the Contract Documents.

.11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated in the Contract Documents.

.12 Do not substitute round concrete column forms in lieu of rectangular column forms unless specifically approved by the Consultant.

.13 Use internal form ties.

.14 Do not permit loads from formwork to be transmitted to adjacent existing structure.

.15 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other Specification Sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.16 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

.17 Do not close formwork before reinforcing steel has been reviewed.

.18 Post-Tensioned Concrete:

.1 Extend formwork 1 m (3'- 3") beyond slabs on stressing sides to provide a working platform for post-tensioning.
.2 Allow clearances required for stressing.
.3 Coordinate with Post-Tensioning trade.

.19 Void form:

.1 Conform to manufacturer's recommendations.
.2 Place on sand leveling bed.
.3 Protect from moisture until concrete is about to be placed.
.4 Protect from excessive construction loads.
.5 If void form collapses during construction, remove and replace affected area.

.20 Concrete Exposed to View

.1 Minimize formwork joints. Locate joints and ties in a uniform pattern with no ties within 300mm (12") of an edge or joint.
.2 Make panels forming slab soffits and wall / beam faces as large as possible, and arrange symmetrically.
.3 Make form joints in columns level from column to column and consistent with form joints in other parts of the structure. Locate lowest horizontal form joints 2400mm (8'-0") above finished floor elevation.
.4 Where grooves, reglets or chamfers are shown on the Drawings, locate panel form joints behind them.
.5 Seal all joints in formwork and between formwork and concrete.
.6 Place 16 mm (5/8") bevel strips at member corners to form chamfers unless architectural details show an alternative profile. When beams are supported on columns of the same width, extend chamfer across face of column.
.7 Do not reuse formwork if there is any evidence of surface damage or wear, which could impair the visual quality of the concrete surface.
.8 Reuse forms only on identical sections, using the original tie holes. Clean forms and fill nail holes before reuse.
.9 Use only galvanized nails.
.10 Remove form tie plastic cones. Install concrete plugs where indicated. Recess 6mm (1/4") and bond to concrete using a cement slurry with a bonding agent in accordance with Section 03 30 00 – Cast in Place Concrete.

3.2 **Removal and Reshoring**

.1 Conform to CSA A23.1.

.2 Remove formwork when concrete has reached 75 % of its design strength. Replace immediately with adequate reshoring where applicable.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm (10’-0”) apart.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.3 **Field Quality Control**

.1 Refer to Section 01 45 00 Quality Control.

.2 The Contractor and its engineer are duly responsible to perform general review of the formwork, falsework and reshoring (as applicable).

.3 The Consultant will not review the suitability or dimensional accuracy of any formwork, falsework or reshoring while performing general review of the Work.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 30 00 – Cast-In-Place Concrete

.3 Section 03 41 23 – Precast Concrete Stairs

.4 Division 04 – Masonry

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 American Society for Testing and Materials (ASTM International):

.1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.4 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.5 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 Canadian Standards Association (CSA International):

.1 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3, Design of Concrete Structures.

.3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC):

.1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 **Quality Assurance**

.1 Submit in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications

.1 Welding of reinforcing steel to be performed by welders certified under CSA W186.

1.4 **Quality Control**

.1 Submit in accordance with Section 01 45 00 - Quality Control.

.2 Source Quality Control Submittals:

.1 Upon request, provide the Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request, inform the Consultant of proposed source of reinforcement material to be supplied.

.3 Upon request, provide the Consultant with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.

.4 Upon request, provide the Consultant with a copy of manufacturer's instructions for patching factory applied epoxy coating.

.3 Bring to the attention of the Consultant any defects or deficiencies in the work together with a proposal for remedy. The Consultant will decide what corrective action may be taken, and will issue the necessary instructions.

.4 Construction Review:

.1 General review during construction by the Consultant will be carried out by examination of representative samples of the work.

.2 Do not close forms or pour concrete before reinforcing steel is reviewed.

.3 Construction review reports will outline any deficiencies found.

1.5 **Action and Informational Submittals**

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:

.1 Submit drawings indicating the placement of reinforcement and:

.1 Bar bending details.
.2 Bar Lists.
.3 Quantities of reinforcement.

.4 Sizes, spacing, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
.5 Concrete cover.
.6 Splice lengths.
.7 Standard hook lengths.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated in the Contract Documents.

.1 Provide Class B tension lap splices unless otherwise indicated in the Contract Documents.

.3 Provide 90° or 180° standard hooks to CAN/CSA-A23.3. Do not shorten hooks to accommodate member dimensions but rather rotate hooks in the member to maintain hook dimensions and adequate concrete cover.

1.6 **Delivery, Storage and Handling**

.1 Deliver, store and handle materials in accordance with this Section and manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.7 **Storage and Handling Requirements:**

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 **PRODUCTS**

2.1 **Materials**

.1 Reinforcing steel: billet steel, grade 400, deformed bars in accordance with CSA-G30.18, unless indicated otherwise in the Contract Documents.

.2 Reinforcing steel: weldable low alloy steel deformed bars in accordance with CSA-G30.18.

.3 Cold-drawn annealed steel wire ties: in accordance with ASTM A82/A82M.

.4 Welded steel wire fabric: in accordance with ASTM A185/A185M.

.1 Provide in flat sheets only.

.5 Epoxy Coating of non-prestressed reinforcement: in accordance with ASTM A775/A775M.

.6 Chairs, bolsters, bar supports, spacers: in accordance with CSA-A23.1/A23.2.

.7 Mechanical splices: to develop 120% of the specified yield strength of the reinforcing bar, subject to approval of the Consultant.

.8 Plain round bars: in accordance with CSA-G40.20/G40.21.

.9 Substitute different size bars only if permitted in writing by the Consultant.

3 EXECUTION

3.1 Fabrication

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain the Consultant's written approval for locations of reinforcement splices other than those shown on placing Drawings.

.3 Upon approval of the Consultant, weld reinforcement in accordance with CSA W186.

.4 Epoxy Coated Reinforcing Steel

.1 Fabricate epoxy coated reinforcing steel in accordance with ASTM D3963/D3963M. Plants to be certified by the Concrete Reinforcing Steel Institute (CRSI) for epoxy coated steel. Provide colour to contrast sharply with reinforcing steel and rust colour.

.2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.3 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

.5 Stagger mechanical splices 750mm (2’-6”) unless otherwise noted on the Drawings.

3.2 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated on the Drawings or authorized by the Consultant.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Unless specifically noted in the Contract Documents, the Contractor is responsible to retain the services of a qualified inspector to review the condition of field bent reinforcement not indicated on the Contract Documents.

.1 Replace bars, which develop cracks or splits at no cost.

3.3 Placing Reinforcement

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Remove all loose scale, dirt, oil or other coatings which would reduce bond.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Turn ends of tie wire towards the interior of concrete.

.5 Use bar supports for beams and slabs.

.6 Prior to placing concrete, obtain the Consultant's general review of reinforcing material and placement.

.7 Ensure cover to reinforcement is maintained during concrete pour. Use side form spacers for walls and columns.

.8 Do not splice reinforcing at locations other than shown on placing drawings without the Consultant’s written approval.

.9 Do not cut reinforcement without the Consultant’s written approval.

.10 Provide concrete chairs where supports rest on the ground.

.1 Space chairs at 600 mm (2’-0”) centres to support welded wire fabric in slabs-on-grade.

.2 Do not lift reinforcement during slab-on-grade concrete placement.

.11 Exposed concrete surfaces:

.1 Use plastic or plastic tipped bar supports and spacer with colour to match concrete.

.12 Epoxy Coated Reinforcement

.1 Protect epoxy coated portions of bars with covering during transportation and handling.

.2 Do not weld epoxy coated reinforcement.

.3 Use plastic bar supports, epoxy coated support bars and plastic coated tie wire

.13 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with [one coat of asphalt paint].

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.14 Where drawings refer to welded deformed reinforcing bars, conform to CSA W186.

3.4 **Field Touch-Up**

.1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 20 00 – Concrete Reinforcing

.3 Section 03 35 00 – Concrete Floor Finishing

.4 Section 03 35 10 – Concrete Finishing - Sand Blast Finish

.5 Section 03 41 23 – Precast Concrete Stairs

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 American Society for Testing and Materials (ASTM International):

.1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.8 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Canadian Standards Association (CSA International):

.1 CSA A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 **Administrative Requirements**

.1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works to verify project requirements. Ensure key personnel, site supervisor, speciality contractors (finishing, forming… etc.), concrete producer and testing laboratories attend.

.2 Concrete Delivery Tickets: keep all concrete delivery tickets on Site until building is complete. Record on each ticket when and where concrete was placed.

.3 Batch Logs: keep record of each batch delivered to the Site.

.4 Record Drawings: Record on a set of Structural Drawings the extent of each pour including the pour date and falsework removal date. Record all field changes including footing elevations.

1.4 **Quality Assurance**

.1 In accordance with Section 01 45 00 - Quality Control.

.2 Provide the Consultant, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Concrete supplier to have a valid “Certificate of Ready Mixed Concrete Production Facilities” issued by the relevant Ready Mixed Concrete Association.

.2 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

1.5 **Quality Control**

.1 Submit in accordance with Section 01 45 00 - Quality Control.

.2 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements in accordance with this Section.

.3 Minimum 4 weeks prior to starting the concrete work, provide proposed quality control procedures for review by the Consultant on the following items:

.1 Hot weather concrete.

.2 Cold weather concrete.

.3 Curing.

.4 Finishes.

.4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, and air temperature and test samples taken.

1.6 **Action and Informational Submittals**

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Minimum four weeks prior to starting concrete work, provide valid certificate from plant delivering concrete and quality control plan.

.3 Minimum 2 weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.

.4 Minimum 2 weeks prior to placing concrete, submit drawings showing locations of all construction joints and slab on grade control joints.

.5 Minimum submission requirements for each concrete mix design shall include the following:

.1 Minimum specified compressive strength at 28 day.

.2 Maximum aggregate size.

.3 Aggregate type (if not normal density).

.4 Concrete density range, wet and dry (if not normal density).

.5 CSA exposure class.

.6 Cement type (if not type GU).

.7 Percentage and type of supplemental cementing materials.

.8 Maximum water/cemetitious ratio.

.9 Assumed method of placement of concrete.

.10 Corrosion inhibitor (name and quantity, if applicable).

.11 Plastic or steel fibres (type, name and quantity, if applicable).

.12 Alkali-aggregate resistance.

.13 Architectural requirements (colour of cement and aggregate, if applicable).

.14 Maximum time from batching to placing concrete (if retarding admixtures are used).

.6 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in Execution.

.7 Concrete hauling time: provide for review by the Consultant deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

.8 On completion of the concrete works, provide written report to the Consultant verifying compliance that concrete in place meets performance requirements of concrete as established in Section 2 – Products, below.

1.7 **Delivery, Storage and Handling**

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to the Place of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from the Consultant and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by the Consultant.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

2 PRODUCTS

2.1 **Design Criteria**

.1 Alternative 1 - Performance: in accordance with CSA A23.1/A23.2, and as described in Materials.

2.2 **Performance Criteria**

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by the Consultant and provide verification of compliance as described in Quality Assurance.

2.3 **Materials**

.1 Portland Cement: in accordance with CSA A3001.

.2 Supplementary cementing materials (SCM):

.1 Cementitious hydraulic slag: in accordance with CSA A3000

.2 Fly Ash: in accordance with CSA A3001, Type CI.

.3 Minimum two weeks prior to placing concrete, Concrete Supplier to provide written recommendation to reduce SCM content to accommodate anticipated environmental conditions.

.3 Water: in accordance with CSA A23.1.

.4 Aggregates: in accordance with CSA A23.1/A23.2. Do not use recycled concrete as aggregate.

.5 Admixtures:

.1 Air entraining admixture: in accordance with ASTM C260.

.2 Chemical admixture: in accordance with ASTM C494.

.3 Corrosion-inhibiting admixture: calcium nitrate solution.

.4 Not to contain chlorides.

.6 Shrinkage compensating (non-shrink) grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 40 MPa at 28 days.

.7 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand

.1 Compressive strength: 50 MPa at 28 days.

.8 Plastic Fiber additive: fibrillated polypropylene fibres at least 19mm (3/4”) in length.

.9 Curing compound: in accordance with CSA A23.1/A23.2 and ASTM C309 to be coordinated and compatible with surface floor hardeners where used.

.10 Mechanical waterstops: ribbed extruded PVC with shop welded corners and intersecting pieces with legs not less than 250 mm (10”) long:

.1 At construction Joints:

.1 Minimum thickness: 3 mm (1/8”).
.2 Minimum width: 100 mm (4”).

.2 Tensile strength: in accordance with ASTM D412, method A, Die "C", minimum 13 MPa.

.3 Elongation: in accordance with ASTM D412, method A, Die "C", minimum 275%.

.4 Tear resistance: in accordance with ASTM D624, method A, Die "B", minimum 50 kN/m.

.5 Low temperature brittleness: to ASTM D746, minimum -37°C.

.6 Width in construction joints: 100mm (4”).

.11 Hydrophilic Waterstops: Bentonite, rectangular, flexible, swellable.

.12 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.13 Weep hole tubes: plastic.

.14 Dovetail anchor slots: minimum 0.6 mm (24 gauge) thick galvanized steel with insulation filled slots.

.15 Bonding adhesive: Portland Cement grout

.16 Bonding adhesive: Synthetic latex.

.17 Rigid insulation: Extruded polystyrene boards per ASTM C578, structural grade, compressive strength 100 psi (690 kPa).

.18 Control joint filler: semi-rigid filler to protect against slab edge breakdown:

.1 For sawcuts made with “Soff-Cut” saw: two component epoxy.

.2 For conventional sawcuts in interior slab: two component epoxy urethane.

.3 For conventional sawcuts in exterior slabs: two or multi component polyurethane based elastomeric.

.19 Continuous sliding bearing:

.1 Two layers of polyolefin, or two layers of promine covered with rubber top and bottom, approximately 6mm (1/4”) in overall thickness.

.2 Deformation under 13.8 MPa at 22°C not to exceed 10% when tested for 24 hours.

.20 Elastomeric bearing pads:

.1 Virgin natural polyisoprene or virgin polychloroprene (Neoprene) conforming to CSA S6.

.21 Sliding bearing assembly:

.1 Galvanized top steel plate (anchored to concrete with min. two 12mm (1/2”) dia. anchor studs) with a type 304 stainless steel highly polished lower surface, and bottom elastomeric pad with a polytetrafluoroethylene (Teflon) upper surface, wrapped in water tight polyethylene wrapping.

.2 Static and kinetic coefficients of friction not to exceed 5% under working stress.

.3 Assembly to have a working stress capacity of 7 MPa on lower pad.

.4 Elastomeric bottom pad to allow a 2% rotation of upper plate and still maintain a substantially uniform bearing pressure between plate and pad.

.22 Crack Filler: low viscosity epoxy resin.

2.4 **Mixes**

.1 Use ready-mix concrete. Proportion concrete in accordance with Alternative 1 - Performance Method for specifying concrete to meet the Consultants performance criteria and to CSA A23.1/A23.2, whichever is more stringent.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Workability: free of surface blemishes, loss of mortar, colour variations (in exposed elements) and segregation.
.2 As required by the trades placing and finishing the concrete.

.3 Provide concrete mixes to meet following hard state requirements:

.1 Durability and class of exposure: as indicated on the structural Drawings.
.2 Compressive strength at 28 days (minimum): as indicated on the structural Drawings.
.3 Intended application: as indicated on the structural Drawings.
.4 Aggregate size 20 mm (3/4”) maximum unless otherwise noted on the structural Drawings.

.4 Supplementary cementing materials (SCM):

.1 Confirm to CSA A23.1.
.2 Minimum 20% replacement, by mass of total cementitious materials to CSA A3001 for concrete that is not architecturally exposed. Maximize SCM content in foundations, walls and columns where rapid strength gain is not critical to the project schedule.
.3 Follow slag and fly ash manufacturers’ directions for proportioning and mixing of concrete.
.4 Fly ash not to exceed more than 15% of total cementitious material.
.5 Maximize SCM content in foundations, walls, columns and any other elements that do not require horizontal finished surface or rapid strength gain to permit early formwork stripping.
.6 Limit SCM content for floors with special finishes (such as Retroplate), to be compatible with the finish.

3 EXECUTION

3.1 Preparation

.1 Obtain written approval of each foundation bearing surface by the Geotechnical Consultant prior to placing concrete. Remove water and disturbed soil from excavations before placing concrete.

.2 Provide 24 hours minimum notice prior to placing of concrete.

.3 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.4 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to the existing structure or the Work.

.5 Pumping of concrete is permitted only after approval of equipment and review of the proposed mix by the concrete supplier.

.6 Ensure reinforcement and inserts are not disturbed during concrete placement.

.7 Protect previous work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars grouted with Hilti HIT HY-200 (or an equivalent product approved by the Consultant) with standard embedment unless noted otherwise on the structural Drawings.

.11 Before placing slab-on-grade, confirm that subgrade and backfill meet the requirements of the Specification Sections and are free of frost and surface water.

.12 Provide vapour barrier under slabs placed on the ground including slabs-on-grade and framed slabs as described in the Specification Sections.

3.2 **Installation/Applications**

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Refer to Notes on Structural Drawings for maximum size and minimum spacing of embedded conduits.

.3 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by the Consultant.

.2 Where approved by the Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated in the Contract Documents.

.3 Sleeves and openings greater than 100 x 100 mm (4” x 4”) not indicated in the Contract Documents must be reviewed by the Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified in the Contract Documents, obtain written approval of modifications from the Consultant before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on the Drawings.

.6 Set special inserts for strength testing as indicated on the Drawings and as required by non-destructive method of testing concrete in accordance with CSA A23.1/A23.2.

.4 Joints

.1 Refer to typical details and Drawing notes for detailing and maximum spacing requirements.

.2 Construction joints:

.1 Formed slab: Locate joints near slab / beam / girder midspans unless a beam intersects a girder at this point. In that case offset the girder joint twice the beam width and provide additional shear reinforcement to the acceptance of the Consultant.

.2 Slabs on steel deck not supported by composite steel beams: Locate joints in slabs at centre of supports unless there are composite beams.

.3 Slabs on steel deck on composite steel beams: Locate joints parallel to purlins at middle of span of slabs and so that joints cross over girders near their supports. Locate construction joints parallel to girders at 1200mm (4'-0") from centre line of girders and so that these girders are not included in the earlier pour.

.4 Walls: locate joints with PVC waterstops at least 300mm (12”) away from wall corners and wall intersections.

.3 Provide evenly spaced vertical control joints in walls.

.4 Provide expansion joints where shown on the structural Drawings. Remove all forming and filler material used during construction and provide clear space between structural elements equal to width specified.

.5 Provide construction gaps where shown on the structural Drawings.

.5 Anchor rods:

.1 Set anchor rods to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Locate each anchor rod group to within 6mm (1/4”) of required location.

.3 Grout anchor rods in holes drilled after concrete has set only after receipt of written approval from the Consultant.

.1 Drilled holes: in accordance manufacturers' recommendations.

.4 Protect anchor rod holes from water accumulations, snow and ice build-ups.

.6 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated as indicated in the Contract Documents.

.7 Dovetail anchor slots: in accordance with Section 04 05 00 - Common Work Results for Masonry.

.1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 800 mm (2’-6”) on centre where concrete walls are masonry faced.

.8 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

.9 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Mechanical Waterstops

.1 Provide mechanical (PVC) waterstops for locations shown on the Drawings.
.2 Do not displace reinforcement when installing waterstops.
.3 Use equipment to manufacturer's requirements to field splice waterstops.
.4 Tie waterstops rigidly in place.
.5 Use only straight heat sealed butt joints in field.
.6 Use factory welded corners and intersections unless otherwise approved by the Consultant.

.4 Bentonite Waterstops:

.1 Provide bentonite waterstops for all locations shown on the structural drawings. Use PVC waterstops for expansion joints.
.2 Locate bentonite waterstops 75 mm (3”) from outside face of concrete to avoid spalling of concrete due to swelling pressure of bentonite.
.3 Butt strips together. Do not overlap.
.4 Fasten to concrete at 600mm (2’-0”) maximum.

.10 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated in the Contract Documents.

.4 Install joint filler.

.5 Use 12 mm (1/2”) thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to finished slab surface unless indicated otherwise in the Contract Documents.

3.3 **Placing Concrete**

.1 Place concrete in accordance with CSA A23.1.

.2 Delivery and place concrete with minimum re-handling.

.3 Do not overload forms.

.4 Use rubber tipped vibrators for concrete containing epoxy coated reinforcement

.5 Cast slabs with a top surface that is level or sloping as required by the Drawings. Allow for cambering where required. Set top of slab below finished floor level by the distance required for the type of applied finish.

.6 Where cambered steel beams are used, ensure that slab thickness is as specified. Measure from top of steel to control thickness.

.7 Construction Gaps:

.1 Do not fill beam and slab construction gaps until all concrete at that level is at least 28 days old.

.2 Do not fill wall construction gaps until all adjoining framed slabs, above and below, are at least 28 days old.

3.4 **Finishing**

.1 Finish concrete to CSA A23.1/A23.2.

.2 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.4 Finish concrete floor to CSA A23.1/A23.2. Class B.

.2 Finishing Flatwork:

.1 See Section 03 35 00 - Concrete Floor Finishing.

.2 Protect concrete during finishing process. Use evaporation reducer during severe drying conditions.

.3 Provide final finish in accordance with proposed use and as follows:

.1 Screeded and bull floated for: mud slabs and footings/pile caps.
.2 Screeded and bull floated with scratch finish for: base slabs which receive mortar setting beds or bonded toppings.
.3 Powered float finish for: roofs (except future floors) and slabs which receive a membrane.
.4 Wood float finish with brooming for: exterior exposed slabs.
.5 Powered steel trowel finish for: interior exposed slabs, slabs which receive resilient flooring, carpet, epoxy-based finishes, thin-set tiles, etc. and future floors. Do not trowel air entrained concrete.
.6 Steel trowel exposed interior concrete floors at least twice. Provide final spin trowelling when non-slip finish is required.

.4 Surface hardeners:

.1 Provide where hardened concrete is required by Architectural Drawings or Specification Sections.
.2 Use only liquid hardeners on air entrained concrete; do not use dry-shake applied surface hardeners.
.3 Incorporate hardener into the surface of the concrete while concrete is still plastic.
.4 Follow manufacturer's recommendations for dosage and application procedure.
.5 Where coloured hardeners are required, colour will be selected from available colours by the Consultant.
.6 Hold pre-construction meeting with hardener technical representative and finisher to ensure proper application, curing and protection.

.3 Finishing Formed Surfaces:

.1 Completely fill holes left by through-bolts with grout.

.2 Do not patch surfaces until instructed in writing by the Consultant.

.3 Concrete exposed to view:

.1 Provide smooth-form finish.
.2 Rub exposed sharp edges with carborundum to produce 3 mm (1/8") radius edges unless otherwise indicated.

.4 Concrete exposed to view:

.1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.

.2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the Consultant.

.5 Toppings:

.1 Topping mixture to meet minimum requirements as follows: Bonded overlay of a thickness noted on the structural drawings.

.2 Make allowance for bonded overlay topping thickness when pouring base course.

.3 Apply cement/sand grout to base course to CSA A23.1/A23.2.

.4 Place bonded topping to CSA A23.1/A23.2 and topping manufacturer's recommendations.

.5 Ensure that joints in topping are of same material as those in base course. Also ensure that their locations precisely match those in base course.

3.5 **Surface Tolerance**

.1 Concrete surface tolerance to CSA A23.1, Straightedge Method.

.2 Finish concrete floor to CSA A23.1/A23.2. Class B.

3.6 **Concrete Curing and Protection**

.1 At a minimum cure and protect concrete in accordance with CSA A23.1

.2 Extend curing and protection period until concrete has reached following strength levels for structural safety:

.1 Framed slabs and beams: 75% of specified 28 day strength.

.2 Columns, walls, piers and footings: 50% of specified 28 day strength

.3 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.

.4 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted in the Contract Documents, use a curing compound compatible with applied finishes.

.5 Do not use curing compound on parking garage slabs and where bonded topping is to be applied. Cover slab surfaces with absorptive mat or fabric and keep continuously wet.

.6 Slabs on grade and structural slabs receiving resilient floor or other moisture sensitive finishes:

.1 Apply 24 hours of wet curing. Start curing immediately after finishing slab.

.2 Cover slab for at least 72 hours using plastic sheets with joints taped and free edges covered.

.3 Protect finished and cured slab from surface water (i.e. rain, snow).

.4 Refer to relevant Specification Sections for required testing methods prior to placing floor finishes.

.7 Concrete exposed to view:

.1 Protect during construction period from wear, damage, marking, discolouration, staining and becoming coated with concrete leakage.

.2 Unless rejected, repair damage and remove marks and stains to the approval of the Consultant.

3.7 **Slabs on Grade**

.1 Construction joints and sawcut joints:

.1 Refer to the Drawing notes for maximum spacing requirements.

.2 Saw cut depth to be equal to one quarter of the concrete thickness.

.3 Locate joints on column lines wherever possible and on intermediate lines, which result in approximately square panels, without re-entrant corners.

.4 Do not create “L” shaped panels nor “T” shaped joint intersections.

.5 Protect edges of sawcuts from breakage.

.6 Clean out sawcuts in exposed concrete and fill with control joint filler after concrete is at least 120 days old.

.7 Sawcut top 25 mm (1") at construction joints in exposed concrete for a width of 5 mm (3/16") and fill with control joint filler after concrete is at least 120 days old.

.8 Clean out sawcuts in other concrete and fill with a sand-cement paste one month prior to installing floor coverings.

.2 Isolation Joints:

.1 Unless otherwise shown on structural drawings, provide min. 10mm (3/8”) thick premoulded joint filler of the same depth as the thickness of the concrete wherever slabs-on-grade abut foundation walls, columns and piers. Omit if slab is chased or dowelled into structure.

.2 Furnish filler for each joint in single piece for depth and width required for joint,

.3 When more than one piece of filler is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Cracks in Slabs-on-Grade:

.1 Extensive cracking of slabs-on-grade or cracks in excess of 3mm (1/8”) in width may be cause for rejection of slab or portion of slab at the Consultant’s discretion.

.2 Protect edges of cracks in slabs-on-grade from breakage.

.3 Exposed slab on grade: Unless slab is rejected, repair cracks that are over 0.4 mm (0.016") wide:

.1 Fill cracks with a sand-cement grout after concrete is at least 120 days old.
.2 Seven days later, cut out top 20 mm (3/4") of crack for a width of 5 mm (3/16") and fill with control joint filler.

.4 Architectural slab on grade: Unless slab is rejected, repair cracks that are over 0.2 mm (0.008") wide:

.1 Fill cracks with epoxy after concrete is at least 180 days old.
.2 Take all measures necessary to prevent epoxy on surface of exposed slab.
.3 Have manufacturer’s technical representative present during initial repairs.

3.8 **Field Quality Control**

.1 Site tests:

.1 Frequency and number of tests to be performed in accordance with CSA A23.1/A23.2.

.2 Conduct tests as follows and submit reports as described in Action and Informational Submittals.

.1 Concrete pours.
.2 Slump.
.3 Air content.
.4 Compressive strength at 7 and 28 days.
.5 Air and concrete temperature.
.6 Fresh density (for low or semi-low density concrete).

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Consultant for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.

.4 Take additional test cylinders during cold weather concreting. Cure cylinders on the Site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.6 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product composition, physical and chemical properties, Product limitations, installation guidelines and warranty details.

1.3 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance guidelines, including precautions for avoiding staining; sufficient quantity for inclusion in operation and maintenance manual.

1.4 QUALIFICATIONS

.1 Applicator: A firm specializing in applying concrete floor sealers, having minimum 5 years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products protected from harmful environmental conditions. Conform to manufacturer's recommended temperature and humidity conditions.

.3 Store and handle Products protected from dirt, corrosion, oil, grease, and other contaminants.

1.6 AMBIENT CONDITIONS

.1 Do not apply Products when air, material, and surface temperatures are expected to fall below 4 degrees C within four hours of completed application.

.2 Ensure adequate temporary heating is available during cold weather work.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 CPD Construction Products.
.2 Degussa.
.3 W. R. Meadows of Canada Limited.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Concrete Floor Sealer: One-component; urethane / acrylic polymer based, high solids, liquid sealer; clear and transparent, non-yellowing formulation; chemical-resistant; maximum 200 g/L VOC content; eg. Decra-Seal W/B by W. R. Meadows of Canada Limited.

.2 Slip-Resistant Additive: Finely ground polymer, silica-free aggregate; eg. Sure-Step by W. R. Meadows of Canada Limited.

2.3 MIXING

.1 Mix slip-resistant additive into sealer at manufacturer's recommended rate.

.2 Occasionally stir mixture to keep particles well suspended within coating.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify concrete has not been previously treated with chlorinated rubber-based cure and seal compounds.

.3 Verify new concrete has cured for minimum 28 days.

3.2 PREPARATION

.1 Sweep and wash floors to remove debris, grease, oil, and wax.

.2 Remove stains and discolourations.

.3 Completely remove incompatible cure and seal compounds. Allow concrete to dry.

3.3 APPLICATION

.1 Spray apply Product, completely wetting concrete surface without producing drips, puddles, or rundown.

.2 Apply Product to achieve Medium sheen finish.

.3 Spray apply two coats to prepared concrete slab.

.4 Allow first coat to dry before applying second coat.

.5 Apply Product evenly, without ponding.

.6 Avoid puddling in low areas.

3.4 PROTECTION

.1 Refer to Section 01 70 00.

.2 Restrict foot traffic for 12 hours.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 10 - Masonry Mortaring and Grouting.

.2 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Section 04 05 23 - Masonry Accessories.

.4 Section 04 22 00 - Concrete Unit Masonry.

.5 Section 05 12 23 - Structural Steel for Buildings.

1.2 REFERENCES

.1 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.

.2 CSA S304:24: Design of Masonry Structures.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Samples: As follows:
- .1 Two samples of each type of masonry unit specified, illustrating colour, texture, and extremities of colour range;
- .2 One sample of each type of masonry reinforcement and tie specified in Section 04 05 19;
- .3 One sample of each type of masonry accessory specified in Section 04 05 23; and
- .4 As required for testing purposes.

1.4 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard masonry analysis and testing reports, indicating compressive strength, initial rate of absorption, maximum water absorption, maximum saturation coefficient, and density for each type of masonry unit; prepared by independent agency.

1.5 QUALIFICATIONS

.1 Installer: A firm specializing in installing commercial masonry, having minimum 5 years documented experience, and a member of OMCA.

1.6 MOCK-UPS

.1 Construct mock-up as specified in Section 01 40 00.

.2 Mock-Up Panel: One 1 200 x 1 800 mm size, illustrating masonry veneer cladding types, textures and colours; mortar joint thickness, tooled finish and colour. Include structural back-up materials, air/vapour barrier membranes, through-wall flashing membranes, mortar dropping control devices, weephole vents, thermal insulation, wall ties, and connectors.

.3 Report mortar colour loading rate for acceptable panel.

.4 Accepted mock-ups will be used as the standard for acceptance of the Work.

.5 Remove and replace installed Product that does not conform to accepted mock-up.

.6 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products to Place of the Work in dry condition.

.3 Keep Products dry until use.

.4 Store Products under waterproof cover on pallets or plank platforms, held off ground by means of plank or timber skids.

.5 Protect masonry units from damage.

1.8 AMBIENT CONDITIONS

.1 Conform to CAN/CSA-A371.

.2 Provide heated enclosures and heat as necessary during cold weather construction.

.3 Protect freshly laid masonry from drying too rapidly during hot weather, by means of waterproof, non-staining coverings.

2 Products

2.1 SOURCE QUALITY CONTROL

.1 Perform shop testing by independent inspection agency as specified in Section 01 40 00.

.2 Refer to Product Specifications for Product-specific shop testing requirements.

3 Execution

3.1 QUALITY OF WORK

.1 Construct masonry plumb, level, and true to line.

.2 Construct masonry with vertical joints in alignment.

.3 Lay out coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.4 Maintain masonry courses to uniform width.

.5 Lay masonry in full bed of mortar, properly jointed with other work.

.6 Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

.7 Maintain dry masonry beds and lay only dry masonry units. Do not pre-soak masonry units in cold weather.

.8 Fully bond intersections, and external corners.

.9 Do not use chipped, cracked or otherwise damaged units in exposed and loadbearing masonry walls.

.10 Build in items required to be built into masonry.

.11 Brace door frames to maintain plumb. Fill spaces between frame jambs and masonry with masonry grout.

.12 Prevent displacement of built-in items during construction. Check plumb, location, and alignment frequently, as work progresses.

3.2 JOINTING

.1 Make vertical and horizontal joints equal and of uniform thickness.

.2 Tooled Joints: Allow joints to set just enough to remove excess water, then tool joints using a round jointer to result in a smooth, tightly compressed, uniformly concave profile.

.3 Flush Joints: Strike flush joints that will be concealed within the wall or which will receive a coating of plaster, tile, insulation, resilient base, bituminous foundation protection, or other joint-concealing finish. Do not strike flush mortar joints designated to receive painted or other thin finishes.

3.3 CUTTING

.1 Cut out masonry neatly for recessed or built-in objects.

.2 Make cuts straight, clean and free from uneven edges.

.3 Make Good masonry which has cracked or broken as a result of cutting in built-in objects.

3.4 PROVISIONS FOR MOVEMENT

.1 Unless specified or shown otherwise, Provide the following space to accommodate movement:
.1 Deflection Space Below Shelf Angles: 10 mm.
.2 Between Masonry and Vertical Structural Elements: 10 mm.
.3 Between Top of Non-loadbearing Partitions and Structural Elements: 12 mm.

.2 Fill space with compressible material and seal both sides as specified in Section 07 92 00. Do not use wedges.

.3 Provide continuous movement control joints, properly sealed with backing rod and joint sealant, as specified in Section 04 05 23.

3.5 LOOSE STEEL LINTELS

.1 Install loose steel lintels.

.2 Centre lintel over opening width.

3.6 TEMPORARY WALL BRACING

.1 Provide engineered temporary bracing for masonry walls to resist wind pressure and other lateral loads during and after erection until permanent lateral support is in place.

3.7 PROTECTING MASONRY

.1 Refer to Section 01 70 00.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind-driven rain, until masonry is completed and protected by flashings or other permanent construction.

.3 Protect masonry and other work from marking and other damage.

.4 Protect completed work from mortar droppings. Use non-staining coverings.

3.8 FIELD QUALITY CONTROL

.1 Field Inspection: Consultant will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.

.2 Masonry will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges of the masonry units exceeding 10 mm or that can be seen from a distance of 3 000 mm. Masonry units supplied with a rusticated face will be inspected for cracks and blemishes only.

.3 Make Good rejected masonry as directed by Consultant.

3.9 TOLERANCES

.1 Conform to CAN/CSA-A371.

3.10 CLEANING

.1 Clean masonry as work progresses.

.2 Allow mortar droppings on masonry to partially dry then remove by means of brushing with a stiff fibre brush.

.3 Post-Construction: Clean one-half of mock-up panel as directed below. Leave cleaned area for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:
- .1 Protect windows, sills, doors, trim and other work from damage.
- .2 Remove large particles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
- .3 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 Litre of clean water using stiff fibre brushes, then clean off immediately with clean water using hose.
- .4 Repeat cleaning process as often as necessary to remove mortar and other stains.

.4 Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 22 00 - Concrete Unit Masonry.

1.2 REFERENCES

.1 ASTM C979/C979M-24: Standard Specification for Pigments for Integrally Colored Concrete.

.2 CAN/CSA-A179-14 (R2024): Mortar and Grout for Unit Masonry.

.3 CSA A3001:23: Cementitious Materials for Use in Concrete.

.4 CSA A3002:23: Masonry and Mortar Cement.

.5 CSA S304:24: Design of Masonry Structures.

.6 NCMA TEK 3-2A-2005: Grouting Concrete Masonry Walls.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: On design mix, indicating Proportion or Property specification method used, required environmental conditions, and admixture limitations.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Two ribbons of mortar, illustrating colour and colour range.
.1 Complete upon acceptance, confirmation of site-mixed colour additive proportional to site-mixed batch.
.2 Prepare and submit sample colour ribbons for each days work for review of consistency.

1.5 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit field quality control submittals as specified in Section 01 40 00.

.2 Verification Samples: Sample cubes for laboratory testing, to CAN/CSA-A179.

.3 Test Reports: Clearly indicating test result data, to CAN/CSA-A179.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in original unbroken and undamaged packages, with maker's name and brand distinctly marked.

.3 Store Products in weatherproof shed until ready for use.

.4 Store or pile sand on a plank platform. Protect from dirt and rubbish.

.5 Store Products in a manner to prevent deterioration or contamination by foreign materials.

1.7 AMBIENT CONDITIONS

.1 Maintain materials and surrounding air temperature to minimum 5 degrees C and maximum 50 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Do not use anti-freeze, liquid salts, or other substances to lower the freezing point of mortar or grout. Conform to CAN/CSA-A179.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of cement having Product considered acceptable for use:
- .1 Essroc.
- .2 Holcim.
- .3 Lafarge Construction Materials.
- .4 St. Marys Cement.

.2 Manufacturers of dry, plant-batched mortar mixtures having Product considered acceptable for use:
- .1 Daubois.
- .2 Graymont Dolime (OH) Inc.
- .3 King Packaged Materials Company.

.3 Manufacturers of mortar pigment having Product considered acceptable for use:
- .1 Bayer Pigments.
- .2 Elementis Pigments.
- .3 Interstar.
- .4 Hamburger Company.

.4 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Portland Cement: To CSA A3001, Type GU; Grey colour.

.2 Masonry Cement: To CSA A3002, Type N.

.3 Mortar Aggregate: Natural sand, to CAN/CSA-A179; standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.

.4 Grout Coarse Aggregate: To CAN/CSA-A179; maximum 10 mm size; 27 percent by volume.

.5 Grout Fine Aggregate: To CAN/CSA-A179; clean well graded sharp sand; 54 percent by volume.

.6 Water: Potable, clean and free of deleterious amounts of acids, alkalies or organic materials.

2.3 ADMIXTURES

.1 Plasticizer: Water reducing type, reducing porosity and absorption to increase bond strength.

.2 Water Repellent: Mixture of calcium carbonate and hydrous magnesium aluminum silicate powders; eg. Hydrocide Powder by Degussa Building Systems.

.3 Pigment: Liquid manufactured or natural oxide pigment, to ASTM C979/C979M; colours as selected by Consultant.

2.4 MORTAR MIXES

.1 Mortar for Use with Loadbearing Concrete Unit Masonry: Portland cement-Masonry cement-Sand mix, to CAN/CSA-A179, Type S using the Property specification method; minimum compressive strength 8.5 MPa at 28 days; complete with water repellent admixture.

.2 Mortar for Use with Non-Loadbearing Concrete Unit Masonry: Masonry cement-Sand mix, to CAN/CSA-A179, Type N using the Property specification method; minimum compressive strength 3.5 MPa at 28 days; complete with water repellent admixture.

.3 Mortar for Use with Non-Loadbearing Masonry Veneers: Masonry cement-Sand mix, to CAN/CSA-A179, Type N using the Proportion specification method; complete with integral colour as selected by Consultant.

2.5 MORTAR MIXING

.1 Thoroughly mix ingredients in proper measured quantities needed for immediate use, to CAN/CSA-A179.

.2 Coloured Mortar: Pigment dosage as selected by Consultant, but not to exceed 10 percent of cement content by mass, as defined in ASTM C979/C979M.

.3 Provide uniformity of mix and colouration.

.4 Take representative samples for testing consistency of strength and colour to CAN/CSA-A179.

.5 Use mortar within 1-1/2 hours after mixing at temperature of 25 degrees C or higher, or 2-1/2 hours after mixing at temperatures less than 25 degrees C.

.6 Discard mortars exceeding time limits specified above.

2.6 GROUT MIXES

.1 Grout for Use in Spaces 50 mm or Wider: Portland cement-Sand-Coarse Aggregate mix, to CAN/CSA-A179, Coarse Grout using the Property Specification method.

.2 Grout for Use in Spaces Narrower than 50 mm: Portland cement-Sand mix, to CAN/CSA-A179, Fine Grout using the Property Specification method.

.3 Match grout's 28 day compressive strength to the compressive strength of the concrete masonry unit being filled.

2.7 GROUT MIXING

.1 Thoroughly mix ingredients accurately in proper measured quantities needed for immediate use, to CAN/CSA-A179.

.2 Use grout within 1-1/2 hours after mixing.

.3 Discard grout exceeding time limit specified above.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Request Consultant inspection of spaces to be grouted.

3.2 PREPARATION

.1 Apply bonding agent to existing concrete surfaces.

.2 Plug clean-out holes with masonry units to prevent leakage of grout materials.

.3 Brace masonry for wet grout pressure.

.4 Install grout dams below voids designated to be filled with grout. Keep dams 25 mm back from faces of units.

.5 Remove excess mortar from grout spaces.

3.3 APPLICATION

.1 Install mortar as specified in Sections 04 21 00 and 04 22 00.

.2 Install grout to NCMA TEK 3-2A.

.3 Fill unit cores with grout fill where hollow concrete masonry units are used instead of solid concrete masonry units.

.4 Place grout as required to maintain an adequate level of structural bearing surface with no voids and to a depth as indicated on Drawings.

3.4 PARGING

.1 Use parging mortar as indicated on Drawings.

.2 Apply parging in two coats not less than 10 mm thick.

.3 Roughen first coat to ensure a good bond for second coat. Allow first coat to dry a minimum of 24 hours before applying second coat.

.4 Dampen first coat with water before applying second coat.

3.5 FIELD QUALITY CONTROL

.1 Perform inspection and testing of mortar and grout mixes as specified in Section 01 40 00.

.2 Test Property specification mortars for compressive strength to CAN/CSA-A179, and as follows:
.1 Test three 50 mm cubes at 7 days and three 50 mm cubes at 28 days.
.2 Mortar for Concrete Unit Masonry: Perform one test for every 500 m^2 of wall, but not less than one set of tests for each storey height of each building.

.3 Test grout for slump and compressive strength to CAN/CSA-A179, and as follows:
.1 Slump at Time and Point of Placement: 225 mm, plus or minus 25 mm.
.2 Take one set of grout cylinders at least daily for each 20 m^3 of grout poured and whenever the mix design changes.
.3 Cylinder Sets: Comprised of minimum three cylinders.
.4 Test one cylinder at 7 days and two cylinders at 28 days.

3.6 NON-CONFORMING WORK

.1 Make Good portions of the Work constructed with mortar or grout that does not meet specified criteria.

.2 Remove and reconstruct affected walls using new Product.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 05 00 - Common Work Results for Masonry.

.3 Section 04 05 10 - Masonry Mortaring and Grouting.

.4 Section 04 05 23 - Masonry Accessories.

.5 Section 04 22 00 - Concrete Unit Masonry.

.6 Section 05 12 23 - Structural Steel for Buildings.

.7 Section 05 40 00 - Cold-Formed Metal Framing.

.8 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

.1 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.4 ASTM A580/A580M-23: Standard Specification for Stainless Steel Wire.

.5 ASTM A641/A641M-19(2025): Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.6 ASTM A951/A951M-22: Standard Specification for Steel Wire for Masonry Joint Reinforcement.

.7 ASTM A1011/A1011M-18a: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra-High Strength.

.8 CSA A370:14 (R2023): Connectors for Masonry.

.9 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.

.10 CSA S304:24: Design of Masonry Structures.

1.3 MOCK-UPS

.1 Supply Product for construction of mock-up panel as specified in Section 04 05 00.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of horizontal joint reinforcement and anchors having Product considered acceptable for use:
.1 Blok-Lok.
.2 WireLock.

.2 Manufacturers of wall ties having Product considered acceptable for use:
.1 Blok-Lok.
.2 Fero.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Steel Wire: To ASTM A951/A951M; galvanized coatings and diameters as specified below.

.2 Stainless Steel Plate: To ASTM A240/A240M, Type 304; sizes and thicknesses as specified below.

.3 Stainless Steel Wire: To ASTM A580/A580M, Type 304; diameters as specified below.

2.3 HORIZONTAL JOINT REINFORCEMENT

.1 Exterior Wall Horizontal Joint Reinforcement: To CSA A370, Ladder-type, Extra Heavy Duty; fabricated from hot dipped galvanized steel wire; width to suit concrete masonry unit bed depth; eg. BL-10 by Blok-Lok.

.2 Interior Wall Horizontal Joint Reinforcement: To CSA A370, as follows:
.1 Loadbearing, Multi-Wythe: Ladder-type, Extra Heavy Duty; fabricated from regular mill galvanized steel wire; width to suit concrete masonry unit bed depths; eg. BL-12 by Blok-Lok.
.2 Loadbearing, Single-Wythe: Ladder-type, Extra Heavy Duty; fabricated from regular mill galvanized steel wire; width to suit concrete masonry unit bed depth; eg. BL-10 by Blok-Lok.
.3 Non-Loadbearing Partitions, Single-Wythe: Ladder-type, Standard Duty; fabricated from regular mill galvanized steel wire; width to suit concrete masonry unit bed depth; eg. BL-10 by Blok-Lok.

2.4 WALL TIES

.1 Wall Tie (Steel Stud Back-up): Adjustable, dual component, rod adjustable plate tie system; as follows:
.1 Flat Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension and stud width; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.
.2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
.3 Fasteners: Chromium-plated steel self-tapping TEK screws, complete with neoprene O-ring washer and hex washer head; 6.35 mm OD, 19 mm long; minimum two screws per tie.
.4 Manufacturer and Product Name: Fero Thermal Tie - Holed Side Mounted Rap-Tie Masonry Connector by Fero Corporation.

.2 Wall Tie (CMU Back-up): Adjustable, dual component, shear connector system; as follows:
.1 Block Plate: 1.52 mm thick stainless steel plate; length to suit air space and CMU bed depth, less 6 mm; complete with a series of eight 5.8 mm OD holes punched along leading edge to receive V-Tie.
.2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
.3 Manufacturer and Product Name: Fero Thermal Tie - Block Shear Masonry Connector by Fero Corporation.

.3 Wall Tie (C-i-P Concrete Back-up): Adjustable, dual component, rod adjustable plate tie system; as follows:
.1 L-Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.
.2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
.3 Fastener: Tapcon-style hex head self-tapping screws, complete with blue climaseal coating; 6.35 mm OD, 83 mm long; minimum two screws per tie.
.4 Manufacturer and Product Name: Fero Thermal Tie - Holed Rap-Tie Masonry Connector by Fero Corporation.

.4 Wall Tie (Structural Steel Back-up): Adjustable, dual component, rod adjustable plate tie system; suitable for welded attachment; as follows:
.1 L-Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.
.2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
.3 Manufacturer and Product Name: Fero Thermal Tie - Holed Rap-Tie Masonry Connector by Fero Corporation.

2.5 ACCESSORIES

.1 Reinforcing Steel: As specified in Section 03 30 00; sizes as indicated on Drawings.

.2 Rigid Strap Anchors: 6.0 mm thick, 38 mm wide steel plate with 50 mm long Z-shaped bends; hot dipped galvanized; lengths to suit application; eg. BLT-11Z by Blok-Lok.

.3 Anchor-Type Fasteners: To CSA A370; hot dipped galvanized steel, purpose made for substrate.

2.6 FINISHES

.1 Hot Dip Galvanized Coating on Steel Components and Hardware: To ASTM A123/A123M and ASTM A153/A153M, Class B2; minimum 458 g/m^2 zinc coating on all surfaces, except as specified below:
.1 Strap Anchors: To ASTM A123/A123M; minimum 503 g/m^2 zinc coating on all surfaces.

.2 Mill Galvanized Coating on Steel Components and Hardware: To ASTM A641/A641M, Regular; minimum 30 g/m^2 zinc coating on all surfaces.

3 Execution

3.1 PREPARATION

.1 Supply metal anchors to the appropriate trades for placement. Direct correct placement.

.2 Verify anchorages embedded in concrete or attached to structural steel members are properly placed. Embed anchorages in every second joint.

3.2 INSTALLATION

.1 Install masonry connectors and reinforcement to CSA A370.

.2 Place horizontal joint reinforcement continuous in every second bed joint, with minimum 300 mm lap splices.

.3 Place horizontal joint reinforcement in first and second bed joints above and below openings. Extend 600 mm minimum each side of opening.

.4 Place horizontal joint reinforcement continuous in first and second bed joints below top of walls.

.5 Reinforce joint corners and intersections with strap anchors spaced at 400 mm OC vertically.

.6 Place bed joint reinforcement at 200 mm OC vertically in bed joints of stack bonded masonry units.

.7 Provide reinforcing supported and secured against displacement as indicated on Drawings, and as follows:
- .1 Maintain minimum clearance of 12 mm from masonry and not less than one bar diameter between bars.
- .2 Provide two 15M reinforcing bars grouted vertically into CMU cores both sides of masonry openings.
- .3 Provide clean out openings at bottom of cores containing vertical reinforcement at each grout lift or pour.

.8 Grout reinforcing and anchorages into masonry as specified in Section 04 05 10.

.9 Secure wall ties to structural back-up at maximum spacing of 400 x 600 mm OC.

.10 Secure wall ties to steel stud web using minimum two fasteners.

.11 Double quantity of wall ties within 200 mm of changes in wall direction.

.12 Double quantity of wall ties within 200 mm of wall openings.

.13 Double quantity of wall ties along parapet walls.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 05 10 - Masonry Mortaring and Grouting.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 22 00 - Concrete Unit Masonry.

.5 Section 05 12 23 - Structural Steel for Buildings.

.6 Section 05 50 00 - Metal Fabrications.

.7 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.8 Section 07 27 00 - Air Barriers.

.9 Section 07 62 00 - Sheet Metal Flashing and Trim.

.10 Section 07 91 00 - Preformed Joint Seals.

.11 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.4 BIA Technical Note on Brick Construction 18A: Accommodating Expansion of Brickwork.

.5 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.

.6 NCMA TEK 10-2C-2010: Control Joints for Concrete Masonry Walls - Empirical Method.

1.3 MOCK-UPS

.1 Supply Product for construction of mock-up as specified in Section 04 05 00.

2 Products

2.1 MATERIALS

.1 Flexible Membrane Flashing: 1.0 mm thick self-adhering SBS rubberized asphalt membrane with a cross-laminated HPDE top surface, sheet width to suit application; eg. Blueskin TWF by Henry (a Carlisle Company).

.2 Sheet Metal Flashing: To ASTM A240/A240M, Type 316; 0.61 mm thick stainless steel sheet.

.3 Flashing Tape: 75 mm wide, self-adhesive sealing tape; eg. X-Seal Tape by Blok-Lok.

.4 Cavity Firestops: To ASTM A240/A240M, Type 316; 1.2 mm thick stainless steel sheet.

.5 Mortar Dropping Control Device: Purpose made open weave nylon and polyester mesh, top hat profile, complete with insect barrier.

.6 Weep Vent: Open weave polyester mesh complete with insect barrier, size to suit mortar joint width and depth; colours as selected by Consultant.

.7 Cavity Wall Filler: To ASTM A240/A240M, Type 316; 1.2 mm thick stainless steel sheet.

.8 Nailing Inserts: 0.61 mm thick purpose made galvanized steel inserts for setting in mortar joints.

.9 Primer: As recommended by sheet membrane manufacturer.

.10 Compressible Filler: Closed cell neoprene; eg. Neoprene Sponge by Blok-Lok.

.11 Building Paper: No. 15 asphalt saturated felt.

.12 Preformed Joint Seal: Premoulded movement joint filler, as specified in Section 07 91 00.

.13 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

2.2 FINISHES

.1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Grade Z275; hot dipped, zinc alloy coating.

.2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped, zinc alloy coating.

3 Execution

3.1 PREPARATION

.1 Apply primer to porous surfaces scheduled to receive self-adhering sheet membranes.

3.2 INSTALLATION

.1 Install vertical cavity wall fillers at external corners to prevent wind driven moisture from crossing the cavity. Seal cavity wall filler to masonry veneer with continuous bead of joint sealant.

.2 Install nailing inserts in mortar joints at 400 mm OC each way, for attachment of wall strapping.

.3 Provide vertical cavity firestops where indicated on Drawings, spaced at maximum 20 000 mm OC.

.4 Provide mortar dropping control devices at base of wall cavities.

.5 Provide weep vents in head joints immediately over through-wall flashing membranes, spaced at maximum 800 mm OC.

.6 Provide weep vents in head joints along top of wall cavities, spaced at maximum 800 mm OC.

3.3 FLASHING

.1 Provide flashings in masonry to CAN/CSA-A371.

.2 Install flashings under exterior masonry walls bearing on foundation walls or slabs, shelf angles, steel lintel angles at wall openings, and as indicated on Drawings.

.3 In double wythe walls and veneered walls, carry flashings from front edge of masonry, under outer wythes, then up backing not less than 150 mm, and as follows:
.1 Masonry Backing: Embed flashing 25 mm in joint.
.2 Concrete Backing: Insert flashing into reglets and seal joint.
.3 Framed and Sheathed Backing: Secure flashing to sheathing behind air barrier.

.4 Lap joints 150 mm and seal watertight.

.5 Form flashing over openings with end dams at both ends to prevent water from travelling horizontally past flashing ends.

.6 Return horizontal base flashing minimum 100 mm around corner to overlap abutting flashing. Seal watertight.

3.4 EXPANSION, MOVEMENT AND CONTROL JOINTS

.1 Provide expansion joints in masonry walls, partitions, and veneers as indicated on Drawings.
.1 Form expansion joints to sizes indicated on Drawings, leaving head joints between stacked units void of mortar and reinforcing.
.2 Provide preformed joint seal in exterior veneer expansion joints, as specified in Section 07 91 00.

.2 Provide movement joints in masonry veneers to BIA Technical Note on Brick Construction 18A.
.1 Form movement joints by leaving head joints between stacked units void of mortar and reinforcing.
.2 Provide compressible filler in joint, set back from face to accommodate application of backer rod and joint sealant.
.3 Seal movement joints as specified in Section 07 92 00.

.3 Provide control joints in concrete unit masonry walls and partitions to NCMA TEK 10-2C.
.1 Form control joints by installing a building paper bond breaker fitted to one side of the hollow contour of block end.
.2 Fill the created core solid with grout.
.3 Rake joint at exposed faces to accommodate application of backer rod and joint sealant.
.4 Seal control joints as specified in Section 07 92 00.

.4 Do not continue horizontal joint reinforcing across expansion, movement, and control joints.

.5 Size movement and control joints for sealant performance as specified in Section 07 92 00.

3.5 PROTECTION

.1 Protect flashings from mortar droppings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 05 10 - Masonry Mortaring and Grouting.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 23 - Masonry Accessories.

.5 Section 05 12 23 - Structural Steel for Buildings.

.6 Section 05 50 00 - Metal Fabrications.

.7 Section 07 21 00 - Thermal Insulation.

.8 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.9 Section 07 27 00 - Air Barriers.

.10 Section 07 62 00 - Sheet Metal Flashing and Trim.

.11 Section 07 92 00 - Joint Sealants.

.12 Section 08 12 13 - Hollow Metal Frames.

.13 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.14 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.15 Section 08 51 13 - Aluminum Windows.

.16 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM C331/C331M-23: Standard Specification for Lightweight Aggregates for Concrete Masonry Units.

.2 CSA A165 SERIES-14 (R2019): CSA Standards on Concrete Masonry Units.

.3 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.

.4 CSA S304:24: Design of Masonry Structures.

1.3 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control samples as specified in Section 01 40 00.

.2 Verification Samples: To CSA S304.

1.4 QUALIFICATIONS

.1 Manufacturers: A firm specializing in manufacturing concrete masonry units, having minimum 5 years documented experience, and a member of CCMPA.

1.5 MOCK-UPS

.1 Supply Product for construction of mock-up panel as specified in Section 04 05 00.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 04 05 00.

1.7 AMBIENT CONDITIONS

.1 Environmental Requirements: As specified in Section 04 05 00.

2 Products

2.1 MATERIALS

.1 Concrete Masonry Units (CMU): To CSA A165.1, using N aggregate; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; solid factory-finished ends with bull nosed corners for use at exposed wall corners, special shapes as required; types where indicated on Drawings, as follows:
.1 Hollow: Types H/15/A/M, H/20/A/M and H/30/A/M.
.2 Solid (75 percent): Types S/15/A/M, S/20/A/M and S/30/A/M.
.3 Solid (100 percent): Types S_f/15/A/M, S_f/20/A/M and S_f/30/A/M.

.2 Lightweight Concrete Masonry Units (CMU-LWT): To CSA A165.1, using $L_2$20S slag aggregate to ASTM C331/C331M; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; solid factory-finished ends with bull nosed corners for use at exposed wall corners, special shapes as required; types where indicated on Drawings, as follows:
.1 Hollow: Types H/15/C/M, H/20/C/M and H/30/C/M.
.2 Solid (75 percent): Types S/15/C/M, S/20/C/M and S/30/C/M.
.3 Solid (100 percent): Types S_f/15/C/M, S_f/20/C/M and S_f/30/C/M.

.3 Decorative Concrete Masonry Units (CMU-DEC-1): To CSA A165.2, Grade I, Solid; complete with integral water repellant; factory-finished ends for use at exposed wall corners; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; Finesse Series by Brampton Brick, Suave texture, Peel Silver colour.

.4 Decorative Concrete Masonry Units (CMU-DEC-2): To CSA A165.2, Grade I, Solid; complete with integral water repellant; factory-finished ends for use at exposed wall corners; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; Finesse Series by Brampton Brick, Smooth texture, Eclipse colour.

.5 Concrete Brick (CMU-BRK): To CSA A165.2, Grade I, Solid; complete with integral water repellant; factory-finished ends for use at exposed wall corners; 57 mm face height, 190 mm face length, 90 mm bed depth; Finesse Series by Brampton Brick, Smooth texture, Canvas Beige colour.

2.2 ACCESSORIES

.1 Mortar and Grout: As specified in Section 04 05 10.

.2 Dry Pack Grout: Pre-mixed composition of non-metallic aggregate and cement with sufficient water to maintain its shape when made into a bar by hand and capable of attaining compressive strength of 35 MPa at 28 days.

.3 Horizontal Joint Reinforcement: As specified in Section 04 05 19.

.4 Reinforcing Steel: As specified in Section 04 05 19.

.5 Wall Ties: As specified in Section 04 05 19.

.6 Rigid Strap Anchors: As specified in Section 04 05 19.

.7 Masonry Accessories: As specified in Section 04 05 23.

2.3 SOURCE QUALITY CONTROL

.1 Perform laboratory testing of concrete masonry units, as specified in Section 01 40 00.

.2 Conduct compressive strength tests and water absorption tests to CSA S304.

3 Execution

3.1 PREPARATION

.1 Install dry-pack grout between masonry and prestressed hollow-core concrete slabs where slabs are parallel to loadbearing masonry walls.

.2 Secure wall ties to structural back-up for masonry veneer as specified in Section 04 05 19.

.3 Install masonry flashing as specified in Section 04 05 23.

3.2 INSTALLATION

.1 Place masonry to lines and levels indicated, as specified in Section 04 05 00.

.2 Unless indicated otherwise, lay concrete masonry units in half-running bond.
.1 Lay decorative concrete masonry units and concrete bricks in bond patterns as indicated on Drawings.

.3 Maintain 10 mm wide mortar joints in both directions.

.4 Provide purpose made pilaster units, 90 and 45 degree corner return units, bullnose units, bond beam units, and lintel units as required.

.5 Provide bullnose concrete masonry units at exposed corners, except at first course at floor level, and at corresponding course located at ceiling level.

.6 Fully bond intersections and external corners.

.7 Extend and laterally support non-loadbearing partitions to underside of structural deck above. Maintain minimum deflection space at top of partitions, as follows:
.1 Partition parallel to structural assembly: 44 mm.
.2 Partition perpendicular to structural member: 19 mm.
.3 Structural member penetrates partition: 19 mm.
.4 Ducts or piping supported from structural assembly that penetrate partition: 19 mm.
.5 Fill deflection space with mineral fibre sound attenuating insulation.

.8 Place horizontal joint reinforcement as specified in Section 04 05 19.

.9 Install loose steel lintels as scheduled, and as specified in Section 04 05 00.

.10 Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled. Construct lintels using grout fill and reinforcing. Maintain minimum 200 mm bearing on each side of opening.

.11 Reinforce bond beams and pilasters as indicated on Drawings. Place and consolidate grout fill without disturbing reinforcing.

.12 At bearing points, fill masonry cores with grout minimum 300 mm from opening.

.13 Provide vertical and horizontal movement control joints as specified in Section 04 05 23.

3.3 TOLERANCES

.1 Variation from Unit to Adjacent Unit: $\leq$ 1.5 mm.

.2 Variation of Joint Thickness: $\leq$ 3 mm per 1 000 mm.

3.4 FIELD QUALITY CONTROL

.1 Refer to Section 01 40 00.

.2 Consultant Inspection: Consultant will inspect completed masonry walls and will reject walls that have chipped, cracked, or blemished (streaked, stained or otherwise damaged) finished surfaces, as described below.

.1 Masonry walls will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges exceeding 10 mm or that can be seen from a distance of 3 000 mm.

.2 Masonry shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a distance of 6 000 mm.

.3 Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a distance of 6 000 mm.

.4 Crazing and efflorescence will not be cause for rejection.

.3 Make Good rejected Products as directed by Consultant.

3.5 CLEANING

.1 Clean masonry as specified in Section 04 05 00.

3.6 PROTECTION

.1 Protect concrete masonry units from damage resulting from subsequent construction operations. Refer to Section 04 05 00.

.2 Remove protection materials upon Ready-for-Takeover, or when risk of damage is no longer present.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 30 00 – Cast-In-Place Concrete.

.2 Section 05 21 00 – Steel Joist Framing.

.3 Section 05 31 00 – Steel Decking.

.4 Section 07 81 00 – Applied Fireproofing.

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 Canadian Standards Association (CSA International):

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CAN/CSA-S16, Limit States Design of Steel Structures.
.3 CAN/CSA-S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
.4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
.5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
.6 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
.7 CSA W59, Welded Steel Construction (Metal Arc Welding).

.3 American Society for Testing and Materials (ASTM International):

.1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
.2 ASTM A123 Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
.3 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
.4 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.5 ASTM A992, Standard Specifications for Structural Steel Shapes.
.6 ASTM D6386, Preparation of Zinc (Hot-Dipped Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
.7 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.
.8 ASTM F3125M, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150

ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-85.10-[99], Protective Coatings for Metals.

.5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):

.1 Handbook of the Canadian Institute of Steel Construction.
.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.6 Master Painters Institute:

.1 MPI-INT 5.1, Structural Steel and Metal Fabrications.
.2 MPI-EXT 5.1, Structural Steel and Metal Fabrications.

.7 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:

.1 SSPC-SP 1, Solvent Cleaning.
.2 NACE No. 3 / SSPC-SP 6, Commercial Blast Cleaning.
.3 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.
.4 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.
.5 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
.6 SSPC Paint Specification No. 20 – Zinc Rich Coating

1.3 **Quality Assurance**

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Structural steel fabricator to be a member of the Canadian Institute of Steel Construction and to have at least five year experience with structural steel for buildings.
.2 Structural steel fabricator to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components.
.3 Welders to be CWB approved, working under supervision of a CWB approved firm.
.4 Engage a Professional Engineer licensed and insured in the Province of Ontario

to be responsible for design, detailing and installation of all connections related to structural steelwork.

.5 The Professional Engineer designing connections to hold a Certificate of Authorization, and to carry the minimum liability insurance (per occurrence) as required by PEO.

1.4 **Quality Control**

.1 Submit in accordance with Section 01 45 00 – Quality Control.

.2 Source Quality Control Submittals:

.1 Submit mill test reports 4 weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project, and show compliance with the required standards.

.2 The reports to be correlated to the materials or products to which they pertain.

.3 Indicate traceability as to the origin of the steel manufacturer. All structural steel (including bolts) shall be produced in Canada, the US or EU countries.

.3 Tolerances

.1 Conform to the fabrication and erection tolerances of CAN/CSA S16.

.2 If more stringent tolerances are specified elsewhere to suit interfacing materials or AESS members, the latter shall govern.

.4 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for structural steel connections certifying that the work has been completed in accordance with all contract documents.

1.5 **Action and Informational Submittals**

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Submit 4 hard copies or unlocked PDF documents to the Consultant for review at least 4 weeks prior to fabrication and/or delivery.

.3 Erection drawings:

.1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including a description of methods; Sequence of erection; type of equipment used in erection, temporary bracings, beam sizes

(in addition to beam marks), and AESS members and their category, and assembly finishing details

.2 It is recommended that erection diagrams are submitted for review prior to preparing shop details. Copies of the original structural drawings will not be accepted as erection diagrams.

.4 Fabrication drawings:

.1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Ontario, Canada. Indicate the following on the drawings:

.1 Material specifications.
.2 Surface preparation.
.3 Shop painting / galvanizing
.4 Section splices.
.5 Types of shop and field connections.
.6 Net weld lengths.
.7 Precautions which will be taken to exclude threads from shear planes of bearing type bolted connections (where applicable).
.8 Protected zones.
.9 Vent holes required for galvanizing process.

.2 Indicate members which are considered AESS, and their category. Refer to AESS Category Matrix as shown in Table 1 of the CISC Code of Standard Practice, Appendix I.

.1 For AESS bolted connections, indicate bolt type, finish and which side of the connection bolt heads should be placed.
.2 For AESS welded connections, show grinding, profile and weld finish.

.3 Show details by which steel assemblies, which are set in concrete, are to be connected to the formwork.

.4 Substitution of alternative sections will only be allowed provided the new members have equal or greater capacity and stiffness and their dimensions are approved by the Consultant.

1.6 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

2 PRODUCTS

2.1 Design Requirements

.1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, and shears and to allow for

movements indicated. Include loads effects on the members and connections for loads due to fabrication, erection, and handling.

.2 Shear connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

.2 Select or design connections to support the reaction resulting from the maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 For composite construction select or design minimum end connection to support the reaction resulting from 150% of the maximum uniformly distributed load that can be safely supported by beam in bending as tabulated in the "Handbook of the Canadian Institute of Steel Construction".

.3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non-standard connections when requested.

.4 Provide seated beam connections with top clip angles.

.5 Provide all spandrel beams and all floor beams not fully braced by floor construction with top and bottom flange connections for torsional restraint.

.6 Assume that bolt threads are intercepted by shear plane, unless special measures are indicated on shop drawings to exclude threads from shear plane.

.7 Connection design to include consideration of all pass-through forces, including tension, compression, moment or shear. Provide local reinforcement at connection or joint as required.

.8 Where axial forces occur in beams framing to opposite sides of a supporting member, design connections for a pass-through force equal to the smaller axial force. If beam sizes differ, assume the axial force is centred in the smaller beam. Where beams frame into columns, connect each beam for the axial force shown.

.9 Follow conceptual connection details if shown on structural drawings. Do not change without the Consultant’s written approval.

.10 Pretension all high-strength bolts used in:

.1 All elements resisting crane loads.

.2 Connections where bolts are subject to tensile loads.

.3 Connections using oversized or slotted holes unless finger-tight bolts are required to accommodate movement.

.4 Connections required by CSA S16 to be pre-tensioned.

.11 Install web and flange stiffener plates at moment connections as required by connection design and detail, as well as when indicated on the drawings. If the shear generated in column web exceeds its shear capacity, reinforce the web.

.12 For beams continuous over support, provide at least one stiffener plate each side of web, unless different stiffeners are shown on drawings.

.13 Design gusset plates and bracing connections for members which are parts of seismic force resisting system to allow ductile rotation and to satisfy requirements of CSA S16. Design gusset plates for other compression members for the force equivalent to twice the specified compression member force, or provide stiffeners to prevent gusset plate buckling.

.14 Provide moment connections at splices to maintain continuity of cranked beams. Provide header plates or stiffener plates to resist unbalanced flange forces at splices.

.15 Provide all wall supporting members (shelf angles, hangers, stubs, back braces, etc.) which are attached to floor beams with adjustable connections capable to compensate for the deflection of the floor beams due to self weight of concrete. Anticipate beam deflection to be equivalent to the camber shown, or 20 mm (whichever is more). Alternatively, fabricate based on actual deflected shape of the beams as measured after concrete is poured.

.16 Detail and erect vertical diagonal plate and rod bracings to provide a prestress of approximately 15 MPa (2 ksi). Prestress to be effective when building ambient temperature has stabilized.

.17 Provide slotted holes long enough to allow for deflection indicated on drawings plus construction tolerance, assuming bolts are centred in slots. Bolts are to be finger-tight with burred threads to allow for movement during the life of structure without bolts loosening.

.18 Do not oversize anchor rod holes for site tolerances.

.19 Connect new steel members to existing concrete using drilled concrete anchors. Activate wedge type anchors by applying pre-determined torque recommended by the manufacturer. Do not field weld at connections with adhesive anchors.

2.2 Materials

.1 Structural steel: to CSA-G40.20/G40.21 except:

- .1 Rolled shapes in “protected zones”: to ASTM A992
- .2 Hollow structural sections: to ASTM A500 or CSA G40.21.
- .3 Structural pipe: to ASTM A53.

.2 Anchor rods: to CSA-G40.20/G40.21, Grade 300W.

.3 High strength anchor rods: to ASTM F1554. Refer to structural drawings for steel grade.

.4 Bolts, nuts and washers: to ASTM F3125, grade A325/ASTM A325M type 1.

.5 Welding materials: to CSA W48 Series, CSA W59 and certified by Canadian Welding Bureau.

.6 Shop paint: to CISC/CPMA 1-73a.

.7 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey. Primer is to be compatible with final paint or coating.

.8 Hot dip galvanizing: galvanize steel, where indicated, to ASTM 123/A123M, minimum zinc coating of 610 g/m^2.

.9 Zinc-rich coating: to SSPC Paint Specification No.20 Type I – Inorganic and Type II - Organic, compatible with top coat (where specified).

.10 Joint filler for exposed steelwork: Epoxy resin.

.11 Galvanizing vent hole plug: Grade 6061 Aluminum circular plug.

2.3 **Fabrication**

.1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.

.2 Continuously seal members by intermittent welds and plastic filler unless continuous welds are indicated on the drawings.

.3 Position beams having permissible mill camber so that the camber is up.

.4 Install stud anchors in shop with end welds in accordance with the recommendations of the stud manufacturer. Lengths of studs given on drawings are the lengths after welding. Replace studs that crack in the weld or shank.

.5 Increase specified section thickness at no extra cost if required for fabrication (bending) or galvanizing, Alternatively, fabricate curved sections from plates.

.6 Reinforce holes through webs of beams and columns in accordance with Typical Detail. Alternatively, design reinforcing in accordance with the procedure set forth in the CISC Handbook of Steel Construction, and provide calculations for the Consultant’s review.

.7 Provide 16mm (5/8”) diameter weep holes in base plates of HSS columns which are not made watertight.

.8 HSS members which require galvanizing to either be per CSA G40.21, grade 350W, Class H, or to be stress relieved prior to galvanizing.

.9 Provide vent holes in HSS sections where required for galvanizing process. Located so that any water inside HSS will drain away when HSS is in its final position. Maximum size – 16mm (5/8”) diameter. Fill holes with vent hole plugs after galvanizing.

.10 Provide 12 (1/2”) dia. holes in HSS columns to be filled with concrete. Locate at opposing column faces 150mm (6”) from each end.

.11 Connect together double beams and double channels in bending at not more than 1200mm (4 ft) centres unless the members are welded toe to toe.

.12 Connect together axially loaded built-up members (including double angles and other built-up sections noted on the drawings) in accordance with the requirements of CSA S16. Unless otherwise noted on the drawings, connect built up members with the longest side back-to-back with a member spacing of 10mm. In addition, interconnect compression members for trusses and bracing at least at the one-third points.

.13 Connect cover plates of built-up members to develop the capacity of the built-up member.

.14 Weld beams to bearing plates unless otherwise noted on drawings. Extend beams for full length of bearing plates. Set bearing plates 10mm (3/8”) back from edge of support.

.15 Anchor roof beams bearing on walls with a minimum of two 16mm (5/8") diameter x 380mm (1'-3") long anchor rods, unless otherwise noted on the Drawings.

.16 Provide cap plates at tops of columns where required for support of deck, slab, joists, beams or safety anchors.

.17 Provide connections between tie joists and columns, coordinate with joist supplier.

.18 Provide closure plates for all exposed and for all exterior tubular members.

.19 Provide diagonal or cantilevered angles at sides of columns where required to support deck or slab.

.20 Complete welded shop connections prior to galvanizing.

.21 Where shop inspection is required, do not ship material to the site before it has been inspected.

.22 Fabricate in stages complex members for which steel inspection is impossible or difficult once completed, and arrange for the Inspection and Testing Agency to do intermediate shop inspections.

.23 Fabricate AESS with tolerances and surface quality consistent with AESS category.

2.4 **Shop Painting**

.1 Clean, prepare surfaces, and shop paint or prime structural steel in accordance with CAN/CSA-S16.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to SSPC-SP-1, Solvent Cleaning, except:

.1 Members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast

Cleaning.

.2 Members receiving intumescent coating: Clean steel to SSPC-SP 6 Commercial Blast Cleaning

.3 Members to receive zinc-rich coating: Prepare surface according to SSPC-SP-10, near white blast cleaning.

.4 Galvanized members to receive a finish coat of paint: ASTM D6386

.3 Apply one coat of CISC/CPMA 1-73a shop paint to steel surfaces, except:

.1 Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required.

.2 Surfaces to be encased in concrete or in contact with concrete (such as tops of beams supporting slabs).

.3 Members to receive spray fireproofing.

.4 Surfaces to receive field installed stud shear connections.

.5 Surfaces and edges to be field welded.

.6 Faying surfaces of slip-critical connections.

.7 Members to be hot-dipped galvanized.

.8 Surfaces to receive zinc-rich coating.

.9 Surfaces to receive intumescent coating for which a compatible shop primer is required.

.4 Apply one coat of compatible primer paint (CISC/CPMA 2-75) in the shop to steelwork to receive a finish coat of paint on site. Primer to be compatible with final paint or coating.

.5 Apply one coat of compatible primer paint in the shop for steel to receive intumescent coating on site, see section 07 81 00 Applied Fireproofing. Primer to be compatible with final paint or coating.

.6 Apply one coat of contrasting colour shop paint to all protected zones indicated on structural drawings to clearly delineate their extent.

.7 Any other paint must be removed to bear steel prior to application of spray applied fireproofing.

.8 Apply galvanizing in the shop to all structural steel located beyond the vapour barrier, including:

.1 Shelf angles and hangers in exterior walls.

.2 Spandrel angles to which precast panels are attached.

.3 Lintels in exterior walls.

.4 Exposed exterior steel members.

.5 Other steel noted on drawings.

.9 If a galvanized surface has been damaged or field welded, clean surfaces down to bare metal and apply two coats of zinc-rich touch up paint.

.10 If galvanized steel is to be painted, use only non passivated galvanizing process (without chromate coating).Prepare galvanized surface in preparation for a coat of paint

according to ASTM D6386. Use only paint that is compatible with the galvanizing and preparation process.

.11 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.12 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.13 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

3 EXECUTION

3.1 Application

.1 Fabricator's Instructions: comply with fabricator's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 General

.1 Structural steel work: in accordance with CAN/CSA-S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 Connection to Existing Work

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to the Consultant for directi on before commencing fabrication.

3.4 Marking

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in an unpainted condition, place the markings at locations not visible from the exterior after erection.

.2 Match marking: shop mark for fit and match.

3.5 Erection

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.

.2 The structural drawings show the final intent of the steel structure. The Contractor is responsible to maintain adequate temporary bracing as necessary to keep the structure stable and in good alignment during construction. Do not overload the structure during construction.

.1 Temporary erection bracing is to be designed by a qualified professional engineer licensed in Province of Ontario, Canada retained by the Contractor.

.3 Field cutting or altering structural members: Obtain approval of the Consultant prior to any modification.

.4 Environmental considerations:

.1 Preheat material adjacent to welding areas when ambient temperature is between +4 degrees C and -17 degrees C.
.2 Do not weld in ambient temperatures below -17 degrees C.

.5 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.6 Continuously seal members by continuous welds where indicated. Grind smooth.

.7 Set column base plates on leveling screws or on steel shims to the required elevation ready for grouting. Alternatively, use leveling plates set with grout and level to within 1.5 mm (1/16") across the plate. Do not erect columns upon plates exceeding this tolerance. Lift base plates for inspection when directed.

.8 Grout under column base plates and beam bearing plates as soon as steelwork is completed. Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.

.9 Do not make permanent connections until structure has been properly aligned.

.10 Adjust and finalize connections at wall supporting elements affected by floor beam deflections after concrete is poured.

.11 Report ill-fitting connections to the Consultant before taking corrective measures.

.12 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.

.13 Do not weld in an ambient temperature below -17ºC. Preheat material adjacent to welding areas when ambient temperature is between -17ºC and +4ºC.

.14 Remove slag from all completed welds so that they may be visually inspected.

.15 Seal members by continuous welds where indicated.

3.6 **Field Quality Control**

.1 Inspection and testing of materials and workmanship, including visual third-party welding inspection, will be carried out by the testing agency as designated requirements in section Section 01 45 00 – Quality Control.

.1 Ensure testing agency is certified to CSA W178.1.
.2 Ensure individuals performing visual inspection of welds are certified to Level 2 or 3 of CSA W178.2.

.3 Do not commence fabrication until details of the inspection program have been coordinated with the Agency.

.4 Provide safe access and working areas for testing on site, as required by testing agency.

.2 Arrange for the testing agency to be present during welding of 10% of moment connections and butt welds in direct tension (minimum 2 of each type).

.3 Ensure test results are promptly distributed to all associated parties including the Owner, Project Manager\Contractor and Consultant.

.4 Inspection or testing by the Consultant will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

.1 Work will be inspected in the shop and when erected. Store fabricated members in the shop so that they are accessible for inspection. Items to be cast into concrete will be inspected on site before being installed.

.2 Inspection will include:

.1 Checking that the mill test certificates or producer’s certificates are properly correlated to materials and products supplied for the project or that legible markings were made on the material and products by the producers in accordance with the applicable standards. Where this is not possible, notify the Consultant and if requested carry out sample tests as described below.

.2 Confirming that all materials meet specifications.

.3 Sampling fabrication and erection procedures for general conformity with the requirements of the Contract.

.4 Checking welders' CWB Certification.

.5 Checking fabricated members against specified member shapes.

.6 Checking fabricated members against allowable mill sweep and camber.

.7 Checking fabricated members against specified camber.

.8 Visual inspection of all welded connections including spot checking of joint preparation and fit up.

.9 Sample checking bolted joints.

.10 Sample checking stud anchors.

.11 Sample checking drilled concrete and masonry anchors.

.12 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.

.13 Inspection of field cutting.

.14 Inspection of sliding bearings.

.15 Inspection of surface preparation, shop paint and field touch-up.

.16 Inspection of galvanizing and field touch-up.

.17 Inspection of grouting under base plates and bearing plates.

.3 Arrange for the Inspector to be present during welding of 10% of moment connections and 10% of butt welds in direct tension.

.4 Sample testing: When required, test coupons will be taken and tested in

accordance with CSA G40.20 to establish identification. Cut samples from member locations selected by Structural Engineer and provide to the Inspection and Testing Agency. Make good the locations if requested, at no extra cost, by adding new plates and welds acceptable to the Structural Engineer. The Agency will have the samples tested for mechanical properties and for chemical composition and will classify the steel as to specification.

.5 Arrange for the Inspector to start field inspection as soon as each section of the work is completed, plumbed, bolts tightened and field welding finished.

.6 The Inspector will check the specified camber of all beams. Do not place steel deck until this has been done and approved in writing by the inspector.

.7 The Inspector will visually check all bolts in bearing connections. Where erection drawings indicate bolts with threads excluded from the shear plane, he will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.

.8 The Inspector will provide full time inspection during installation of post installed adhesive anchors subject to sustained tension loads.

.9 The Inspector will randomly select and pull test 5% of all types and sizes of post installed anchors installed on a weekly basis, but not less than one anchor of each type, size and orientation. Pull test to twice the allowable tensile load, or 1.5 times the factored resistance of the anchor given by the manufacturer. Chose anchor locations where proximity to concrete edge does not affect anchor capacity, or use reduced anchor loads per manufacturer's recommendation. Submit reports to Consultant within one week of testing. Reports to indicate each anchor location, test load and mode of failure, if applicable. Notify Consultant immediately if any anchor fails the pull test.

.10 The Inspector will visually check all the adjustable connections at wall supporting members to ensure the connections have been finalized after the concrete is poured.

3.7 **Field Painting**

.1 Paint in accordance with Section 09 91 23 - Interior Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to match original coating.

.2 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with the SSPC Technology Guide No. 14.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 30 00 – Cast-In-Place Concrete.

.2 Section 05 12 23 – Structural Steel for Buildings.

.3 Section 05 31 00 – Steel Decking.

.4 Section 05 50 00 – Metal Fabrications.

.5 Section 09 91 00 – Painting.

.6 Section 09 91 23 - Interior Painting

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 Canadian Standards Association (CSA International):

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S16, Design of Steel Structures.
.3 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.
.4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
.5 CSA W55.3, Certificate of Companies for Resistance Welding of Steel and Aluminum.
.6 CSA W59, Welded Steel Construction (Metal Arc Welding).

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-85.10, Protective Coatings for Metals.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):

.1 CISC Handbook of Steel Construction.
.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.5 The Master Painters Institute (MPI):

.1 Architectural Painting Specification Manual.

1.3 **Quality Assurance**

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Steel joist fabricator shall have at least five year experience with structural steel for buildings.
.2 Steel joist fabricator shall be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components.
.3 Welders shall be CWB approved, working under supervision of a CWB approved firm.
.4 Engage a qualified professional engineer licensed to practice and insured in the Province of Ontario to be responsible for design, detailing and installation of all steel joists.
.5 The professional engineer designing steel joists to hold a Certificate of Authorization, and to carry the minimum insurance required by the PEO.

.3 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for steel joists certifying that the work has been completed in accordance with all contract documents.

1.4 **Quality Control**

.1 Submit in accordance with Section 01 45 00 – Quality Control.

.2 Source Quality Control Submittals:

.1 Submit mill test reports 4 weeks prior to fabrication of structural steel.
.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
.2 The reports to be correlated to the materials or products to which they pertain.

.3 Tolerances

.1 Conform to the fabrication and erection tolerances of CAN/CSA S16.
.2 If more stringent tolerances are specified elsewhere in the Contract Documents to suit interfacing materials or AESS members, the latter shall govern.

1.5 **Action and Informational Submittals**

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed Product literature and data sheets for steel joist framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide drawings stamped and signed by the professional engineer responsible for the steel joist design.
.2 Submit four hard copies or unlocked PDF documents to the Consultant for review at least four weeks prior to fabrication and/or delivery.
.3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
.4 Indicate particulars, on shop drawings, relative to joist geometry, spacing, camber, framed openings, splicing details, bearing and anchorage. Include member size, material properties, specified and factored member loads, and stresses under various loadings, deflection and camber, surface preparation and shop painting.

.4 Delegated Design Submittals:

.1 Submit four hard copies or unlocked PDF documents of calculations for strength and deflection; and joist design drawings to the Consultant for review at least four weeks prior to fabrication and/or delivery. Calculations are to show design loads, member forces, and member utilizations.

1.6 **Delivery, Storage and Handling**

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged materials with new materials at no additional cost to the Owner.

2 PRODUCTS

2.1 **Design Criteria**

.1 Design steel joists and bridging to carry loads indicated on the structural drawings to CSA S16 and CSA S136.

.2 Arrange members to form a statically determinate truss. Chose web and chord members to have an axis of symmetry in the plane of the web.

.3 Design joists and anchorages for uplift forces as indicated in the Contract Documents.

.4 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

.5 Limit joist deflection due to specified live load to 1/360 maximum of span and deflection due to specified total load to 1/240 maximum of span unless more stringent requirements are noted on the Drawings.

.6 Limit joist deflection of joists with spans greater than 12m (40 ft.) adjacent to more rigid surfaces (such as adjacent columns and load-bearing walls) to an equivalent deck deflection of L/120 cumulatively between adjacent joists. Increase stiffness of joists incrementally.

.7 Camber floor joists for the anticipated dead load, less the weight of partitions unless otherwise noted on the structural drawings.

.8 Apply unbalanced live loads and concentrated loads in accordance with CSA S16.

.9 Design joist shoes for rollover forces where shown on structural drawings.

.10 Where joists support 76 mm deep composite steel deck, total width of top chord elements that actually support the deck shall be 140 mm minimum.

.11 Minimum thickness of material: flats and hot rolled sections 2.5mm (0.10"); rods 10mm (0.39") diameter; cold formed sections 2mm (0.079"); members supporting steel deck 3.15mm (0.125").

.12 Arrange joist web configuration and bridging to accommodate mechanical, electrical and architectural equipment/finishes.

.13 Line up web members along joist runs sufficiently to permit mechanical services.
Hot dip galvanizing: galvanize steel, where indicated, to ASTM 123/A123M, minimum zinc coating of 610 g/m^2.

2.2 **Materials**

.1 Open web steel joists: in accordance with CSA S16 and CSA S136.

.2 Structural steel: in accordance with CSA G40.20/G40.21.

.3 Welding materials: in accordance with CSA W59 and certified by Canadian Welding Bureau.

.4 Shop paint: in accordance with CISC/CPMA 1-73a.

.5 Shop paint primer: in accordance with CISC/CPMA2-75 solvent reducible alkyd, red oxide.

.6 Anchor rods: CSA G40.21, Grade 300W.

.7 Headed shear studs: in accordance with CSA W59, Appendix H. Min. Fy=340MPa.

.8 Joint filler for exposed steelwork: Epoxy resin.

2.3 **Fabrication**

.1 Fabricate steel joists and accessories as indicated in accordance with CSA S16, CSA S136 and in accordance with reviewed shop drawings.

.2 Welding: in accordance with CSA W59.

.3 Make all joist shoes with solid webs.

.4 Weld in accordance with CSA W59.

.5 Provide diagonal bridging, horizontal bridging, and anchorages as indicated on the shop Drawings.

.6 Install shear studs in accordance with CSA W59.

.7 Provide top and bottom chord extensions where required.

.8 Stagger chord member splices.

.9 Extend joist shoes for full length of bearing plates.

.10 Weld joists to bearing plates unless otherwise noted on drawings. Set bearing plates 10mm (.375”) back from edge of support.

.11 Do not ship joists to the Site before being inspected.

2.4 **Shop Painting**

.1 Clean, prepare and shop paint or prime surfaces of steel joists in accordance with CAN/CSA-S16.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to SSPC-SP-1, Solvent Cleaning, except:

.1 Members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.

.3 Apply one coat of shop paint CISC/CPMA 1-73a to joists in the shop with the exception of:

.1 Members to receive spray fireproofing.

.2 Members to receive a finish coat of paint on Site for which a CISC/CPMA 2-75 shop primer is required.

.3 Members to receive zinc-rich coating.
.4 Galvanized members.
.5 Top chords of composite joists with field welded shear connectors.
.6 Surfaces encased in or in contact with cast-in-place concrete including top chords of joists supporting slabs.
.7 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.

.4 Apply one coat of primer paint (CISC/CPMA 2-75) in the shop to joists to receive a finish coat of paint on Site. Primer shall be compatible with final paint or coating.

.5 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.6 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.7 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

.8 Apply galvanizing in the shop to all structural steel joists noted on the drawings.

.9 If a galvanized surface has been damaged or field welded, clean surfaces down to bare metal and apply two coats of zinc-rich touch up paint.

.10 If galvanized steel is to be painted, use only non passivated galvanizing process (without chromate coating).

3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify conditions of substrates previously installed under other Specification Sections are acceptable for steel joist framing installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate prior to delivery and/or installation.
.2 Inform the Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

.1 Do structural steel work: in accordance with CSA S16.

.2 Do welding: in accordance with CSA W59.

.3 Ensure installers are certified in accordance with CSA W47.1 for fusion welding or CSA W55.3 for resistance welding as appropriate.
.4 Submit certification that welded joints are qualified by Canadian Welding Bureau.

3.3 **Connection to Existing Work**

.1 Verify dimensions and condition of existing work; report discrepancies and potential problem areas to the Consultant for direction before commencing fabrication.

3.4 **Field Quality Control**

.1 Inspection and testing of materials and workmanship will be carried out by testing agency designated by the Consultant.

.1 Ensure testing agency is certified in accordance with CSA W178.1.
.2 Ensure individuals performing visual inspection of welds are certified to Level 2 or 3 of CSA W178.2.

.2 Ensure testing agency inspects representative joists for integrity, accuracy of fabrication and soundness of welds.

.3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.

.4 Test shear studs in accordance with CSA W59.

.5 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.

3.5 **Erection**

.1 Erect steel joists and bridging in accordance with CSA S16 and in accordance with reviewed erection drawings.

.2 Complete installation of bridging and anchorages before placing construction loads on joists.

.3 Field cutting or altering joists or bridging that are not shown on shop drawings: to approval of the Consultant.

.4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

.5 Do not make permanent connections until structure has been properly aligned.

.6 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4°C.

.7 Protect installed Products from damage during construction.

.8 Tolerances:
.1 Conform to the fabrication and erection tolerances of CSA S16.

.2 If more stringent tolerances are specified elsewhere to suit interfacing materials or AESS members, the latter shall govern.

3.6 **Inspection and testing:**

.1 Do not commence fabrication until details of inspection have been worked out with the inspection and testing agency.

.2 The inspection and testing agency will submit reports to the Owner, Contractor, and Consultant covering the Work inspected and provide details of errors or deficiencies observed.

.3 Work will be inspected in the shop and when erected. Store fabricated members in the shop so that they are accessible for inspection.

.4 Inspection will include:

.1 Checking that the mill test certificates or producer's certificates are properly correlated to materials and products supplied for the project or that legible markings were made on the material and products by the producers in accordance with the applicable standards.

.2 Confirming that all materials meet specifications.

.3 Sampling fabrication and erection procedures for general conformity with the requirements of the Contract.

.4 Checking welders' CWB Certification.

.5 Checking fabricated joists against specified member shapes.

.6 Checking fabricated joists against allowable sweep and camber.

.7 Checking fabricated joists against specified camber.

.8 Visual inspection of all welded connections including spot checking of joint preparation and fit up.

.9 Sample checking stud anchors.

.10 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.

.11 Inspection of surface preparation, shop paint and field touch-up.

.12 Inspection of galvanizing and field touch-up.

.13 Inspection of grouting under bearing plates.

3.7 **Field Painting**

.1 Paint: in accordance with Section 09 91 23 - Interior Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.8 **Protection**

.1 Protect installed Products and components from damage during construction.

.2 Repair damage to adjacent materials caused by steel joist framing installation.

END OF SECTION

1 GENERAL

1.1 Related Requirements

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 30 00 – Cast-In-Place Concrete.

.3 Section 05 12 23 – Structural Steel for Buildings.

.4 Section 05 21 00 – Steel Joist Framing.

.5 Section 05 50 00 – Metal Fabrications.

.6 Section 07 81 00 – Applied Fireproofing.

.7 Section 09 91 00 – Painting.

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.

.2 Canadian Standards Association (CSA International):

.1 CSA C22.2 No.79, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.

.2 CSA S16, Design of Steel Structures.

.3 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.

.4 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.

.6 CSA W59, Welded Steel Construction, (Metal Arc Welding).

.3 Current versions of Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI 10M, Standard for Steel Roof Deck.

.2 CSSBI 12M, Standard for Composite Steel Deck.

.4 American Society for Testing and Materials (ASTM International):

.1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.5 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

1.3 **Quality Assurance**

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

.2 Welders to be CWB approved for deck welding by Canadian Welding Bureau.

.3 Engage a Professional Engineer licensed and insured in the Province of Ontario to be responsible for design and installation of all decking.

.4 The Professional Engineer designing steel decking to hold a Certificate of Authorization, and to carry minimum liability insurance required by the PEO.

1.4 **Action and Informational Submittals**

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for steel decking and include product characteristics, performance criteria, physical size, finish and limitations.

.2 When requested, provide data to substantiate deck load capacity, including diaphragm shear capacity.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by a qualified professional engineer licensed to practice in the Province of Ontario.

.2 Submit design calculations if requested by the Consultant.

.3 Submit four hard copies or unlocked PDF documents to the Consultant for review at least four weeks prior to fabrication and/or delivery.

.4 Indicate deck layout, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and between sheets, projections, openings, reinforcement details and accessories..

.5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete filled decks.

1.5 **Delivery, Storage and Handling**

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect decking from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 **PRODUCTS**

2.1 **Design Criteria**

.1 Design steel deck to CSA S136, CSSBI 10M and CSSBI 12M.

.2 Design steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated in the Contract Documents.

.3 Deflection under specified live load not to exceed 1/240 of span, except that when deflection-sensitive finishes are supported directly from deck, live load deflection not to exceed 1/360 of span. The incremental portion of long term deflection for floor deck not to exceed 1/480 (under live load, superimposed dead load, shrinkage and creep).

.5 Design deck for indicated diaphragm action, including anchorage and side laps, in accordance with CSSBI “Design of Steel Deck Diaphragms” and Hilti Product Technical Guide (for Powder Actuated Fasteners). Increase deck thickness if required by diaphragm design.

.6 Deck profiles and welding to satisfy requirements of any Fire Rated Assembly Design specified in other relevant Specification Sections for the project.

.7 Use only 19mm puddle welds in areas where deck supports are within structural steel protected zones.

.8 Make sections continuous over 3 spans or increase thickness of material to give the equivalent stiffness and strength of a 3-span deck.

.9 If increased wind uplift loads applicable at roof edges and corners are not specifically noted on the structural Drawings, increase the minimum design wind uplift shown (which is applicable in the zones away from roof edges) in accordance with the Users's Guide to NBC – Structural Commentaries (Part 4 of Division B).

2.2 **Materials**

.1 Steel Deck: Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather.

.3 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.4 Aluminum-zinc alloy (AZ) coated steel sheet: to ASTM A792/A 792M structural quality grade 230, with AZ 150 coating, surface, chemically treated for paint finish, for exterior surfaces exposed to weather or interior spaces with high humidity as noted on the structural drawings.

.5 Fasteners for galvanized deck and prefinished deck: coated or stainless steel, hex head, self-tapping screws with EPDM bonded washers.

.6 Fasteners for deck to wood supports: galvanized screws with flat seal washers.

.7 Powder-actuated fasteners: Hilti Decking Fastening System.

.8 Acoustic insulation: fibrous glass 17.5 kg/m^3 (1.1 lb/ft^3) density minimum profiled to suit deck flutes.

.9 Closures: as indicated on the Drawings and in accordance with manufacturer's recommendations. Minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.10 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm (22 gauge) minimum. Metallic coating same as deck material.

.11 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

.1 VOC limit 250 g/L maximum

.12 Caulking: to Section 07 92 00 - Joint Sealants.

.1 Sealants: VOC limit 250 g/L maximum.

.13 Headed shear studs: to CSA W59, Appendix H, min. Fy=340MPa.

2.3 **Types of Decking**

.1 Steel roof deck:

.1 38 mm (1 1/2”) maximum deep profile, 152 mm (6”) flute spacing, non-cellular, interlocking side laps.

.2 76 mm (3”) maximum deep profile, 152 mm (6”) or 203 mm (8”) flute spacing, non-cellular, interlocking side laps.

2.4 **Fabrication**

.1 Conform to CSA S136 and CSA W59.

.2 Fabricate sections from steel sheets by rolling. Form integral ribs which will bear on supports and form interlocking male and female side laps.

3 **EXECUTION**

3.1 **Examination**

.1 Verification of Conditions: verify conditions of the work previously installed under other Specification Sections are acceptable for steel decking installation in accordance with manufacturer's written instructions.

.1 Visually inspect the previously installed work.

.2 Inform the Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 **Installation**

.1 Structural steel work: in accordance with CSA S136, CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59.

3.3 **Erection**

.1 Erect steel deck as indicated and in accordance with CSA S136, CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.

.2 Butt ends: 1.5mm to 3mm (1/16” to 1/8”) gap. Install steel cover plates over gaps wider than 3 mm (1/8”).

.3 Lap ends: 50 mm (2”) minimum.

.4 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.

.5 Do not overload structure during erection. Place deck bundles near columns.

.6 Align deck end to end for accurate fit with corresponding sections. Sections shall be parallel, even and straight.

.7 Locate deck rib directly over perimeter steel beams spanning parallel to deck and at same elevation as underside of deck.

.8 For exposed deck end laps, do not extend lower deck sheet past the face of the supports.

.9 Exercise particular care in erection of exposed deck. Sections which are dented, damaged or perforated by welding will be rejected.

.10 Connections

.1 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.11 Prior to concrete placement, steel deck to be free of soil, debris, standing water, and loose mil scale and other foreign matter.

.12 Temporary shoring, if required, shall be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.

.13 Place and support reinforcing steel as indicated on the structural Drawings. 3.4

Closures

.1 Install closures in accordance with approved details.

.1 Reinforce edge of free spanning deck with channel shaped closure fitted to edge and fastened to deck.

.2 Provide flashing at columns and points of discontinuity to prevent leakage of mortar when concrete is placed over deck.

.3 Provide edge forming for concrete slabs over deck. Fasten to deck.

3.5 Openings and Areas of Concentrated Loads

.1 The structural Drawings do not show all openings required. Refer also to architectural, mechanical and electrical drawings. Cut all opening required by the work under other Specification Sections.

.2 No reinforcement required for openings cut in deck which are smaller than 150 mm (6”) square.

.3 Frame deck openings with any one dimension between 150 to 300 mm (6” to 12”) as shown on the structural Drawings or as recommended by manufacturer.

.4 For deck openings with any one dimension greater than 300 mm (12”) and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated on the structural Drawings.

.5 Temporary shoring, if required, not to be removed until concrete attains 75% of its specified 28 day compression strength.

3.6 **Connections**

.1 Install connections in accordance with CSSBI recommendations as indicated.

.2 Use connections specified on reviewed shop drawings, to suite uplift, diaphragm shear, requirements of any Fire Rated Assembly Design specified for the Project.

.3 Connect deck to supporting beams using arc spot welds, mechanical fasters or power actuated fasteners. Connect male and female side laps using seam or arc puddle welds, mechanical fasteners or by interlocking with a button punch

.4 Use coated or stainless steel fasteners for all prefinished and galvanized deck, as well as for decks at steep slopes. Side laps for prefinished or galvanized deck to be mechanically interlocked.

.5 Predrill holes for screws connecting deck to timber beams. Screws shall tap metal and extend into wood, clamping deck to wood.

3.7 **Field Quality Control**

.1 Refer to Section 01 45 00 Quality Control.

.1 Inspection and testing of materials and workmanship will be carried out by testing agency designated by the Consultant.

.1 Ensure testing agency is certified in accordance with CSA W178.1.
.2 Ensure individuals performing visual inspection of welds are certified to Level 2 or 3 of CSA W178.2.

.2 Ensure testing agency inspects representative joists for integrity, accuracy of fabrication and soundness of welds.

.3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.

.4 Inspection or testing by the Consultant will not augment or replace the Contractor’s quality control nor relieve the Contractor of its contractual responsibility.

.2 Inspection and testing:

.1 The inspection agency will submit reports to the Owner, Contractor, and Consultant covering the Work inspected and provide details of errors or deficiencies observed.

.2 The work will be inspected when erected.

.3 Inspection will include:

.1 Checking that mill test reports are properly correlated to materials.
.2 Confirming that all materials meet specifications.
.3 Checking welders' CWB certification.
.4 Checking deck types and gauge thicknesses.
.5 Checking all welding, fastening and button punching.
.6 Checking of all reinforcement required at holes cut in deck.
.7 Checking installation of sheet metal strips and edge reinforcing.

3.8 **Protection**

.1 Protect installed Products and components from damage during construction.

.2 Repair damage to adjacent materials caused by steel decking installation.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Section 04 22 00 - Concrete Unit Masonry.

.4 Section 06 10 00 - Rough Carpentry.

.5 Section 06 16 43 - Gypsum Sheathing.

.6 Section 07 21 00 - Thermal Insulation.

.7 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.8 Section 07 26 00 - Vapour Retarders.

.9 Section 07 92 21 - Sprayed Foam Sealant.

.10 Section 08 12 13 - Hollow Metal Frames.

.11 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.12 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.13 Section 08 51 13 - Aluminum Windows.

.14 Section 09 21 16 - Gypsum Board Assemblies.

1.2 DEFINITIONS

.1 Camber: The deviation from straightness of a member or any portion of a member with respect to its major axis.

.2 Sweep: The deviation from straightness of a member or any portion of a member with respect to its minor axis.

1.3 REFERENCES

.1 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.2 ASTM A563/A563M-24: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.3 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A792/A792M-23: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.5 ASTM C955-24: Standard Specifications for Cold-Formed Steel Structural Framing Members.

.6 ASTM C1007-20: Standard Specification for Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories.

.7 ASTM C1513-24: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

.8 ASTM F436/F436M-24: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

.9 CAN/CGSB-7.1-98: Lightweight Steel Wall Framing Components.

.10 CSA S16:19: Design of Steel Structures.

.11 CSA S136-16 (R2021): North American Specification for the Design of Cold-Formed Steel Structural Members.

.12 CSA S304:24: Design of Masonry Structures.

.13 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.

.14 CSA W55.3-08 (R2023): Certification of Companies for Resistance Welding of Steel and Aluminum.

.15 CSA W59:24: Welded Steel Construction.

.16 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating mechanical fasteners, sizes, load capacities, and type of corrosion protection.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, showing both design and installation requirements, and illustrating:
- .1 Materials, sizes, locations, thicknesses exclusive of coating, and coatings.
- .2 Connection details for attaching framing to itself and for attachment to structure. Show splice details where permitted.
- .3 Dimensions, openings, requirements of related work, and critical installation procedures. Show temporary bracing required for erection purposes.
- .4 Design loads.
- .5 Engineering calculations or data verifying capacity of members, including masonry connectors if specified, and the ability of assemblies to meet design criteria.

.3 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.6 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Upon request, submit representative pieces of framing component parts, including mechanical fasteners if used.

1.7 TEST AND EVALUATION REPORTS

.1 Submit mill test reports as specified in Section 01 40 00.

.2 Mill Test Reports: Five certified copies, reporting chemical properties, mechanical properties, and coating designation of steel.

1.8 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit test and inspection reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Manufacturer's field review and inspection reports.

.3 Independent Test Reports: Summary of inspection and test findings conducted by independent testing agency.

1.9 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced with designing, fabricating, and erecting cold-formed metal framing systems, licenced to practice at Place of the Work.

.2 Installers: A firm specializing in erecting cold-formed metal framing systems, having minimum 10 years documented experience, and a member of CSSBI.

.3 Welders: Companies certified by CWB to CSA W47.1 and CSA W55.3, having welders qualified for base material types and thicknesses being welded.

1.10 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products protected from conditions that may cause physical damage or corrosion.

.3 Handle and lift prefabricated panels carefully to avoid permanent distortion to any member or collateral material.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Products considered acceptable for use:
- .1 Bailey Metal Products.
- .2 Dietrich Metal Framing.
- .3 MiTek Canada Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Lateral Loadbearing Vertical Framing: Comprised of the following elements:
- .1 Wall studs subjected to lateral loads (no axial loads other than self-weight and the weight of applied finishes).
- .2 Steel bridging.
- .3 Top and bottom track.
- .4 Lintel, sill and jamb members for wall openings.
- .5 Stud, bridging and track connections.
- .6 Top and bottom connections to the main structure including anchor clip angles, through-bolts and epoxy bolts, and detailing to accommodate floor or roof deflections.

.2 Loadbearing Horizontal Framing: Comprised of the following elements:
- .1 Joists.
- .2 Headers and trimmers for openings.
- .3 Bridging.
- .4 Closure channels.
- .5 Connections including web stiffeners.

2.3 DESIGN AND PERFORMANCE CRITERIA

.1 Base design on Limit States Design principles using factored loads and resistances.

.2 Loads and load factors shall be in accordance with applicable regulatory requirements.

.3 For wind load calculations, the reference velocity pressure, q, shall be based on a 1 in 50 probability of being exceeded in any one year for strength design and for deflection.

.4 Determine resistances and resistance factors in accordance with applicable regulatory requirements and CSA S136.

.5 Conform to requirements of fire rated assemblies which have been tested to CAN/ULC-S101. Provide fire resistance ratings as indicated on Drawings.

.6 Stud and joist depths are shown on Drawings. Adjust stud and joist material thicknesses and spacings as required by design criteria. Use greater or lesser depths only if approved by Consultant.

.7 Space framing members as noted on Drawings. Use lesser spacings if required by design criteria.

.8 For studs, track and joists, conform to minimum design thicknesses listed below. Use greater design thicknesses if required by design criteria.
- .1 64 mm Width: 0.84 mm thick.
- .2 92 mm Width: 0.84 mm thick.
- .3 102 mm Width: 0.84 mm thick.
- .4 140 mm Width: 0.84 mm thick.
- .5 152 mm Width: 0.84 mm thick.
- .6 184 mm Width: 0.91 mm thick.
- .7 203 mm Width: 1.12 mm thick.
- .8 235 mm Width: 1.22 mm thick.
- .9 254 mm Width: 1.52 mm thick.
- .10 286 mm Width: 1.52 mm thick.
- .11 305 mm Width: 1.52 mm thick.
- .12 356 mm Width: 1.91 mm thick.

.9 For wall studs supporting masonry veneer, minimum design thickness exclusive of coating shall be the greater of the design thicknesses listed above or 1.12 mm.

.10 Minimum design thickness for bridging channel shall be 1.22 mm for studs and 1.52 mm for joists. Use greater bridging channel design thickness if required by design criteria.

.11 Minimum design thickness for clip angles shall be 1.52 mm for studs and 1.91 mm for joists. Use greater clip angle thickness if required by design criteria.

.12 Maximum flexural deflections under specified live or wind loads shall conform to:
- .1 Design loadbearing vertical framing supporting masonry veneer to CSA S304 with lateral stud deflections limited to L/720.
- .2 Design loadbearing vertical framing supporting other finishes to limit lateral deflections to L/360.
- .3 Design loadbearing horizontal framing to limit deflection to L/360.
- .4 Building sway due to all effects, 1/400 of building height or 1/500 of storey height.

.13 For lateral loadbearing vertical framing:
.1 Design connections to accommodate vertical deflection movement of the structure, frame shortening and vertical tolerances without imposing axial loads onto the framing. Leave a minimum gap of 12 mm. Larger gaps may be required to accommodate structural movement. Co-ordinate with the Consultant.
.2 Limit free play and movement in connections perpendicular to the plane of the framing to plus or minus 0.5 mm relative to building structure.

.14 Design cold-formed metal framing components and assemblies to accommodate specified erection tolerances of the structure.

.15 Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis.

.16 Design and Provide bridging as follows:
.1 Lateral Loadbearing Vertical Framing: 1 500 mm OC maximum.
.2 Loadbearing Horizontal Framing: 2 100 mm OC maximum.
.3 Space bridging at equal intervals over the span length of the member. Closer spacings may be required to satisfy structural requirements.

.17 Design anchorage and splice details for bridging.

.18 Design for local loading due to anchorage of cladding and interior wall mounted fixtures where shown.

.19 Connect cold-formed metal framing members by bolting, welding or screwing.

.20 Provide lintel, sill and jamb members and connections in stud walls to frame openings larger than 100 mm in any dimension.

.21 Provide headers and trimmers and connections in joist assemblies to frame openings larger than 100 mm in any dimension.

2.4 MATERIALS

.1 Steel: To CSA S136; identified on Shop Drawings as to specification, grade, mechanical properties and coating type and thickness.

.2 Machine Bolts: To ASTM A307, Grade A; hot dipped galvanized.

.3 Nuts: To ASTM A563/A563M, Grade A, Hex Style; hot dipped galvanized, carbon and alloy steel.

.4 Washers: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; hardened steel, hot dipped galvanized; circular, beveled and clipped types as required.

.5 Screws: To ASTM C1513; galvanized steel, self-tapping.

.6 Welding Materials: To CSA W59.

.7 Welding Electrodes: 480 MPa minimum tensile strength series; e.g. E480XX or ER480S-X.

.8 Touch-up Paint: Zinc-rich, ready-mixed paint.

2.5 MANUFACTURED UNITS

.1 Loadbearing Steel Studs, Joists, Tracks, and Bracing: To ASTM C955; finishes, sizes, and thicknesses as identified on accepted Shop Drawings.

2.6 FABRICATION

.1 Except as noted herein, fabricate wall framing components to CAN/CGSB-7.1, and in accordance with accepted Shop Drawings.

.2 Where specified, provide cut-outs centred in the webs of members to accommodate services and though-the-knockout style bridging. Unreinforced cut-outs shall be limited to the following dimensions. Limit the distance from the centreline of the last unreinforced cut-out to the end of the member to be not less than 300 mm. The effect of cut-outs on the strength and stiffness of the member shall be considered.
- .1 92 mm and 102 mm Deep Members
  - .1 Perpendicular to the Length of the Member: 40 mm.
  - .2 Parallel to the Length of the Member: 105 mm.
  - .3 Centre to Centre Spacing: 600 mm.
- .2 152 mm Deep Members
  - .1 Perpendicular to the Length of the Member: 65 mm.
  - .2 Parallel to the Length of the Member: 115 mm.
  - .3 Centre to Centre Spacing: 600 mm.

.3 Length tolerances for members:
- .1 Tracks: None.
- .2 Lateral Loadbearing Vertical Framing: Plus or minus 3 mm.
- .3 Loadbearing Horizontal Framing: Plus or minus 3 mm.

.4 Cross sectional geometry tolerances for members shall conform to the following:
- .1 Member Depth: Minus 1 mm, plus 2 mm.
- .2 Flange depth: Minus 1 mm, plus 2 mm; minimum 31 mm width.
- .3 Lip Length: Plus 4 mm.
- .4 Thickness: To CSA S136.
- .5 Corner Angles: Plus or minus 3 degrees.

.5 Mark steel thickness, exclusive of coating, on each member by embossing, stamping with indelible ink, or by colour coding.

2.7 FINISHES

.1 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped, zinc alloy coating.

.2 Galvalumed Coating on Sheet Steel: To ASTM A792/A792M, Coating Designation AZM150; hot dipped, aluminum-zinc alloy coating.

.3 Concrete Anchors: Minimum zinc coating thickness of .008 mm. Other coatings providing equal or better corrosion protection may be used.

.4 Powder-actuated and Low Velocity Fasteners: Minimum zinc coating thickness of 0.008 mm. Other coatings providing equal or better corrosion protection may be used.

3 Execution

3.1 FASTENERS AND WELDS

.1 Ensure connected parts are in contact. Provide clamping before welding or installing screws as required.

.2 Welds: To CSA S136, CSA W59 and ANSI/AWS D1.3, as applicable.

.3 For material less than 3 mm thick, Shop Drawings may show nominal weld leg sizes. For such material, the effective throats of welds shall not be less than the thickness of the thinnest connected part.

.4 Sheet metal screws shall be of the minimum diameter indicated on the Shop Drawings, but not less than #8.

.5 Penetration of Sheet Metal Screws Beyond Joined Materials: Not less than 3 exposed threads.

.6 Sheet metal screw thread types, drilling capability, and installation shall conform to manufacturer's recommendations.

.7 Provide sheet metal screws with low profile heads where covered by sheathing materials.

.8 Install concrete anchors in accordance with manufacturer's recommendations.

3.2 ERECTION

.1 Erect cold-formed metal framing to ASTM C1007.

.2 Methods of construction may be either piece by piece (stick-built) or by fabrication into panels (panelized) either on- or off-site.

.3 Erect cold-formed metal framing true and plumb within specified tolerances.

.4 Employ temporary bracing wherever necessary to withstand loads to which structure may be subject during erection and subsequent construction. Leave temporary bracing in place as long as required for safety and integrity of structure. During construction, ensure a margin of safety consistent with requirements of applicable regulatory requirements and CSA S136 exists in uncompleted structure.

.5 Seat studs into top and bottom tracks. Do not allow gap between end of stud and web of track to exceed 4 mm.

.6 Align adjacent or abutting members in the same plane to within plus or minus 0.5 mm maximum.

.7 Space studs within 3 mm either direction of design spacing. Cumulative error in spacing shall not exceed requirements of finishing materials.

.8 Align web cut-outs in studs and joists as required for installation of through-the-knockout style bridging and services.

.9 Take field measurements necessary to ensure proper fit of members.

.10 Use either saws or shears to cut members. Do not torch cut material.

.11 Reinforce cut-outs when distance from centre line of cut-out to end of member is less than 300 mm. Submit reinforcing detail to Consultant for approval.

.12 Locate loadbearing horizontal framing members and their end stiffeners directly over axial loadbearing building elements. Alternately, Provide a load distribution member to transfer loads. Do not use cold-formed metal track as a load distribution member.

.13 Field cut holes into cold-formed metal framing members as described above.

.14 Replace members with localized damage.

.15 Unless a closer spacing is shown on accepted Shop Drawings, anchor top and bottom tracks securely to structure at 800 mm OC maximum. Place one additional anchor within 100 mm of the end of each piece of track and additionally as required by accepted Shop Drawings.

.16 Install additional vertical framing members at abutting walls, openings, terminations against other materials and on each side at corners unless explicitly detailed otherwise on accepted Shop Drawings.

.17 Insulate jamb and header assemblies that may become inaccessible after installation. Use self-expanding foam sealant as specified in Section 07 27 36.

3.3 TOLERANCES

.1 Plumbness: 1/500th of member length.

.2 Out-of-Straightness: Including camber and sweep:
- .1 Vertical Framing: 1/1000th of member length.
- .2 Joists: 1/1000th of member length.
- .3 Track: Camber not to exceed 1/1000th of member length.

3.4 FIELD QUALITY CONTROL

.1 Submittal engineer will undertake periodic field review during construction and shall submit reports as described above.

.2 Submittal Engineer Review: Include review of mill tests reports, welded and screwed connections, connections to main structure, member sizes, location and material thickness, coating thickness, erection tolerances, and field cutting.

.3 Additional field inspection and testing will be conducted by qualified independent inspection agency, as specified in Section 01 40 00.

.4 Independent inspection and testing will include:
- .1 Checking mill test reports are properly correlated to materials.
- .2 Sampling fabrication and erection procedures for general conformity to specified requirements.
- .3 Checking welding conforms to requirements of Contract Documents.
- .4 Checking fabricated members against specified member geometries.
- .5 Visual inspection of welded connections, including sample checking of joint preparation and fit-up.
- .6 Sample checking of screwed and bolted joints.
- .7 Sample checking that tolerances are not exceeded during fit-up or erection.
- .8 Additional inspection and testing of welded connections as required by CSA W59.
- .9 General inspection of field cutting and alterations required by other Sections.
- .10 Submission of reports to Consultant, Contractor, and authorities having jurisdiction; covering inspected parts of the Work, with details of deficiencies discovered.

3.5 ADJUSTING

.1 Touch-up welds and coatings damaged by welding with zinc rich paint.

.2 Prior to touch-ups, prepare surface in accordance with paint manufacturer's recommendations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 12 23 - Structural Steel for Buildings.

.4 Section 07 84 00 - Firestopping.

.5 Section 07 95 13 - Expansion Joint Cover Assemblies.

.6 Section 08 71 00 - Door Hardware.

.7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.2 AAMA 2604-26: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.3 AAMA 2605-26: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.4 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.5 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.6 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.7 ASTM A269/A269M-22: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.8 ASTM A276/A276M-25: Standard Specification for Stainless Steel Bars and Shapes.

.9 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.10 ASTM A385/A385M-22: Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

.11 ASTM A449-14(2020): Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

.12 ASTM A563/A563M-24: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.13 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.14 ASTM A780/A780M-20: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.15 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

.16 ASTM B36/B36M-23: Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.

.17 ASTM B103/B103M-19: Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar.

.18 ASTM B139/B139M-12: Standard Specification for Phosphor Bronze Rod, Bar and Shapes.

.19 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.20 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.21 ASTM D6386-22: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

.22 ASTM D7803-25: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

.23 ASTM F436/F436M-24: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

.24 ASTM F467M-06a(2025): Standard Specification for Nonferrous Nuts for General Use (Metric).

.25 ASTM F468M-06(2025): Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use (Metric).

.26 ASTM F593-24: Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.

.27 ASTM F594-22: Standard Specification for Stainless Steel Nuts.

.28 ASTM F1267-18: Standard Specification for Metal, Expanded, Steel.

.29 ASTM F3125/F3125M-26: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

.30 CSA A500:16 (R2021): Building Guards.

.31 CSA G40.20-13 (R2023): General Requirements for Rolled or Welded Structural Quality Steel.

.32 CSA G40.21-13 (R2023): Structural Quality Steel.

.33 CSA S136-16 (R2021): North American Specification for the Design of Cold-Formed Steel Structural Members.

.34 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.

.35 CSA W47.2-11 (R2020): Certification of Companies for Fusion Welding of Aluminum.

.36 CSA W55.3-08 (R2023): Certification of Companies for Resistance Welding of Steel and Aluminum.

.37 CSA W59:24: Welded Steel Construction.

.38 CSA W59.2:24: Welded Aluminum Construction.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, prepared for each required custom-fabricated metal item, illustrating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

.3 Shop Drawings for metal ladders, balustrades, guards, railings, and handrails must be stamped, signed, and dated by fabricator's design engineer.

1.4 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing metal ladders, balustrades, guards, and railings, licensed to practice at Place of the Work.

.2 Fabricator: A firm specializing in custom fabricating metal components, and having minimum 3 years documented experience.

.3 Welders: Workers certified by CWB to CSA W47.1 and CSA W55.3.

2 Products

2.1 DESIGN CRITERIA

.1 Design cold-formed steel fabrications to CSA S136.

.2 Design metal guards, including balustrades, railings and handrails to CSA A500 and applicable regulatory requirements, and capable of resisting:
.1 Uniform Load = 0.75 kN/m in any direction.
.2 Vertical Load = 1.5 kN/m.
.3 Loads on Pickets = 0.5 kN on 100 x 100 mm area.
.4 Non-concurrent Loads on Handrails = 0.9 kN applied at any point in any direction.
.5 Lateral Force = 1.0 kN at any point without damage or permanent set.

.3 Design galvanized metal fabrications to accommodate venting and drainage during hot dip galvanizing process, to ASTM A385/A385M.

2.2 MATERIALS

.1 Galvanized Sheet Steel: To ASTM A653/A653M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, galvanized; thicknesses as indicated.

.2 Sheet Steel: To ASTM A1008/A1008M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, thicknesses as indicated.

.3 Steel Sections and Plates: To CSA G40.20 and CSA G40.21, Grade 300W; profiles and sizes as indicated.

.4 Hollow Structural Steel Sections: To CSA G40.20 and CSA G40.21, Grade 350W, Class H; sizes as indicated.

.5 Stainless Steel Sheet, Sections and Plates: To ASTM A240/A240M, Type 304L for welded applications and Type 304 for other applications; thicknesses and sizes as indicated.

.6 Stainless Steel Tubing: To ASTM A269/A269M, Grade TP316L for welded applications and Grade TP316 for other applications; thicknesses, diameters and sizes as indicated.

.7 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304L for welded applications and Type 304 for other applications; sizes and profiles as indicated.

.8 Extruded Aluminum: To ASTM B221M, 6063 alloy, T6 temper; profiles and sizes as indicated.

.9 Aluminum Sheet: To ASTM B209/B209M, 3003-H14 alloy for shop-painted material and 5005-H32 alloy for anodized material; thicknesses as indicated.

.10 Brass: To ASTM B36/B36M, UNS C22000 alloy, hot rolled temper; profiles and sizes as indicated.

.11 Bronze Plate, Strip and Sheet: To ASTM B103/B103M, UNS C53400; leaded phosphor type; profiles and sizes as indicated.

.12 Cast Bronze: To ASTM B139/B139M; phosphor type; profiles and sizes as indicated.

2.3 MANUFACTURED UNITS

.1 Wire Mesh: 3.6 mm OD steel wire welded into a 25 x 25 mm square mesh pattern; galvanized after welding (GAW) finish.

.2 Checkerplate: 6 mm thick sheet steel, to CSA G40.20; 1.27 mm raised checker pattern.

.3 Welded Metal Grating: 4.8 mm twisted steel cross bars welded at 102 mm OC to flat steel bearing bars spaced at 30 mm OC; width and length as indicated on Drawings; galvanized after welding (GAW) finish; eg. Type W/B by Borden Metal Products (Canada) Ltd.

.4 Expanded Metal Grating: To ASTM F1267; 1.9 mm thick galvanized steel, 50 mm deep channel; up to 610 mm wide; diamond shaped openings with serrated edges; eg. Deck Span by Fisher & Ludlow.

.5 Perforated Sheet Steel: 1.52 mm thick cold-rolled commercial quality sheet steel; 1 220 x 2 440 mm size panels, having 25 mm OD round perforations spaced at 32 mm OC with 60 degree staggered line pattern; 58 percent open area; with powder coated finish applied after perforating.

.6 Wall-Mounted Handrail Bar Brackets: Stainless steel; 75 mm OD mounting plate with three countersunk holes for 6 mm exposed fasteners; 62 mm long radiused plate welded to bent metal bar for mounting bar handrail and complete with two pre-drilled holes; 81 mm offset from wall to center line of handrail bar; No. 5 - Satin finish; eg. Model RB15030.4 by Wagner.

2.4 ACCESSORIES

.1 Stainless Steel Bolts: To ASTM F593, Group 1.

.2 Stainless Steel Nuts and Washers: To ASTM F594, Group 1.

.3 High-Strength Bolts: To ASTM F3125/F3125M, Type 1 for interior applications, Type 3 for exterior applications; quenched and tempered steel heavy hex structural bolts.

.4 Medium-Strength Bolts: To ASTM A449, Type 1 for interior applications, Type 3 for exterior applications; quenched and tempered steel hex bolts.

.5 Machine Bolts: To ASTM A307, Grade A; carbon and alloy steel, galvanized where noted.

.6 Steel Nuts: To ASTM A563M, Grade A, Heavy Hex Style for use with high strength bolts, and Hex Style for use with medium strength bolts and machine bolts; carbon and alloy steel, galvanized where noted.

.7 Steel Washers: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; hardened steel; circular, bevelled, and clipped types as required.

.8 Aluminum Bolts: To ASTM F468M, shop finished to match adjacent surfaces.

.9 Aluminum Nuts and Washers: To ASTM F467M, including plain washers; shop finished to match adjacent surfaces.

.10 Welding Materials: To CSA W59 and CSA W59.2.

2.5 PRIMERS

.1 Primer for Ferrous Metal Surfaces: Red oxide type.

.2 Primer for Galvanized Surfaces: Zinc-rich paint type.

2.6 FABRICATION

.1 Prior to fabrication, verify existing conditions and take field measurements to ensure perfect fit.

.2 Fabricate cold-formed steel components to CSA S136.

.3 Fabricate metal guards, including balustrades, railings, and handrails, to CSA A500.

.4 Shop weld steel components to CSA W59.

.5 Shop weld aluminum components to CSA W59.2.

.6 Fit and shop assemble components in largest practical sections to accommodate delivery to Place of the Work.

.7 Seal joints with continuous welds.

.8 Grind visually-exposed joints flush and smooth with adjacent finish surface.

.9 Make visually-exposed joints butt tight, flush, and hairline.

.10 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; except where specifically noted otherwise.

.11 Supply components required for anchorage of fabrications.

2.7 FINISHES

.1 Shop Priming:
- .1 Clean surfaces of rust, scale, grease and foreign matter prior to shop priming.
- .2 Do not prime surfaces designated to come into direct contact with concrete, or where field welding is required.
- .3 Prime components using minimum two coats primer.

.2 Galvanizing:
- .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .4 Prepare hot dip galvanized coatings to ASTM D6386 for subsequent paint application.
- .5 Prepare hot dip galvanized coatings to ASTM D7803 for subsequent powder coating application.

.3 Stainless Steel: To AISI No. 4 - Brushed.

.4 Brass: To AISI No. 4 - Brushed.

.5 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.6 Monochromatic Paint Coating on Aluminum: To AAMA 2605, three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc., colour as selected by Consultant.

.7 Metallic Paint Coating on Aluminum: To AAMA 2605, three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, complete with metal flakes incorporated in the colour coat; factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc., colour as selected by Consultant.

.8 Powder Coated Finish on Metal Components: To AAMA 2604, electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colour as selected by Consultant.

.9 Monochromatic Paint Coating on Sheet Steel: Two-coat silicone modified polyester coil coating, factory-applied to 0.028 mm dry film thickness; eg. WeatherXL by The Sherwin-Williams Company, colour as selected by Consultant.

3 Execution

3.1 PREPARATION

.1 Make provision for erection loads with temporary bracing.

.2 Clean and strip primed steel items to bare metal where site welding is required.

.3 Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.2 INSTALLATION

.1 Install Products plumb and level.

.2 Install Products accurately fitted, and free from distortion or defects.

.3 Provide fasteners and anchors necessary to secure components rigidly in place.

.4 Field weld steel components to CSA W59.

.5 Field weld aluminum components to CSA W59.2.

.6 Field bolt and weld to match shop bolting and welding.

.7 Mechanically fasten joints butted tight, flush, and hairline.

.8 Grind welds smooth and flush.

.9 After erection, prime welds, abrasions, and surfaces not yet shop primed or galvanized, except surfaces to be in direct contact with concrete.

.10 Make Good damaged or defective galvanized coatings to ASTM A780/A780M.

3.3 SCHEDULE

.1 The following schedule is a list of principal items only. Refer to Drawings for items not specifically scheduled.

.1 Sleeves and Openings: Including templates and required information, supplied to appropriate Sections.

.2 Attachments: Anchor bolts, washers, nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, etc. as required and secured with sufficient self-tapping shake-proof screws with flat countersunk heads.

.3 Brackets: Fabricated from mild steel plate, sizes and configurations as required to support counter tops, shelving, seating, benches, valances, coat hooks and other similar components; pre-drilled for fastening of other components.

.4 Lateral Support Brackets for Masonry Partitions: 75 x 75 mm steel angles, 6 mm thick, as follows:
  .1 Concealed Conditions: 200 mm long and spaced at 3 000 mm OC; minimum two anchors each.
  .2 Exposed Conditions: Continuous lengths, anchored at 1 000 mm OC.

.5 Steel Pipe Bollards: 150 mm OD galvanized steel pipe, sufficient length to be 1 000 mm above finished grade; set in 450 mm OD concrete pier set minimum 1 200 mm deep. Fill steel pipe solid with concrete and finish with rounded top.

.6 Metal Balustrades, Guards, and Railings: Sizes and configurations as indicated on Drawings; engineered by fabricator to meet specified design criteria; shop primed steel for interior applications and stainless steel for exterior applications.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 06 20 00 - Finish Carpentry.

.3 Section 06 41 00 - Architectural Wood Casework.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

.1 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM F593-24: Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.

.3 ASTM F594-22: Standard Specification for Stainless Steel Nuts.

.4 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.5 CSA O80 Series:21: Wood Preservation.

.6 CSA O86:19: Engineering Design in Wood.

.7 CSA O121:17 (R2022): Douglas Fir Plywood.

.8 CSA O141:23: Canadian Standard Lumber.

.9 CSA O151:17 (R2022): Canadian Softwood Plywood.

.10 NLGA Standard Grading Rules for Canadian Lumber (2022 Edition).

.11 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 QUALITY ASSURANCE

.1 Lumber Identification: Grade stamp clearly identifying assigned grade, mill of origin, moisture content at time of manufacture, species or species group, and grading authority having jurisdiction over mill of origin.

.2 Plywood Identification: Face or edge stamp depending on appearance requirement, clearly identifying panel grade, species designation, mill identification, certifying agency, and waterproof glue bond designation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver and store Products under waterproof cover.

.3 Prevent damage to Products, existing properties, and to the Work.

.4 Store Products where it does not hinder the progress of the Work.

2 Products

2.1 MATERIALS

.1 Dimension Lumber: To CSA O141, S4S; SPF species, kiln dried to S-Dry moisture content; NLGA Light Framing Grade Category, Standard and Better Common Grade Mix; preservative treated for exterior applications and flame retardant treated where noted, sizes as indicated on Drawings.

.2 Plywood - Exterior Applications: To CSA O121, DFP species, SHG Grade, Exterior waterproof glue bond; veneer core, butt edge, unsanded faces; preservative treated, thicknesses as indicated on Drawings.

.3 Plywood - Interior Applications: To CSA O151, CSP species, SHG Grade, Exterior waterproof glue bond; veneer core, butt edge, unsanded faces; flame retardant treated where noted; thicknesses as indicated on Drawings.

2.2 ACCESSORIES

.1 Nails: To ASTM F1667, Type I (NL); common wire type for general use and spiral type for structural connections; sizes necessary to ensure adequate securement; and as follows:
.1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
.2 For Use with Untreated Wood: Galvanized steel.

.2 Spikes: To ASTM F1667, Type III (SP); common wire type for general use and spiral type for structural connections; sizes necessary to ensure adequate securement; and as follows:
.1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
.2 For Use with Untreated Wood: Galvanized steel.

.3 Staples: To ASTM F1667, Type IV (ST); common wire; leg length necessary to ensure adequate securement; and as follows:
.1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
.2 For Use with Untreated Wood: Galvanized steel.

.4 Screws: Bugle head, power driven type, sizes necessary to ensure adequate securement; types as follows:
.1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
.2 For Use with Untreated Wood: Galvanized steel.

.5 Stainless Steel Bolts: To ASTM F593, Group 1.

.6 Stainless Steel Nuts: To ASTM F594, Group 1.

.7 Anchors: Toggle bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete, or bolts or ballistic fasteners for anchorages to steel.

.8 Touch-Up Wood Preservative: To CSA O80; brush-applied copper azole (CBA-A or CA-B) or alkaline copper quaternary (ACQ) preservative.

.9 Touch-up Flame Retardant Coating: To CSA O80; brush-applied Dricon by Lonza.

2.3 FINISHES

.1 Flame Retardant Treatment
.1 Flame Retardant Treatment: To CSA O80; chemically treated and pressure impregnated; as follows:
.1 Surface Burning Characteristics (CAN/ULC-S102): Flame Spread Index $\leq$ 25.
.2 Manufacturer and Product Name: eg. Dricon by Lonza.
.2 Flame retardant treated materials must bear ULC classification label.

.2 Wood Preservative Treatment:
.1 Wood Preservative Treatment: To CSA O80; chemically treated and pressure impregnated using copper azole (CBA-A or CA-B) or alkaline copper quaternary (ACQ) preservative.
.2 Preservative treated materials must bear CSA classification label.
.3 Make preservative treated materials available for inspection by Consultant at place of treatment, before shipment to Place of the Work.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M; Classes B, C or D; hot dipped zinc alloy coating.

3 Execution

3.1 SITE APPLIED WOOD TREATMENT

.1 Conform to CSA O80.

.2 When wood in contact with exterior cementitious materials, roofing and related metal flashings has not been previously preservative treated, brush apply two coats of touch-up wood preservative.

.3 Apply two coats of touch-up wood preservative to sawn ends of preservative treated material.

.4 Apply two coats of touch-up flame retardant coating to sawn ends of flame retardant treated material.

3.2 INSTALLATION

.1 Erect Products level and plumb.

.2 Place horizontal members laid flat, crown side up.

.3 Construct framing members full length without splices.

.4 Secure plywood sheets perpendicular to framing members, with ends staggered and sheet edges located directly over firm bearing.

.5 Provide wood blocking required for attachment of fitments and equipment by other Sections.

.6 Provide 19 mm thick flame retardant treated plywood backer board on flame retardant treated wood blocking for mounting electrical equipment where indicated on Drawings.

.7 Construct curb and cant members of single pieces per location.

.8 Curb roof openings except where prefabricated curbs are provided.

.9 Form corners by lapping side members alternately.

.10 Coordinate work with installation of decking and support of decking at openings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 40 00 - Cold-Formed Metal Framing.

.2 Section 07 21 00 - Thermal Insulation.

.3 Section 07 27 00 - Air Barriers.

.4 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM C475/C475M-17(2022): Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C954-22: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.3 ASTM C1002-20: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.4 ASTM C1177/C1177M-24: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.5 ASTM C1264-19(2024): Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.

.6 ASTM C1280-25: Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

.7 CGC Gypsum Construction Handbook.

.8 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.9 GA-214-2021: Levels of Finish for Gypsum Panel Products.

.10 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.11 ULC List of Equipment and Materials.

1.3 QUALIFICATIONS

.1 Applicators: A firm specializing in applying gypsum sheathing, having minimum 5 years documented experience.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Conform to ASTM C1264.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 CertainTeed Canada, Inc.
.2 CGC Inc.
.3 G-P Gypsum Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Gypsum Sheathing Board (GSB-1): To ASTM C1177/C1177M; as follows:
- .1 Thickness: 12.7 mm.
- .2 Edges: Square.
- .3 Core: Silicone-treated gypsum.
- .4 Facers: Glass fiber mesh, both sides.
- .5 Manufacturer and Product Name: eg. DensGlass Exterior Sheathing by G-P Gypsum Corporation.

.2 Gypsum Sheathing Board (GSB-2): To ASTM C1177/C1177M, Type X; as follows:
- .1 Thickness: 15.9 mm.
- .2 Edges: Square.
- .3 Core: Silicone-treated gypsum.
- .4 Facers: Glass fiber mesh facers, both sides.
- .5 Flame Spread Index (CAN/ULC-S102): $\leq$ 10.
- .6 Manufacturer and Product Name: eg. DensGlass Fireguard Sheathing by G-P Gypsum Corporation.

.3 Steel Drill Screws: To ASTM C954; galvanized steel, sheet metal type.

.4 Self-Tapping Screws: To ASTM C1002, Type S, Fine Thread; galvanized steel.

.5 Adhesive: To CAN/CGSB-71.25-M.

.6 Joint Materials: To ASTM C475/C475M; reinforcing tape, joint compound, adhesive, water, fasteners.

.7 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

3 Execution

3.1 INSTALLATION

.1 Install Products to ASTM C1280.

.2 Install boards perpendicular to supports with ends staggered.

.3 Secure board edges over firm bearing.

.4 Screw fasten boards to furring or framing.

.5 Finish boards to GA-214, Level 1.

.6 Finished work shall be plane and free from depressions.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 06 24 00 - High Pressure Decorative Laminate.

.3 Section 06 41 00 - Architectural Wood Casework.

.4 Section 07 92 00 - Joint Sealants.

.5 Section 08 14 00 - Wood Doors.

.6 Section 08 71 00 - Finishing Hardware.

.7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ANSI A135.4-2004: Basic Hardboard.

.2 ANSI A208.1-2009: Particleboard.

.3 ANSI A208.2-2009: Medium Density Fiberboard (MDF) for Interior Applications.

.4 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.5 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.6 AWMAC NAAWS 5.0-2026: North American Architectural Woodwork Standards.

.7 CSA O141:23: Canadian Standard Lumber.

.8 CSA O151:17 (R2022): Canadian Softwood Plywood.

.9 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.

.10 NHLA Grading Rules.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, component profiles and sizes, fastening methods, jointing details, finishes, accessories, and hardware.

.3 Prepare Shop Drawings at minimum scale of 1:10.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Duplicate samples, as follows:
.1 Melamine Composite Panel: 300 x 300 mm size, illustrating laminate-clad face colour, pattern, and texture; core materials; and quality of edgebanding.
.2 Hardwood Plywood: 300 x 300 mm size, illustrating full panel sheet, edge and joint trim.
.3 Hardwood Trim: 300 mm long, illustrating size and shape of profiles, and quality of wood grain.

1.5 QUALIFICATIONS

.1 Trim and Finish Carpenter: A firm employing workers specializing in finish carpentry work, and having minimum three years documented experience.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of hardboard having Product considered acceptable for use:
.1 Decorative Panels International.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 LUMBER

.1 Dressed Softwood Lumber (DL-SWD): To CSA O141, SPF species, maximum moisture content of 7 percent, with mixed grain capable of receiving high quality opaque finish; sizes as indicated on Drawings.

.2 Dressed Hardwood Lumber (DL-HWD): White Birch species, to NHLA Select and Better Grade; maximum moisture content of 7 percent, with vertical grain capable of receiving high quality transparent finish; sizes as indicated on Drawings.

.3 Dimension Lumber: As specified in Section 06 10 00.

2.3 PLYWOOD

.1 Softwood Plywood (PLY-SWD): To CSA O151; CSP species, SEL TF Grade; veneer core of minimum 9 plies; thicknesses as indicated on Drawings; capable of receiving high quality opaque finish.

.2 Softwood Plywood - Moisture-Resistant Core (PLY-SWD-MR): To CSA O151, CSP species, SEL TF Grade; composite core of moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue; thicknesses as indicated on Drawings; capable of receiving high quality opaque finish.

.3 Hardwood Plywood (PLY-HWD): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Hardwood veneer core, minimum 9 plies.
.2 Face Veneers: White Birch species; Face Grade AA; Plain-Sliced; of clear Book Matched grain capable of receiving high quality transparent finish.

.4 Hardwood Plywood - Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Composite core, moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue.
.2 Face Veneers: White Birch species; Face Grade AA; Plain-Sliced; of clear Book Matched grain capable of receiving high quality transparent finish.

2.4 COMPOSITE BOARDS AND PANELS

.1 Particleboard (PB): To ANSI A208.1, Grade M-2; made from 100 percent post-industrial wood fibres; minimum 635 kg/m^3 density and maximum 6 percent moisture content; no added urea formaldehyde (nauf); certified EPP by Composite Panel Association; thicknesses as indicated on Drawings.

.2 Melamine Composite Panel (MCP): Particleboard core with factory-applied low pressure laminate thermo-fused to both faces; Premium quality; thicknesses as indicated on Drawings; colours, textures, and patterns as selected by Consultant.

.3 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; minimum 740 kg/m^3 density and moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.

.4 Hardboard (HB): To ANSI A135.4, Class 1 - Tempered, G2S; 6.4 mm thick; Tempered Premium Hardboard by Decorative Panels International.

2.5 CLOSET ACCESSORIES

.1 Metal Tube Closet Rod System: 27 mm OD, heavy wall steel tube rod, with heavy duty metal flanges and brackets; chrome-plated finish.

.2 Coat Hook: Two-prong heavy duty design, 4.5 mm thick flat steel bar, 108 mm high, 19 mm wide; pre-drilled for screw attachment; zinc plated finish; Model 209Z by Royal Arch Inc.

2.6 ACCESSORIES

.1 Decorative Laminate: High pressure decorative laminate, Type HPDL as specified in Section 06 24 00.

.2 Contact Adhesives: Water base type.

.3 Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

.4 Nails: To ASTM F1667, Type I (NL), galvanized steel, common wire; sizes necessary to ensure adequate securement.

.5 Staples: To ASTM F1667, Type IV (ST); galvanized steel, common wire; leg length necessary to ensure adequate securement.

.6 Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; plain finish.

.7 Primer: Alkyd primer sealer type.

.8 Wood Filler: Solvent base, tinted to match surface finish colour.

.9 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

2.7 FINISHES

.1 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

3 Execution

3.1 INSTALLATION

.1 Install Products to AWMAC NAAWS 5.0, Premium Grade.

.2 Set and secure Products in place; straight, plumb, and level.

.3 Unless noted otherwise, install Products with nails, screws, or bolts with blind fasteners spaced at 400 mm OC, or adhesive as required by specific installation requirements.

.4 Finish exposed edges of veneer-clad panels with 3.2 mm thick hardwood edge trim, glued and nailed.

.5 Finish exposed edges of laminate-clad panels with 1.0 mm thick decorative laminate edgebanding, applied using hot melt adhesive.

.6 Apply decorative laminate to core materials as specified in Section 06 24 00.

.7 Install MCP shelf and metal tube closet rod in closets where indicated on Drawings.

.8 Install coat hooks where indicated on Drawings.

.9 Install wood doors as specified in Section 08 14 00.

.10 Install door hardware as specified in Section 08 71 00.

.11 Seal gaps and joints as specified in Section 07 92 00.

3.2 ADJUSTING AND CLEANING

.1 Set exposed fasteners.

.2 Apply wood filler in exposed fastener indentations. Allow to dry and sand smooth.

.3 Conceal countersunk fasteners with matching hardwood dowels, sanded smooth and flush to adjacent surface.

.4 Clean and prepare surfaces for site finishing. Coordinate with Section 09 90 00.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 06 20 00 - Finish Carpentry.

.2 Section 06 41 00 - Architectural Wood Casework.

.3 Section 08 14 00 - Wood Doors.

1.2 REFERENCES

.1 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.

.2 ASTM E84-26a: Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 AWMAC NAAWS 5.0-2021: North American Architectural Woodwork Standards.

.4 CAN/CGSB-71.20-M88: Adhesive, Contact, Brushable.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate chains of laminate samples, illustrating available colours and surface textures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver decorative laminate with heavy kraft paper protection, and store in cartons during shipping.

.3 Protect decorative laminate surfaces during fabrication and installation stages; do not remove protective covering until final clean-up prior to final inspection.

.4 Do not store or install Products in areas where relative humidity is less than 25 percent or greater than 60 percent at 22 degrees C.

1.5 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of two years, covering against warping, splitting, or delamination, subject to normal usage excluding excessive moisture or heat.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 Arborite.
- .2 Egger Group.
- .3 Formica.
- .4 Nevamar.
- .5 Octolam.
- .6 Pionite.
- .7 Tafisa.
- .8 Wilsonart.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 High Pressure Decorative Laminate (HPDL): To ANSI/NEMA LD 3; decorative surface papers impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins; colours, textures, and patterns as selected by Consultant; NEMA Types, Grades and thicknesses as listed below:
- .1 General Purpose Type: Grade HGS; 1.2 mm thick.
- .2 Vertical Surface Type: Grade VGS; 0.7 mm thick.
- .3 Postforming Type: Grade HGP; 1.0 mm thick.
- .4 Cabinet Liner Type: Grade CLS; 0.5 mm thick.
- .5 Cabinet Liner Type: Grade CLS; 0.5 mm thick.
- .6 Backer Type:
  - .1 Grade BKL; 0.5 mm thick.
  - .2 Grade BKV; 0.7 mm thick.
  - .3 Grade BKM; 1.0 mm, thick.
  - .4 Grade BKH; 1.2 mm thick.

.2 High Pressure Decorative Laminate - Flame-Retardant (HPDL-FR): To ANSI/NEMA LD 3; decorative surface papers impregnated with melamine resins, bonded under heat and pressure to fire-retardant kraft papers impregnated with phenolic resins; colours, textures, and patterns as selected by Consultant; NEMA Types, Grades, thicknesses, and surface burning characteristics as listed below:
- .1 Vertical Surface Type: Grade VGF; 0.8 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
  - .1 Flame Spread Index = 15.
  - .2 Smoke Developed Index = 15.
- .2 Backer Type: Grade BKV; 0.7 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
  - .1 Flame Spread Index = 15.
  - .2 Smoke Developed Index = 0.

.3 Core Materials: As indicated on Drawings.

.4 Sealer: Water-resistant type.

.5 Draw Bolts and Splines: Suitable for new core bases, and acceptable to fabricator.

.6 Contact Adhesive: To CAN/CGSB-71.20-M.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify cutouts in core materials are prepared for faucets, sinks, and other penetrating components.

3.2 PREPARATION

.1 Make joints in core materials tight, flush, and hairline; using draw bolts and splines.

.2 Round internal corners, chamfer edges, and seal exposed edges in core materials.

3.3 INSTALLATION

.1 Comply with ANSI/NEMA LD 3, Annex A and AWMAC NAAWS 5.0.

.2 Install Products plumb, true, and square.

.3 Install Products neatly scribed and fitted to adjoining surfaces.

.4 Ensure adjacent laminate sheets match in colour, texture, and pattern.

.5 Ensure decorative laminate and core profiles coincide to ensure full continuous support and bond over entire surface.

.6 Use continuous lengths to minimize joints.

.7 Locate joints minimum 600 mm from sink cutouts.

.8 Offset joints in decorative laminate from joints in core material.

.9 Apply decorative laminate to exposed edges of core material for straight self-edging strips or flat work.

.10 Chamfer exposed edges of decorative laminate uniformly at 20 degrees.

.11 Do not mitre decorative laminate edges.

.12 Apply backer sheets where required to conceal and balance core material. Match thickness of decorative face sheets.

.13 Apply cabinet liner sheets to interior of cabinets where indicated on Drawings.

3.4 FIELD QUALITY CONTROL

.1 Gaps at corners or between trim and core materials will be rejected by Consultant.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove kraft paper protective covering.

.3 Visually inspect each installed item, wash, and thoroughly polish surfaces.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage with removable, temporary protective coverings.

.3 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 06 20 00 - Finish Carpentry.

.2 Section 06 24 00 - High Pressure Decorative Laminate.

.3 Section 07 92 00 - Joint Sealants.

.4 Section 08 14 00 - Wood Doors.

.5 Section 08 71 00 - Finishing Hardware.

1.2 REFERENCES

.1 ANSI A135.4-2004: Basic Hardboard.

.2 ANSI A208.1-2009: Particleboard.

.3 ANSI A208.2-2009: Medium Density Fiberboard (MDF) for Interior Applications.

.4 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.5 ASTM A276/A276M-25: Standard Specification for Stainless Steel Bars and Shapes.

.6 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.7 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.8 AWMAC NAAWS 5.0-2026: North American Architectural Woodwork Standards.

.9 ANSI/BHMA A156.1-2016: Butts and Hinges.

.10 ANSI/BHMA A156.9-2015: Cabinet Hardware.

.11 ANSI/BHMA A156.11-2014: Cabinet Locks.

.12 ANSI/BHMA A156.26-2017: Continuous Hinges.

.13 CSA O112.9:21: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.14 CSA O112.10-08 (R2022): Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.15 CSA O141:23: Canadian Standard Lumber.

.16 CSA O151:17 (R2022): Canadian Softwood Plywood.

.17 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.

.18 NHLA Grading Rules.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, materials, component profiles and sizes, fastening methods, jointing details, finishes, accessories, locations of outlets, anchorages, and hardware.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Duplicate samples, as follows:
.1 Melamine Composite Panel: 300 x 300 mm size, illustrating laminate-clad face colour, pattern and texture; core materials; and quality of PVC edgebanding.
.2 Hardwood Plywood: 300 x 300 mm size, illustrating quality of veneer faces, edge profile, quantity of plies, joint and edge trim, and shop-applied finish.
.3 Hardwood Lumber and Trim: 300 mm long, illustrating profiles, sizes, and shapes, quality of wood grain, and shop-applied finish.

1.5 QUALIFICATIONS

.1 Fabricator and Installer: A firm specializing in fabricating and installing custom cabinetry, having minimum three years documented experience, and a member of AWMAC.

1.6 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-up: A full-scale, 450 mm wide mock-up of each type of custom casework required on the Project, demonstrating materials, fabrication methods, shop-applied finishes, specified hardware, and designated countertops.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products under waterproof cover both in transit and at Place of the Work in a manner to prevent damage to Products, to any existing building or property, or to the Work.

.3 Store completed Products in a dry, clean area where it does not hinder progress of the Work.

.4 Do not store or install Products in the Work until building is dry and heated.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of melamine composite panels having Product considered acceptable for use:
.1 Arauco North America.
.2 Panolam.
.3 Tafisa.
.4 Uniboard.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 LUMBER

.1 Dressed Softwood Lumber (DL-SWD): To CSA O141, S4S; AWMAC Premium grade; Spruce species, maximum moisture content of 7 percent, with mixed grain capable of receiving high quality opaque finish; sizes as indicated on Drawings.

.2 Dressed Hardwood Lumber (DL-HWD): White Birch species, to NHLA Select and Better Grade; maximum moisture content of 7 percent, with vertical grain capable of receiving high quality transparent finish; sizes as indicated on Drawings.

.3 Dimension Lumber: As specified in Section 06 10 00; sizes as indicated on Drawings.

2.3 PLYWOOD

.1 Hardwood Plywood (PLY-HWD): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Hardwood veneer core, minimum 9 plies.
.2 Face Veneers: White Birch species; Face Grade AA; Plain-Sliced; of clear Book Matched grain capable of receiving high quality transparent finish.

.2 Hardwood Plywood - Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Composite core, moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue.
.2 Face Veneers: White Birch species; Face Grade AA; Plain-Sliced; of clear Book Matched grain capable of receiving high quality transparent finish.

2.4 COMPOSITE BOARDS AND PANELS

.1 Melamine Composite Panel (MCP): Particleboard core with factory-applied low pressure laminate thermo-fused to both faces; Premium quality; colours, textures, and patterns as selected by Consultant; thicknesses as indicated on Drawings.

.2 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; minimum 740 kg/m^3 density and moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.

.3 Particleboard (PB): To ANSI A208.1, Grade M-2; made from 100 percent post-industrial wood fibres; minimum 635 kg/m^3 density and maximum 6 percent moisture content; no added urea formaldehyde (nauf); certified EPP by Composite Panel Association; thicknesses as indicated on Drawings.

.4 Hardboard (HB): To ANSI A135.4, Class 1 - Tempered; inter-felted ligno-cellulosic fibers consolidated under heat and pressure; minimum 500 kg/m^3 density; S1S surface finish; complete with factory-applied low pressure laminate thermo-fused to one face; colours, textures, and patterns as selected by Consultant; thicknesses as indicated on Drawings.

2.5 METALS

.1 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 304; sizes and thicknesses as indicated on Drawings.

.2 Stainless Steel Bar and Shape: To ASTM A276/A276M, Type 304; sizes and profiles as indicated on Drawings.

2.6 MANUFACTURED UNITS

.1 Teacher Closet Doors: Solid core flush wood doors, non-rated type; as specified in Section 08 14 00.

2.7 ACCESSORIES

.1 Decorative Laminate: High pressure decorative laminate, Type HPDL as specified in Section 06 24 00.

.2 Solid Plastic Edgebanding: 3 mm thick PVC edgebanding with eased edge, colour and pattern to match cabinet panel faces, unless noted otherwise.

.3 Tackable Surface: 6 mm thick linoleum-based cork sheet, Krommenie by Forbo Linoleum Inc., up to 4 colours as selected by Consultant.

.4 Adhesive for Wet Area Exposures: To CSA O112.9.

.5 Adhesive for Dry Area Exposures: To CSA O112.10.

.6 Nails: To ASTM F1667, Type I (NL); galvanized steel, common wire; sizes necessary to ensure adequate securement.

.7 Spikes: To ASTM F1667, Type III (SP); galvanized steel, common wire; sizes necessary to ensure adequate securement.

.8 Staples: To ASTM F1667, Type IV (ST); galvanized steel, common wire; leg length necessary to ensure adequate securement.

.9 Screws: Galvanized steel, bugle head, power driven type, sizes necessary to ensure adequate securement.

.10 Anchors: Galvanized steel, drilled and epoxy-fastened types; sizes necessary to ensure adequate securement.

.11 Joint Sealants: As specified in Section 07 92 00, types as follows:
.1 Dry Areas and Food Preparation Wet Areas: Interior general purpose sealant, SEAL-INT-GP.
.2 Other Wet Areas: Interior mildew-resistant sealant, SEAL-INT-MR.

2.8 CASEWORK HARDWARE

.1 Unless specified otherwise, Provide cabinet hardware to ANSI/BHMA A156.9, Grade 1.

.2 Casework Hinge: Fully concealed, adjustable, articulated, metal hinges, screw on type; accommodating 100 degree, 110 degree, 125 degree and 170 degree openings, with soft-closing mechanism.

.3 Pull: Stainless steel, 10 mm OD handle, 185 mm overall length with 128 mm centre-to-centre fastening and 35 mm projection; eg. Contemporary Stainless Steel Handle Pull - 2102 by Richelieu.

.4 Drawer Box and Slides: Full extension for 60 kg load at 500 mm; roller runners for bottom mounting, steel construction with baked enamel finish, ball bearing rollers, and soft-closing mechanism.

.5 Continuous Hinges: To ANSI/BHMA A156.26; continuous stainless steel hinges, heavy duty type, length to suit full door height; eg. Roton 790-900 by Hager, with US32D finish.

.6 Cupboard and Drawer Lock: To ANSI/BHMA A156.11, Operational Class, Grade 1; National disc tumbler cylinder cam lock C8080 Series; 90 degree or 180 degree cam turn; Bright Nickel finish, master keyed; complete with strikes, escutcheons, and flat washers as necessary; sizes to suit applications.

.7 Padlock Hasp: Stainless steel, Type 304; with countersunk screw holes.

.8 Elbow Catch: Heavy duty type, nickel finish; eg. Model 5540180 by Richelieu.

.9 Door Bumper: Nylon, eg. Model MP303-11 by Richelieu.

.10 Pilaster Strip: 16 mm wide, 4 mm deep perforated metal strip, zinc plated; length as required; Model 2332GXX by Richelieu.

.11 Pilaster Clip: Heavy duty bent metal clips, zinc plated; Model CP2562G by Richelieu.

.12 Shelf Support for Drilled Gable: 5 mm OD metal pin, plastic-clad; eg. Model 34004011 by Richelieu.

.13 Support Housing and Bolt: Nickel-plated metal, 9.5 mm mounting centre, suitable for 19 mm thick panels; complete with matching connecting bolt; eg. Rafix-SE Housing Model 263.15.705 by Hafele.

.14 Cable Grommet: Plastic counter top fitting for computer / telephone / power cables; two-part cable set with spring closure top, 50 mm OD; Black colour; Model 60.2700.90 by Richelieu, or Type SG by Doug Mockett.

.15 Circular Cable Entry Plug: Aluminum construction, 72 mm OD, 60 mm OD hole, 22 mm deep with 3 mm thick cap; polished chrome finish; eg. Model 600910140 by Richelieu.

.16 Wire Management Moulding: 50 x 38 mm size, lengths as indicated; complete with mounting screws; Black colour; eg. Model 512490 by Richelieu.

.17 Heavy Duty Bracket (HD-1): Prefinished steel construction, 500 kg capacity per pair, Hebgo brackets by Hafele, 480 mm long, 180 mm high, 80 mm wide; Model 287.45.468.

.18 Medium Duty Bracket (MD-1): Prefinished steel construction, 150 kg capacity per pair, Hebgo brackets by Hafele, 580 mm long, 170 mm high, 82 mm wide; Model 287.44.470.

.19 Magnetic Catch: Magnetic catch, automatic opening.

.20 Automatic Door Bolt: Model 245.58.754 by Hafele.

.21 Cart Casters: Heavy duty swivel caster, 100 mm OD elastic Dynatread wheel; 31 mm thread width; sealed brass wheel bearing; rated for 160 kg; eg. Model FC.421A14R100DZPH by McFadden.

.22 Cart Corner Bumpers: Rigid plastic tapered corner bumper; surface mounted design, screw-fastened; colour as selected by Consultant; EcoRigid 90° Corner Cap by Richelieu, or JCBTPR Tapered Corner Bumper by Access Casters.

.23 Countertop/Table Legs: 60 mm OD chrome-plated steel tubing, adjustable.

.24 Base Cabinet Leveller: 100 mm size, adjustable to minus 5 mm and plus 10 mm; Model 637.45.326 by Hafele.

.25 Coat Hook: Two-prong heavy duty design, 4.5 mm thick flat steel bar, 108 mm high, 19 mm wide; pre-drilled for screw attachment; zinc plated finish; Model 209Z by Royal Arch Inc.

.26 Closet Rod and Flanges: 32 mm OD, 2 mm thick stainless steel tube, C32D satin finish; complete with matching closet rod flange; CBH 762 with CBH 742 and 752 closed end flanges.

2.9 TEACHER CLOSET DOOR HARDWARE

.1 Hinges: To ANSI/BHMA A156.1, Grade 1; 75 x 75 mm size, 5-knuckle ball bearing standard weight full mortise butt hinges, with brushed chrome finish; 1-1/2 pair required per door leaf; eg. Model FBB179 by Stanley.

.2 Automatic Door Bolt: Type as specified above, two required for top and bottom attachment to inactive door leaf.

.3 Lockable Handset: As specified in Section 08 71 00.

2.10 FABRICATION

.1 Prior to fabrication, verify existing conditions and take field measurements necessary to ensure perfect fit.

.2 Fabricate Products to AWMAC NAAWS 5.0, Premium Grade.

.3 Manufacture casework as individual cabinets in standard width increments, or in custom widths where indicated on Drawings.

.4 Fabricate each module to be self-supporting with both exterior gables finished to allow removal and relocation without any alteration to casework.

.5 Pre-drill and cut mounting holes for sinks, faucets, and electrical receptacles.

.6 Finish exposed edges of veneer-faced components with 3.2 mm thick hardwood edgebanding, glued and nailed.

.7 Finish exposed edges of laminate-faced components with solid plastic edgebanding, applied with an edge-bander using hot melt adhesive.

.8 Secure wall case and floor case bottoms to casework with three locking mechanical fasteners at each end.

.9 Secure fixed shelves, toe space rails, bottom rails, and top rails to casework with two locking mechanical fasteners at each end.

.10 Limit unsupported span of shelving to AWMAC NAAWS 5.0.

.11 Rabbet gables and insert pilaster strips for flush, recessed appearance. Screw fasten pilaster strips in place.

.12 Construct joints to have a good fit, fully glued, and rigid in final construction.

.13 Hardware Preparation - Casework Doors: Factory install cabinet hinges, runners, and hardware, anchoring components firmly into position for long life under hard use. Provide hinges on each door leaf in the following quantities:
.1 Doors up to 1 000 mm High: Two.
.2 Doors up to 1 500 mm High: Three.
.3 Doors greater than 1 500 mm High: Four.

.14 Hardware Preparation - Teacher Closet Doors: Machine cut relief for hinges, and core doors for handsets and cylinders.

.15 Equally space banks of drawers, with minimum height of 120 mm.

.16 Apply decorative laminate to core materials as specified in Section 06 24 00.

.17 Factory seal cutouts and service fitting openings in countertops with a moisture-resistant epoxy.

.18 Drill holes in gables to receive adjustable shelving pins. Provide ferow sleeves in drilled holes.

.19 Install neoprene or rubber bumpers at top and bottom of cabinet doors and drawers.

.20 Adjust doors and drawers to proper operation prior to and after installation.

2.11 FINISHES

.1 Shop-Applied Finish on Hardwood Lumber, Hardwood Plywood, and Hardwood Veneer: To AWMAC NAAWS 5.0, System 12 - POLYURETHANE, WATER-BASED, Premium Grade for Transparent finish; colours and sheens as selected by Consultant.

.2 Shop-Applied Finish on Softwood, Softwood Plywood and Unfaced Composite Panels: To AWMAC NAAWS 5.0, System 4 - LATEX ACRYLIC, WATER-BASED, Custom Grade for Opaque finish; colour and sheen as selected by Consultant.

.3 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

.4 Stainless Steel: To AISI No. 5 - Satin or No. 6 - Matte.

3 Execution

4 PREPARATION

.1 Where practical, assemble finished wood casework at point of fabrication, and deliver ready for installation.

4.2 INSTALLATION

.1 Install Products to AWMAC NAAWS 5.0, Premium Grade.

.2 Accurately fit joints and miters, and set nail heads, ready for finishing.

.3 Set and secure materials and components in place, rigid, square, and plumb.

.4 Provide wood blocking, framing, or furring shown on Drawings as part of casework installation.

.5 Accurately scribe and closely fit compounds to irregularities of adjacent surfaces.

.6 Use draw bolts and splines to form tight, flush, and hairline joints. Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.

.7 Provide heavy duty fasteners, securely anchoring cabinets to floor, ceiling, and wall surfaces. Use only concealed type fasteners.

.8 Where permitted, secure concealed elements with small headed finishing nails. Countersink nail heads with nail setter.

.9 Provide sinks, service fittings, and electrical outlets. Coordinate with other Sections for connection to facility services.

.10 Where access is required to valves and other facility service components located behind casework, Provide suitably removable wood access panels, each secured with minimum 4 brass screws.

.11 Install laminate-clad countertops, as specified in Section 06 24 00.

.12 Provide closers and filler strips in matching finish as required to ensure a neat and complete finished assembly.

.13 Seal gaps and joints in wet areas with mildew-resistant joint sealer, and in non-wet areas with general purpose interior sealant. Conform to Section 07 92 00.

.14 Install teacher closet doors and related door hardware.

4.3 ADJUSTING

.1 Fill and touch up damaged finishes to match factory finish.

.2 Replace damaged Product that can not be repaired.

4.4 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage by other Sections.

.3 Provide protective covering to protect installed Products.

.4 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 31 23 23 - Fill.

.5 Section 33 46 00 - Subdrain.

1.2 REFERENCES

.1 ASTM C836/C836M-18(2022): Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

.2 ASTM D412-16(2021): Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

.3 ASTM D1621-16(2023): Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.4 ASTM D2370-16(2021): Standard Test Method for Tensile Properties of Organic Coatings.

.5 ASTM D2697-03(2021): Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.

.6 ASTM D4632/D4632M-15a(2023): Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

.7 ASTM D4716/D4716M-22: Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

.8 ASTM D4833/D4833-07(2020): Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

.9 ASTM D5295/D5295M-18: Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems.

.10 ASTM D5385/D5385M-25: Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

.11 ASTM D6506/D6506M-01(2024)e1: Standard Specification for Asphalt Based Protection Board for Below-Grade Waterproofing.

.12 ASTM E96/E96M-24: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.13 ASTM E154/E154M-08a(2025): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.3 PREINSTALLATION MEETINGS

.1 Conduct preinstallation meetings as specified in Section 01 30 00.

.2 Preinstallation Meeting: One week prior to commencing installation, to discuss proposed methods and Products.

.3 Representatives of Consultant, Contractor, installer, and manufacturer are to be in attendance.

.4 Do not conduct meeting unless identified parties are present.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating properties and characteristics of:
- .1 Primers and mastics;
- .2 Waterproofing membranes and flashings;
- .3 Control and expansion joints;
- .4 Sealing at openings, projections, and reglets;
- .5 Sealing of holes, slots, and sleeves; and
- .6 Special details.

1.5 QUALIFICATIONS

.1 Applicator: A firm specializing in applying self-adhered sheet waterproofing, having minimum 5 years documented experience.

1.6 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up: One 3 000 x 3 000 mm size mock-up panel, demonstrating foundation wall waterproofing application; including typical detailing, soil anchors, base of foundation wall, concrete cold joints, water stops, and pipe penetrations.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Protect Products from rain and damage.

.3 Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.

.4 Store adhesives at temperatures greater than 5 degrees C.

.5 Store Products at temperature not exceeding 32 degrees C for extended periods of time.

1.8 AMBIENT CONDITIONS

.1 Do not proceed with waterproofing application during rainy or inclement weather, or when ambient air and substrate temperatures are below -4 degrees C.

.2 Apply moderate temperature Products when ambient air and substrate temperatures are above 5 degrees C.

.3 Apply low temperature Products when ambient air and substrate temperatures are above -4 degrees C. Avoid using low temperature Products when ambient air and substrate temperatures are above 10 degrees C.

1.9 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 5 years, covering against failure to resist penetration of water, except where such failures are the result of structural failures of building.
.1 Hairline cracking of concrete due to temperature change or shrinkage is not considered structural failure.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Carlisle Coatings and Waterproofing Inc.
.2 Dörken Systems, Inc.
.3 Henry (a Carlisle Company).
.4 IKO Industries Ltd.
.5 Soprema Inc.
.6 W. R. Meadows of Canada Ltd.

.2 Manufacturers of drainage composite boards having Product considered acceptable for use:
.1 Big 'O'.
.2 DMX Plastics Limited.
.3 Dörken Systems, Inc.
.4 GCP Applied Technologies, Inc.
.5 Henry (a Carlisle Company).
.6 JDR Enterprises, Inc.
.7 W. R. Meadows of Canada Limited.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Sheet Waterproofing Membrane: Capable of preventing moisture migration to interior, and meeting the following performance criteria:
.1 Hydrostatic Pressure Resistance (ASTM D5385): 45.72 metres.
.2 Elongation (ASTM D412): > 200 percent.
.3 Peel Adhesion (dry): 196.6 g/mm.
.4 Puncture Resistance (ASTM E154/E154M): Passing 0.18 kN.
.5 Water Vapour Permeance (ASTM E96/E96M): < 2.6 Ng/Pa•s•m^2.

.2 Drainage Composite Board: Meeting the following performance criteria:
.1 Core Compressive Strength (ASTM D1621): 718 kPa.
.2 Flow Rate (ASTM D4716/D4716M): 211 Lpm/m^2 @ HG = 1.0.
.3 Fabric Grab Tensile Strength (ASTM D4632/D4632M): 445 N.
.4 Fabric Puncture Resistance (ASTM D4833/D4833M): 289 N.

.3 Liquid Membrane: Meeting the following performance criteria:
.1 VOC Content: 26 g/L.
.2 Solids Content by Volume (ASTM D2697): 98 percent.
.3 Tensile Strength (ASTM D2370): > 480 kPa.
.4 Elongation (ASTM D2370): 440 percent.
.5 Water Vapour Transmission (ASTM E96/E96M): 0.1 ng/Pa•s•m.

2.3 MATERIALS

.1 Self-Adhering Waterproofing Membrane: 1.5 mm thick self-adhering sheet; polymeric membrane laminated to heavy duty cross-laminated polyethylene carrier film; as follows:
.1 Moderate Temperature Applications: eg. Mel-Rol by W. R. Meadows of Canada Limited.
.2 Low Temperature Applications: eg. Mel-Rol Low Temp by W. R. Meadows of Canada Limited.

.2 Protection Course for Horizontal Waterproofing Applications: To ASTM D6506/D6506M, Class B; 1 220 x 2 440 mm size multi-ply board; comprised of mineral-fortified asphaltic semi-rigid core formed between two outside layers of asphalt-impregnated reinforced mats; having minimum puncture strength of 365 N; eg. PC-3 Heavy Duty Protection Course by W. R. Meadows of Canada Limited.

.3 Drainage Composite Board for Vertical Waterproofing Applications: 11.0 mm thick, moulded polystyrene sheet with raised dimples, bonded to high strength, non-woven polypropylene filter fabric; eg. Mel-Drain 5035 by W. R. Meadows of Canada Limited.

.4 Flexible Membrane Flashing: Self-adhering waterproofing membrane as specified above.

.5 Primer:
.1 Moderate Temperature Applications: Water-based non-combustible adhesive; eg. Mel-Prime W/B by W. R. Meadows of Canada Limited.
.2 Low Temperature Applications: Solvent-based flammable adhesive, with flash point of 10 degrees C; eg. Mel-Prime by W. R. Meadows of Canada Limited.

.6 Mastic: Rubberized, single component asphalt-base elastomeric mastic, Black colour; eg. Pointing Mastic by W. R. Meadows of Canada Limited.

.7 Liquid Membrane: To ASTM C836/C836M, cold-applied, solvent-free single-component low-VOC liquid waterproofing membrane, Black colour; eg. Hydralastic 836 by W. R. Meadows of Canada Limited.

.8 Patching Compound: Non-metallic, non-shrinking, rapid set high strength concrete compound; eg. Sealtight Speed-Crete by W. R. Meadows of Canada Limited.

.9 Accessories: Detail strips and termination bars as recommended by manufacturer.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify concrete has been properly cured for minimum 7 days prior to membrane application.

.3 Ensure surfaces are unfrozen, clean, dry, smooth, and free of voids.

3.2 PREPARATION

.1 Clean and prepare concrete surfaces to ASTM D5295/D5295M.

.2 Treat shrinkage cracks with one layer of membrane material 150 mm wide.

.3 Patch damaged surfaces, including tie-wire holes, with approved patching compound.

.4 Prime and treat penetrations with two layers of membrane material.

.5 Prime concrete substrate at manufacturer's recommended rate of coverage, and allow to dry until tack-free.

.6 Re-prime surfaces that have not been covered with waterproofing membrane within 24 hours.

3.3 APPLICATION

.1 Apply sheet waterproofing membrane vertically full height of wall between bottom of footing and grade line.

.2 Apply 19 mm bead of liquid membrane to internal corner conditions.

.3 Apply 305 mm wide strip of flexible flashing to internal and external corner conditions.

.4 Overlap seams a minimum of 65 mm.

.5 Apply a bead of mastic to vertical and horizontal terminations of sheet membrane.

.6 Position membrane horizontally from low to high point so laps shed water. Stagger end laps.

.7 Apply double thickness of membrane over construction control joints, expansion joints, and over cracks greater than 1.6 mm wide.

.8 Ensure positive adhesion of sheet waterproofing membrane to surfaces.

.9 Install protection course over horizontal waterproofing membranes.

3.4 DRAINAGE COMPOSITE BOARDS

.1 Install drainage composite boards over vertical waterproofing membranes.

.2 Lap filter fabric joints.

.3 Ensure positive drainage directly to foundation drainage pipe.

.4 Secure drainage composite boards to wall surfaces at finished grade.

3.5 FIELD QUALITY CONTROL

.1 Advise Consultant prior to application and again on completion.

.2 Do not allow backfill operations to commence until application has been reviewed and accepted by Consultant.

3.6 CLEANING

.1 Remove material staining other surfaces.

3.7 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage prior to and during backfill operations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 40 00 - Cold-Formed Metal Framing.

.4 Section 06 10 00 - Rough Carpentry.

.5 Section 06 16 43 - Gypsum Sheathing.

.6 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.7 Section 07 26 00 - Vapour Retarders.

.8 Section 07 27 00 - Air Barriers.

.9 Section 07 51 00 - Built-up Bituminous Roofing.

.10 Section 07 81 00 - Applied Fireproofing.

.11 Section 07 84 00 - Firestopping.

.12 Section 08 80 00 - Glazing.

.13 Section 09 21 16 - Gypsum Board Assemblies.

.14 Section 09 81 00 - Acoustic Insulation.

.15 Section 20 05 25 - Mechanical Insulation.

.16 Section 31 23 23 - Fill.

.17 Section 32 11 23 - Aggregate Base Courses.

.18 Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

.1 ASTM C167-25: Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

.2 ASTM C303-21: Standard Test Method for Dimensions and Density of Performed Block and Board-Type Thermal Insulation.

.3 ASTM C518-21: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 ASTM C1104/C1104M-19(2025): Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.5 ASTM D1621-16(2023): Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.6 ASTM D2842-25: Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.7 ASTM E96/E96M-24: Standard Test Methods for Water Vapor Transmission of Materials.

.8 CGSB 71-GP-24M: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

.9 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.10 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.11 CAN/ULC-S701.1-2017: Standard for Thermal Insulation, Polystyrene Boards.

.12 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.13 ULC-S702.2-15: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation.

.14 CAN/ULC-S704.1-2017: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

.15 CAN/ULC-S770-15 (R2020): Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Store, handle, and protect Products as specified in Section 01 61 00.

.2 Minimize time plastic-type insulation Products are stored or exposed to sunlight at Place of the Work.

.3 Store Products away from construction activity and sources of ignition.

.4 Protect Products from damage during handling, installation, and at point of installation.

1.4 AMBIENT CONDITIONS

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturer's prescribed limits.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of extruded polystyrene rigid board insulation having Product considered acceptable for use:
.1 DuPont de Nemours, Inc.
.2 Owens-Corning Canada Inc.

.2 Manufacturers of polyisocyanurate rigid board insulation having Product considered acceptable for use:
.1 Atlas Roofing Corporation.
.2 Elevate.
.3 GAF Materials Corporation.
.4 Hunter Panels.
.5 IKO Industries Ltd.
.6 Soprema Inc.

.3 Manufacturers of mineral fibre rigid board insulation having Product considered acceptable for use:
.1 Rockwool.

.4 Manufacturers of mineral fibre batt, blanket, and semi-rigid board insulations having Product considered acceptable for use:
.1 CertainTeed Canada, Inc.
.2 Knauf Insulation.
.3 Owens-Corning Canada Inc.
.4 Rockwool.

.5 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Conform to applicable regulatory requirements for combustibility and surface burning characteristic requirements.

.2 Ensure foamed plastic insulations contain zero HFC and HCFC blowing agents, and conform to Global Warming Potential (GWP) values required by The Montreal Protocol.

2.3 RIGID BOARD INSULATION

.1 Rigid Board Insulation (INS-RB-1): To CAN/ULC-S701.1, Type 4; extruded polystyrene (XPS) rigid board insulation, closed cell type, with integral high density skin; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.88 m^2•K/W per 25 mm of thickness.
.2 Board Size: 600 x 2 400 mm.
.3 Board Edges: Shiplapped.
.4 Compressive Strength (ASTM D1621): 207 kPa.
.5 Water Absorption (ASTM D2842): $\leq$ 0.3 percent by volume.
.6 Water Vapour Permeance (ASTM E96/E96M): 50 ng/Pa•s•m^2.
.7 Thickness: As indicated on Drawings.
.8 Manufacturer and Product Name: eg. Styrofoam Brand SM30 by DuPont de Nemours, Inc.

.2 Rigid Board Insulation (INS-RB-2): To CAN/ULC-S701.1, Type 4; extruded polystyrene (XPS) rigid board insulation, closed cell type, with integral high density skin; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.88 m^2•K/W per 25 mm of thickness.
.2 Board Size: 600 x 2 400 mm.
.3 Board Edges: Butt.
.4 Compressive Strength (ASTM D1621): 275 kPa.
.5 Water Absorption (ASTM D2842): $\leq$ 0.3 percent by volume.
.6 Water Vapour Permeance (ASTM E96/E96M): 58 ng/Pa•s•m^2.
.7 Thickness: As indicated on Drawings.
.8 Manufacturer and Product Name: eg. Styrofoam Brand Highload 40 by DuPont de Nemours, Inc.

.3 Rigid Board Insulation (INS-RB-3): To CAN/ULC-S704.1; polyisocyanurate rigid board insulation, closed cell type; and as follows:
.1 Long Term Thermal Resistance (CAN/ULC-S770): RSI $\geq$ 0.93 m^2•K/W per 25 mm of thickness.
.2 Board Edges: Square.
.3 Board Faces: Glass reinforced mat facers both sides.
.4 Compressive Strength (ASTM D1621): 140 kPa.
.5 Water Absorption (ASTM D2842): < 1 percent.
.6 Combustibility: Meets CAN/ULC-S107 and CAN/ULC-S126.
.7 Water Vapour Permeance (ASTM E96/E96M): 85 ng/Pa•s•m^2.
.8 Thickness: Do not use boards less than 38 mm thick; total thickness as indicated on Drawings, using minimum two layers.
.9 Manufacturer and Product Name: eg. ISO 95+GL by Elevate.

.4 Rigid Board Insulation (INS-RB-4): To CAN/ULC-S702.1, Type 1; mineral fibre rigid board insulation, manufactured from only rock or slag fibers; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.74 m^2•K/W per 25 mm of thickness.
.2 Board Facing: Unfaced.
.3 Density (ASTM C303): Monolithic density > 69 kg/m^3.
.4 Combustibility (CAN/ULC-S114): Noncombustible.
.5 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index = 0.
.2 Smoke Developed Index = 0.
.6 Water Vapour Permeance (ASTM E96/E96M, Dessicant Method): 2 005 ng/Pa•s•m^2.
.7 Water Vapour Sorption (ASTM C1104/C1104M): 0.01 percent by volume.
.8 Thickness: 50 mm.
.9 Manufacturer and Product Name: CavityRock by Rockwool.

2.4 BATT AND BLANKET INSULATION

.1 Batt Insulation (INS-BB-1): To CAN/ULC-S702.1, Type 1; mineral fibre thermal batts, non-rigid, friction fit type, manufactured from glass, rock, or slag fibers; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.75 m^2•K/W per 25 mm of thickness.
.2 Facing: Unfaced.
.3 Batt Size: 413 x 1 219 mm.
.4 Density (ASTM C167): $\geq$ 32 kg/m^3.
.5 Water Vapour Transmission (ASTM E96/E96M - Dessicant Method): 2 404 ng/Pa•s•m^2.
.6 Combustibility (CAN/ULC-S114): Noncombustible.
.7 Batt Thickness: As indicated on Drawings.
.8 Manufacturer and Product Name: eg. ComfortBatt by Rockwool.

2.5 SEMI-RIGID INSULATION

.1 Semi-Rigid Insulation (INS-SR-1): To CAN/ULC-S702.1, Type 1; mineral fibre semi-rigid board, manufactured from glass, rock, or slag fibers; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.74 m^2•K/W per 25 mm of thickness.
.2 Board Size: 610 x 1 220 mm.
.3 Board Facing: Unfaced.
.4 Density (ASTM C303): 56 kg/m^3.
.5 Combustibility (CAN/ULC-S114): Noncombustible.
.6 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index = 0.
.2 Smoke Developed Index = 0.
.7 Water Vapour Sorption (ASTM C1104/C1104M): 0.01 percent.
.8 Thickness: As indicated on Drawings.
.9 Manufacturer and Product Name: eg. CurtainRock by Rockwool.

2.6 ACCESSORIES

.1 Mechanical Fasteners: Stainless steel screw type fastener, complete with 75 mm OD moulded plastic disc washer.

.2 Adhesive for Use with Polystyrene: To CGSB 71-GP-24M, Type 1.

.3 Adhesive for Use with Other Materials: Mastic type, synthetic rubber base, fungi resistant, gun or trowel application.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure air seals and vapour retarders are in place.

3.2 RIGID AND SEMI-RIGID BOARDS

.1 Unless noted otherwise, secure rigid board insulation with adhesive, applied in three continuous beads per board length.

.2 Install insulation boards on wall surface either horizontally or vertically as required. Place membrane surface of insulation solidly against substrate and securely fasten.

.3 Install mineral fibre rigid and semi-rigid boards to ULC-S702.2.

.4 Do not crush insulation face when fastening with mechanical fasteners.

.5 Stagger side and end joints.

.6 Butt edges and ends tight to adjacent board and to protrusions.

3.3 BATTS AND BLANKETS

.1 Install mineral fibre batts and blankets to ULC-S702.2.

.2 Install batt insulation in spaces without gaps and voids.

.3 Fit insulation tight in spaces and tight to exterior side of facility service components within plane of insulation.

3.4 FIELD QUALITY CONTROL

.1 Notify Consultant and independent inspection company to inspect thermal insulation before, during, and upon completion of installation.

3.5 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect insulation edges at end of each Working Day.

.3 Protect insulation in areas where welding will be carried out.

.4 Replace insulation damaged by others.

.5 Protect insulation requiring a thermal barrier in accordance with applicable regulatory requirements.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 40 00 - Cold-Formed Metal Framing.

.4 Section 06 10 00 - Rough Carpentry.

.5 Section 07 21 00 - Thermal Insulation.

.6 Section 07 26 00 - Vapour Retarders.

.7 Section 07 27 00 - Air Barriers.

.8 Section 07 81 00 - Applied Fireproofing.

.9 Section 07 92 21 - Sprayed Foam Sealant.

1.2 REFERENCES

.1 ASTM D1621-16(2023): Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.2 ASTM D1622-26: Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.3 ASTM D1623-17(2023): Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.4 ASTM D2240-15(2021): Standard Test Method for Rubber Property-Durometer Hardness.

.5 ASTM D2842-25: Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.6 ASTM D6226-21: Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

.7 ASTM E96/E96M-24: Standard Test Methods for Water Vapor Transmission of Materials.

.8 CUFCA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.

.9 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.10 CAN/ULC-S705.1-18: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.

.11 CAN/ULC-S705.2-2020: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.

.12 CAN/ULC-S718-2018: Standard for Site Quality Assurance Program for Spray Applied Polyurethane Foam.

.13 CAN/ULC-S770-15 (R2020): Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 CERTIFICATES

.1 Submit certificates as specified in Section 01 40 00.

.2 Submit copy of foam contractor's license under a recognized third-party quality assurance program.

.3 Submit one copy of applicator certification issued by third-party.

1.4 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.
.1 Include results of CCMC air barrier system tests.

1.5 QUALIFICATIONS

.1 Applicator: A firm employing persons certified as approved applicators in accordance with CAN/ULC-S718.

.2 Independent Inspection Agency: A urethane foam insulation and air barrier system inspector certified in accordance with CAN/ULC-S718.

1.6 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up: A 10 square metre size mock-up panel, illustrating typical conditions, including window corner condition, door corner condition, inside corner, and outside corner.

.3 Conduct the following tests on mock-up panel and report results for the following criteria:
.1 Core density,
.2 Adhesion between transition sheet membrane and substrate, and
.3 Cohesion or adhesion between sprayed insulation and substrate.

.4 Verify results comply with inspector's daily report.

.5 Accepted mock-ups will be used as the standard for acceptance of the Work.

.6 Remove and replace installed Product that does not conform to accepted mock-up.

.7 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.7 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver and store Product in original packaging, bearing manufacturer's name, quantity, expiry date, CCMC numbers, and other appropriate technical indicators and references.

.3 Cold Weather Storage: Store materials during cold weather in heated storage area.

1.8 AMBIENT CONDITIONS

.1 Apply Product when surface and ambient air temperatures are within manufacturer's prescribed limits.

.2 Ventilate area as specified in Section 01 50 00.

.3 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

1.9 FIELD CONDITIONS

.1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.2 Protect workers as recommended by insulation manufacturer.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.4 On a daily basis, dispose of waste foam and decontaminate empty drums. Conform to authorities having jurisdiction.

1.10 WARRANTY

.1 Submit a standard Consumer Warranty for Rigid Insulation from the Energy Conservation Contractors Warranty Corporation.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 BASF Canada.
- .2 Carlisle Spray Foam Insulation.
- .3 Elastochem Specialty Chemicals, Inc.
- .4 Genyk Inc.
- .5 Huntsman Building Solutions.
- .6 Soprema Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Foamed-in-Place Urethane Insulation: Meeting the following properties:
- .1 Density (ASTM D1622): $\geq$ 28 kg/m^3.
- .2 Open Cell Content (ASTM D6226): $\leq$ 10 percent.
- .3 Long-Term Thermal Resistance (CAN/ULC S770): RSI $\geq$ 1.82 at 50 mm thick.
- .4 Air Permeance: $\leq$ 0.02 L/s•m^2 @ 75 Pa.
- .5 Flame Spread (CAN/ULC S102): < 500.
- .6 Compressive Strength (ASTM D1621, 10% parallel to rise): $\geq$ 170 kPa.
- .7 Tensile Strength (ASTM D1623): $\geq$ 200 kPa.
- .8 Water Absorption by Volume (ASTM D2842): $\leq$ 4 percent.
- .9 Water Vapour Permeance (ASTM E96/E96M): $\leq$ 60 ng/Pa•s•m^2 with outer skin in place.
- .10 Product Global Warming Potential: GWP $\leq$ 1.0 kg CO^2 eq / m^2 @ RSI 1.

.2 Ensure continuity of building enclosure thermal and air barriers in conjunction with Products specified in other Sections.

.3 Seal gaps between building enclosure components and wall and roof opening frames.

2.3 MATERIALS

.1 Foamed-in-Place Insulation (INS-FIP-1): To CAN/ULC S705.1, Type 2; two-component, closed cell polyurethane cellular plastic foam, using HFO blowing agent; eg. Walltite v.5 by BASF Canada.

.2 Primers: As recommended for specific substrate by CUFCA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.

.3 Transition Sheet Membranes: Air/vapour barrier sheet membrane, as specified in Section 07 27 00.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure surfaces are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.

.3 Ensure components required to penetrate sprayed insulation are installed before insulation application commences.

3.2 PREPARATION

.1 Mask and cover adjacent areas to protect from overspray.

.2 Apply primers for special conditions as recommended by manufacturer.

.3 Cover wide joints with transition sheet membrane as specified in Section 07 27 00.

.4 Clean area of work prior to application of sprayed insulation.

3.3 APPLICATION

.1 Spray apply Product to CAN/ULC S705.2 and CUFCA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.

.2 Apply foamed-in-place insulation in consecutive layers of not less than 12 mm and not more than 25 mm thick each. Apply sufficient layers to achieve total thickness indicated.

.3 Avoid formation of sub-layer air pockets.

.4 Apply Product in overlapping layers, so as to obtain a smooth, uniform surface.

.5 Maintain 75 mm clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures, and other heat sources.

.6 Do not apply Product to inside of exit openings or electrical junction boxes.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect application (minimum twice per week) and confirm insulation and air barrier system is installed in strict accordance with CCMC requirements.

.2 Conduct field inspection and testing to CAN/ULC-S718.

.3 Test completed application daily for core density and cohesion/adhesion to substrate. Record results in daily report forms.

.4 After Product has properly cured, conduct the following tests using CUFCA recommended equipment.
  .1 Conduct adhesion tests on all corners and building angles, at wall-to-slab junctions, and at wall-to-roof junctions.
  .2 Perform one test for every wall less than 30 metres in length. Perform two tests for every wall greater than 30 metres and less than 60 metres in length, with an additional test conducted for every additional 30 metres, or part thereof, in wall length.
  .3 Remove and replace defective Product.

.5 Verify adhesion of sprayed insulation to transition sheet membranes at perimeters of openings. Conduct adhesion tests randomly on 15 percent of wall openings, and at every tenth column or beam.

3.5 TOLERANCES

.1 Maximum Variation in Applied Thickness: Plus or minus 6 mm.

3.6 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove overspray from non-prescribed surfaces without causing damage to surfaces.

.3 Remove protective covers from adjacent surfaces.

3.7 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage.

.3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 40 00 - Cold-Formed Metal Framing.

.2 Section 07 21 00 - Thermal Insulation.

.3 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.4 Section 07 27 00 - Air Barriers.

.5 Section 07 51 00 - Built-up Bituminous Roofing.

.6 Section 07 92 00 - Joint Sealants.

.7 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 ASTM E96/E96M-24: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.2 CAN/CGSB-51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use In Building Construction.

.3 CAN/CGSB-51.34-M86: Vapour Barrier, Polyethylene Sheet for Use In Building Construction.

.4 SWI Sealant and Caulking Guide Specification.

1.3 SEQUENCING

.1 Sequence installation of Products in conjunction with other air and vapour barrier materials and seals.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product characteristics, performance criteria, and limitations.

2 Products

2.1 PERFORMANCE CRITERIA

.1 Ensure continuity of building enclosure vapour retarder in conjunction with materials specified in other Sections.

.2 Seal gaps between building enclosure components and opening frames.

2.2 MATERIALS

.1 Plastic Sheet Vapour Retarder: To CAN/CGSB-51.34-M; polyethylene sheet, as follows:
.1 Thickness: 0.15 mm.
.2 Water Vapour Permeance (ASTM E96/E96M): $\leq$ 2.2 ng/Pa•s•m^2.

.2 Kraft Paper Asphaltic Vapour Retarder: To CAN/CGSB-51.33-M, Type 2; double layer kraft paper laminated with asphalt and edge reinforced, having maximum water vapour permeance of 20 ng/Pa•s•m^2 when tested to ASTM E96/E96M.

.3 Bitumen: As specified in Section 07 51 00.

.4 Adhesive: Compatible with sheet barrier and substrate, permanently non-curing.

.5 Joint Sealant: As specified in Section 07 92 00, types as follows:
.1 Plastic Sheets: Interior general purpose sealant, Type SEAL-INT-GP.
.2 Kraft Paper Asphaltic Membranes: Exterior flashing sealant, Type SEAL-EXT-FL.

3 Execution

3.1 PREPARATION

.1 Ensure substrates are clean and dry.

.2 Ensure substrates are free of oil, grease, dirt, excess mortar, or other contaminants.

.3 Cure new concrete for minimum two weeks.

3.2 INSTALLATION

.1 Install Products to SWI Sealant and Caulking Guide Specification.

.2 Position joints or laps of sheets over firm bearing to achieve an effective and permanent seal.

.3 Install kraft paper asphaltic membrane to roof underlay board in flood coat moppings of hot bitumen. Refer to Section 07 51 00.

.4 Seal laps, joints, and terminations with approved sealant to ensure complete, continuous seal of building envelope.

3.3 FIELD QUALITY CONTROL

.1 Inspect vapour retarders prior to concealment and identify gaps, holes, and punctures.

.2 Seal gaps, holes, and punctures in plastic sheet vapour retarder membranes with joint sealant, as specified in Section 07 92 00.

.3 Seal gaps, holes, and punctures in kraft paper asphaltic vapour retarder membranes with additional applications of bitumen, as specified in Section 07 51 00.

.4 Request Consultant inspection of vapour retarders prior to concealment. Work that has been concealed prior to Consultant inspection will be exposed while Consultant remains at Place of the Work, inspected, and only concealed upon Consultant acceptance of conditions.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean extra materials from adjacent surfaces.

.3 Leave a suitable substrate for subsequent installations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

.1 ASTM D1709-24: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

.2 ASTM E96/E96M-24: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.3 ASTM E154/E154M-08a(2025): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.

.4 ASTM E1643-24: Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.5 ASTM E1745-17(2023): Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating properties and characteristics of sheet membranes, flashings, control and expansion joints, sealing at openings, projections, reglets, holes, slots, sleeves, and special details.

1.4 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Complete set of after-conditioning results, as described in ASTM E1745.

1.5 QUALIFICATIONS

.1 Installer: A firm specializing in installing below-slab vapour retarders, having minimum 5 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Protect Products from rain and damage.

.3 Store membrane cartons on pallets, and cover if left outside.

1.7 AMBIENT CONDITIONS

.1 Do not proceed with application during rainy or inclement weather.

1.8 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of three years, protecting against penetration of moisture resulting in buckling, blistering, cracking, or delamination of flooring products.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ISI Building Products.
.2 Stego Industries, LLC.
.3 W. R. Meadows of Canada Ltd.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Below-Slab Vapour Retarder: Preventing moisture migration through concrete slabs-on-fill to building interior, and having the following physical properties:
.1 Water Vapour Permeance (ASTM E96/E96M): $\leq$ 1.4 ng/(Pa•s•m^2).
.2 Tensile Strength (ASTM E154/E154M): $\geq$ 12.6 kN/m.
.3 Puncture Resistance (ASTM D1709, Method B): > 3200 g.

2.3 MATERIALS

.1 Below-Slab Vapour Retarder: To ASTM E1745, Classes A, B, & C; 0.38 mm thick resin-based single-ply sheet membrane; eg. Perminator 15 by W. R. Meadows of Canada Ltd.

.2 Lapping Tape: 100 mm wide, as recommended by membrane manufacturer.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure surfaces are unfrozen, clean, dry, smooth, and free of voids.

3.2 PREPARATION

.1 Level, then tamp or roll aggregate base course.

3.3 INSTALLATION

.1 Apply Products to ASTM E1643.

.2 Provide permanent, monolithic vapour seal without voids or open seams, and completely covering pour area.

.3 Ensure accessory materials are compatible with membrane, and approved by membrane manufacturer.

.4 Lap joints minimum 150 mm and continuously seal with lapping tape.

.5 Place membrane collar around protrusions through concrete slab, including sewer pipes, water pipes, and utility inlets to create a positive seal between protrusions and membrane. Seal in place with lapping tape.

.6 Seal membrane to vertical surfaces with lapping tape.

3.4 FIELD QUALITY CONTROL

.1 Advise Consultant prior to installation and again on completion.

.2 Do not allow concrete pour to commence until completed installation has been reviewed and accepted by Consultant.

3.5 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation and adjacent parts of the Work until covered by subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 07 21 00 - Thermal Insulation.

.5 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.6 Section 07 26 00 - Vapour Retarders.

.7 Section 07 51 00 - Built-up Bituminous Roofing.

.8 Section 07 92 00 - Joint Sealants.

.9 Section 07 92 21 - Sprayed Foam Sealant.

.10 Section 08 12 13 - Hollow Metal Frames.

.11 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.12 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

.1 ASTM D412-16(2021): Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

.2 ASTM D882-26: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.3 ASTM E154/E154M-08a(2025): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

.4 ASTM E96/E96M-24: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.5 ASTM E2178-21a: Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

.6 SWI Sealant and Caulking Guide Specification.

.7 CAN/ULC-S741-08 (R2016): Standard for Air Barrier Materials - Specification.

.8 CAN/ULC-S742-11 (R2016): Standard for Air Barrier Assemblies - Specification.

1.3 SEQUENCING

.1 Sequence installation in conjunction with other air and vapour barrier materials and seals.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product characteristics, performance criteria, and limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 30 00.

.2 Manufacturer's Instructions: Manufacturer's standard installation instructions, indicating substrate preparation, and Product installation requirements and techniques.

1.6 QUALIFICATIONS

.1 Applicators: A firm recognized by manufacturer as suitable for applying specified air barrier Products.

1.7 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in undamaged containers and original packaging, indicating names of manufacturer and Product.

.3 Store roll materials on end in original packaging.

.4 Store adhesives and primers at temperatures of 5 degrees C to facilitate handling.

.5 Keep solvent away from open flame or excessive heat.

.6 Protect rolls from direct sunlight until ready for use.

1.8 AMBIENT CONDITIONS

.1 Apply sheet membranes when ambient air temperature is above 5 degrees C.

.2 Apply membranes only during dry conditions, and to dry substrates that are free of snow, ice, and water.

.3 Apply only dry materials during weather that will not introduce moisture into membrane system.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of air barrier membranes having Product considered acceptable for use:
- .1 Dörken Systems, Inc.
- .2 Henry (a Carlisle Company).
- .3 Soprema Inc.
- .4 SRP Canada, Inc.
- .5 VaproShield.
- .6 W. R. Meadows of Canada Limited.

.2 Manufacturers of air/vapour barrier membranes having Product considered acceptable for use:
- .1 Carlisle Coatings and Waterproofing, Inc.
- .2 Henry (a Carlisle Company).
- .3 IKO Industries Ltd.
- .4 Soprema Inc.
- .5 Tremco Construction Products Group.
- .6 W. R. Meadows of Canada Limited.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Ensure continuity of building enclosure air barrier in conjunction with adjacent Products.

.2 Seal gaps between building enclosure components and opening frames.

2.3 MATERIALS

.1 Air Barrier Sheet Membrane: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; vapour permeable, water resistive, air barrier sheet membrane, self-adhering grade; and as follows:
.1 Thickness: $\geq$ 0.55 mm.
.2 Air Leakage (ASTM E2178): $\leq$ 0.02 L/s•m^2 @ 75 Pa.
.3 Water Vapour Permeance (ASTM E96/E96M, Method A): $\geq$ 1 655 ng/Pa•s•m^2.
.4 Tensile Strength (ASTM D882): 182 N.
.5 Product and Manufacturer Name: eg. Blueskin VP 160 by Henry (a Carlisle Company).

.2 Air/Vapour Barrier Sheet Membrane: SBS rubberized asphalt sheet membrane, self-adhering grade; to CAN/ULC-S741 and CAN/ULC-S742, Class A1; and as follows:
.1 Thickness: $\geq$ 1.0 mm.
.2 Air Leakage (ASTM E2178): $\leq$ 0.02 L/s•m^2 @ 75 Pa.
.3 Water Vapour Permeance (ASTM E96/E96M, Method A): $\leq$ 1.71 ng/Pa•s•m^2.
.4 Elongation (ASTM D412 - Modified): 200 percent.
.5 Tensile Strength (ASTM D412 - Modified): 3.45 MPa.
.6 Puncture Resistance (ASTM E154/E154M): 178 N.
.7 Product and Manufacturer Name: eg. Blueskin SA by Henry (a Carlisle Company).

.3 Air/Vapour Barrier Patching Compound: Single-component, trowel- or brush-applied; solvent type synthetic rubber, to CAN/ULC-S741 and CAN/ULC-S742, Class A1; and as follows:
.1 Air Leakage (ASTM E2178): $\leq$ 0.02 L/s•m^2 @ 75 Pa.
.2 Water Vapour Permeance (ASTM E96/E96M, Method A): $\leq$ 1.7 ng/Pa•m^2•s.
.3 Solids Content by Weight: 72 percent.
.4 Product and Manufacturer Name: eg. Air-Bloc 21 by Henry (a Carlisle Company).

.4 Primer: As recommended by self-adhering membrane manufacturer.

.5 Tape: 66 mm wide, self-adhering polypropylene tape.

.6 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

3 Execution

3.1 PREPARATION

.1 Ensure substrates are clean and dry.

.2 Ensure substrates are free of oil, grease, dirt, excess mortar, and other contaminants.

.3 Cure new concrete for minimum two weeks.

.4 Fill spalled concrete or open mortar joints to provide an even plane.

.5 Apply primer to porous surfaces scheduled to receive self-adhering sheet membranes.

.6 Tape unfinished joints and gaps between sheathing boards.

3.2 INSTALLATION

.1 Install Products to SWI Sealant and Caulking Guide Specification.

.2 Provide air tight joints.

.3 Seal Products completely around projections and penetrations.

.4 Fully adhere sheet membranes to primed substrate, using consecutive weatherboard method.

.5 Eliminate wrinkles, gaps, bubbles, air pockets, and fishmouths.

.6 Apply transition sheet membranes at openings and transitional connections.

.7 Leave sufficient amount of excess membrane over top of parapet walls, and around wall openings, for tie-in by other Sections.

.8 Cut membrane neatly around penetrations. Use heated trowel to soften and form membrane. Seal with air/vapour barrier patching compound.

.9 Do not leave installed membranes exposed to UV or weather for more than 42 days.

3.3 FIELD QUALITY CONTROL

.1 Inspect air barriers prior to concealment and identify gaps, holes, and punctures.

.2 Seal gaps, holes, and punctures in sheet membranes with air/vapour barrier patching compound.

.3 Request Consultant inspection of air barriers prior to concealment. Work that has been concealed prior to Consultant inspection will be exposed while Consultant remains at Place of the Work, inspected, and only concealed upon Consultant acceptance of conditions.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean extra material from adjacent surfaces.

.3 Leave suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 12 23 - Structural Steel for Buildings.

.2 Section 05 31 00 - Steel Decking.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 07 21 00 - Thermal Insulation.

.5 Section 07 62 00 - Sheet Metal Flashing and Trim.

.6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A755/A755M-18: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

.3 ASTM C1278/C1278M-24: Standard Specification for Fiber-Reinforced Gypsum Panel.

.4 ASTM D1970/D1970M-25: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.5 ASTM E1514-98(2023)e1: Standard Specification for Structural Standing Seam Steel Roof Panel Systems.

.6 CSA S136-16 (R2021): North American Specification for the Design of Cold-Formed Steel Structural Members.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
.1 Large scale details of members and materials, schedule of elevations, trim and closure pieces; of subgirts, brackets and anchorage devices; of connection and jointing details; of drainage system; and interface with adjacent materials;
.2 Fully dimensioned layouts for positioning of subgirts, brackets, anchorage devices to structures, and snow guards;
.3 Dimensions and thicknesses;
.4 Description of materials including catalogue numbers, Product names, and manufacturer's name;
.5 Finish specifications; and
.6 Other pertinent data.

.3 Submit documentation of:
.1 Thicknesses, profiles, and descriptions of components used in assembly.
.2 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project, including:
.1 Tolerance for bowing,
.2 Squareness,
.3 Camber, and
.4 Thermal resistance criteria required by applicable regulatory requirements.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate sets of 150 x 150 mm size prefinished metal samples, illustrating full range of available colours.

1.5 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing metal panel roofing, licensed to practice at Place of the Work.

.2 Fabricator and Installer: A firm specializing in fabricating and installing metal panel roofing, having minimum 5 years documented experience, and a member of CSSBI.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver and store Products in original wrappings, cartons, or containers; clearly marked as to type, colour, and manufacturer.

.3 Stack bundles on wood blocking, clear of ground, and tilted sufficiently to ensure no water remains on material.

.4 Open bundles on underside to allow drainage from leaks or condensation.

1.7 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of two years, covering damage to building and contents resulting from failure to resist penetration of water.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers standing seam metal roof panels having Product considered acceptable for use:
- .1 Agway Metals Inc.
- .2 Flynn Canada Limited
- .3 Vicwest Steel Inc.

.2 Manufacturers of thermal isolation clips having Product considered acceptable for use:
- .1 Exterior Technologies Group.
- .2 Northern Facade.
- .3 Soprema Inc.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN CRITERIA

.1 Design assembly to accommodate design loads, weight carrying requirements, and deflection limitations. Conform to CSA S136.

.2 Deflection Limits: Maintain integrity of panels and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.

.3 Design anchors, fasteners, subgirts, and braces to limit structural stress to not more than 50 percent of allowable stress when maximum load conditions are applied.

2.3 MATERIALS

.1 Prefinished Standing Seam Metal Roof Panels: To ASTM A755/A755M, Structural Steel (SS) Grade 230; galvanized sheet steel, 0.61 mm thick before galvanizing; 33 mm deep I-style standing seams with snap-on caps, spaced at 400 mm OC; with monochromatic paint coating; eg. Tradition 100 by Vicwest Steel Inc.

.2 Prefinished Steel Trim and Flashings: To ASTM A755/A755M, Structural Steel (SS) Grade 230; galvanized sheet steel, 0.61 mm thick before galvanizing; with monochromatic paint coating.

.3 Underlay Board: To ASTM C1278/C1278M, Type X; 15.9 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
.1 Combustibility (CAN/ULC-S114): Noncombustible.
.2 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index $\leq$ 5.
.2 Smoke Developed Index = 0.
.3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.

.4 Flexible Membrane Underlay / Vapour Retarder: To ASTM D1970/D1970M; 1.0 mm thick, self-sealing, self-adhering, heat-resistant rubberized asphalt membrane, eg. Ice & Water Shield HT by GCP Applied Technologies, Inc.

.5 Thermal Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-3 as specified in Section 07 21 00.

.6 Subgirts: 1.22 mm thick galvanized steel shapes; Z-, J-, or Hat-shaped profiles, sizes as required to suit application.

.7 Concealed Fastening Clips: L-shaped galvanized steel snap-on clips, for mechanical attachment to subgirts.

.8 Closure Strips: Preformed rubber on neoprene. Closures where materials are in continuous contact will be butyl pressure sensitive tape.

2.4 ACCESSORIES

.1 Eave Gutters: To ASTM A755/A755M, Structural Steel (SS) Grade 230; galvanized sheet steel, 0.46 mm thick before galvanizing; precision formed to size and profile indicated on Drawings, complete with end caps; with monochromatic paint coating.

.2 Downspouts: To ASTM A755/A755M, Structural Steel (SS) Grade 230; galvanized sheet steel, 0.51 mm thick before galvanizing; precision formed to size and profile indicated on Drawings, complete with prefabricated elbows and attachment brackets; with monochromatic paint coating.

.3 Mechanical Fasteners: Premium No. 12 hex head fasteners and 75 mm OD locking plates; corrosion-resistant, twin lead threads with sharp drill point and tapered wedge entry; sufficient length to penetrate structural deck minimum 19 mm; complete with galvanized steel disc washers.

.4 Thermal Isolation Clips: 1.9 mm thick galvanized sheet steel, complete with integral glass fibre reinforced polyamide thermal isolator pad; capable of supporting vertical and horizontal subgirts; sizes as indicated on Drawings; eg. ISO Clip by Northern Facade.

.5 Joint Sealant: Exterior high-movement weatherseal sealant, Type SEAL-EXT-HM as specified in Section 07 92 00.

.6 Gutter Liner: 1.0 mm thick polymeric alloy, reinforced with a polyester scrim; minimum tear strength of 27 kg; Black colour; eg. FR-40 by Lexcor.

.7 Gutter Liner Adhesive: CA-105 by Lexcor.

.8 Primer: Water-based primer, eg. Perm-A-Barrier WB Primer by Grace.

2.5 FABRICATION

.1 Shop fabricate Products as far as possible.

.2 Layout cutting, punching, and forming at Shop Drawing stage. Minimize such operations at Place of the Work.

.3 Preform standing seam friction interlock at side joints.

2.6 FINISHES

.1 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

.2 Monochromatic Paint Coating on Sheet Steel: To ASTM A755/A755M; two-coat silicone modified polyester (SMP) coil coating, factory-applied to 0.028 mm dry film thickness; eg. WeatherXL by The Sherwin-Williams Company, colour as selected by Consultant.

3 Execution

3.1 PREPARATION

.1 Maintain uniform temperature in work area, adequate for work being performed, as recommended by manufacturer.

3.2 INSTALLATION

.1 Mechanically fasten underlay board to roof deck, at manufacturer's recommended rate.

.2 Prime underlay board at manufacturer's recommended rate of application.

.3 Adhere flexible membrane underlay continuously over primed underlay board. Lap side and ends minimum 150 mm.

.4 Securely install thermal isolation clips to substrate using recommended fasteners at spacings indicated on accepted Shop Drawings. Secure subgirts to thermal isolation clips using recommended fasteners as indicated on accepted Shop Drawings.

.5 Install standing seam metal roof system to ASTM E1514.

.6 Conform to accepted Shop Drawings.

.7 Layout panels in continuous lengths with no horizontal joints.

.8 Mechanically seam panels with field-operated machine.

.9 Fold and hook panels into starter strips at valley and eave locations

.10 Secure metal panels with concealed clips and fasteners.

.11 Provide proper weatherproof seals at junctions and laps of materials.

.12 Install and seal flashings and closures.

.13 Cut and flash openings in roofing surfaces.

.14 Provide collars, miscellaneous trim or flat areas necessary to accommodate openings and penetrating components.

.15 Reinforce openings and sufficiently strengthen areas to accommodate penetrating components.

3.3 RAIN WATER MANAGEMENT ACCESSORIES

.1 Provide bent metal rain deflectors at base of roof valleys.

.2 Provide gutters with flexible membrane lining, and downspouts where noted on Drawings.

.3 Secure downspouts to wall surfaces with purpose made brackets, using proper anchorages according to nature of substrate.

3.4 ADJUSTING

.1 Touch up marks and abrasions as installation proceeds.

.2 Discard dented panels.

.3 Defective materials or workmanship whenever found at any time prior to final acceptance of the Work will be rejected, regardless of previous acceptance.

3.5 PROTECTION

.1 Refer to Section 01 70 00.

.2 Provide temporary blocking to prevent damage to standing seam roof near mechanical equipment until completion of mechanical equipment installation.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 40 00 - Cold-Formed Metal Framing.

.2 Section 07 41 13 - Metal Roof Panels.

.3 Section 07 42 93.23 - Linear Metal Soffits.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

.5 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 AAMA CW-10-26: Care and Handling of Architectural Aluminum from Shop to Site.

.2 AAMA 2605-26: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.3 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.6 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.7 CSA S136-16 (R2021): North American Specification for the Design of Cold-Formed Steel Structural Members.

.8 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
- .1 Large scale details of members and materials, schedule of trim and closure pieces, soffit panels; detail and location of joints and gaskets, including joints necessary to accommodate thermal movement;
- .2 Large scale details of girts, clips and connection details, including fully dimensioned layouts for positioning;
- .3 Dimensions and thicknesses;
- .4 Description of materials including catalogue numbers, Product names, and manufacturer's name;
- .5 Finish specifications; and
- .6 Other pertinent data.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate 38 x 50 mm size prefinished metal samples, illustrating full range of available colours.

.3 Verification Samples: Duplicate 50 x 90 mm size samples for each panel type, illustrating selected finish, fabrication, and methods of anchorage.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 30 00.

.2 Manufacturer's Instructions: Manufacturer's standard instructions and recommendations, describing Product storage and handling requirements, substrate preparation instructions, and installation methods.

1.6 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.7 QUALIFICATIONS

.1 Manufacturer: A firm specializing in manufacturing extruded aluminum soffits and trim with finishes conforming to AkzoNobel and AAMA 2605; and having minimum 5 years documented experience.

.2 Installer: A firm specializing in laying out and installing extruded aluminum soffits and trim, having minimum three years documented experience.

1.8 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up Panel: A 1 220 x 1 220 mm size mock-up panel, demonstrating panel profiles, textures, and colours; jointing and gasketing techniques; metal flashings; and methods of attachment to substrate.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Conform to AAMA CW-10.

.3 Deliver and store Products in original wrappings, cartons or containers clearly marked as to type, colour and manufacturer.

.4 Stack on wood blocking, clear of ground, tilted sufficiently to ensure no water remains on material.

.5 Open bundles on underside to allow drainage from leaks or condensation.

1.10 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 15 years, covering against failure of factory-applied exterior finish.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Longboard Architectural Products, Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN CRITERIA

.1 Design soffit assemblies to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of soffit, as calculated in accordance with applicable regulatory requirements. Conform to CSA S136.

.2 Deflection Limits: Maintain integrity of panels at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, or to cause them to touch other building components.

.3 Design anchors, fasteners and braces so as to limit their structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.

.4 Structural Movement: Design soffit assemblies to accommodate movement of supporting structural framing without causing bowing, buckling, delamination, oil canning, excessive stress on fasteners, or any other detrimental effects.

.5 Thermal Movements: Design soffit assemblies to accommodate thermal movements from ambient and surface temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

2.3 MATERIALS

.1 Sheet Aluminum: To ASTM B209/B209M, 3005-H14 alloy.

.2 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper.

.3 Bituminous Coating: Fibrous asphalt emulsion.

.4 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

2.4 COMPONENTS

.1 Perforated Soffit Panels: 152 mm wide, 7 315 mm long extruded aluminum panels; perforated V-groove profile with 21 percent open area; non-combustible to CAN/ULC-S114; faux-woodgrain powder coated finish; Tongue & Groove Soffit System, Model 6VP.289 Perforated V-Groove by Longboard Architectural Products, Inc.

.2 Trim: Extruded aluminum profiles, including starter strips, corner sets, termination sets, compression joints, flat reveal sets, U-reveal sets, T&G U-reveals, and J-tracks in sizes and shapes necessary to accommodate intended application; with faux-woodgrain powder coated finish.

.3 Clips: Galvanized steel L-shaped clips, galvanized finish, sizes necessary to accommodate the intended application.

.4 Girts: Aluminum T-shaped girts.

.5 Fasteners: Stainless steel; concealed type; sizes as recommended by manufacturer.

2.5 FABRICATION

.1 Layout cutting, punching, and forming at Shop Drawing stage so as to avoid site cutting.

.2 Fabricate Products with straight lines, square corners or smooth bends, free from twists or warps, kinks, dents, and other imperfections which may affect the appearance or serviceability of the completed installation.

.3 Use metal of sufficient thickness, configured to adequate detail and sufficiently supported to provide adequate strength and stiffness to resist distortion of finished surfaces.

.4 Dress exposed edges and ends smooth and free of sharp edges.

2.6 FINISHES

.1 Aluminum Pre-treatment: To AAMA 2605; E-CLPS Chrome Free five stage aluminum pre-treatment system.

.2 Faux-Woodgrain Powder Coated Finish on Aluminum: To AAMA 2605; electrostatically applied polyurethane powder with ink-based wood grain pattern; Akzo Nobel Interpon D3000 Series, colour as selected by Consultant.

.3 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.4 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify substrates are plumb and level within 1:1000 of overall distance, and are plus or minus 3 mm within designed location.

3.2 PREPARATION

.1 Maintain uniform temperature in work area, adequate for work being performed, as recommended by manufacturer.

3.3 INSTALLATION

.1 Install Products plumb, true, level, and in alignment.

.2 Install Products to established lines and elevations.

.3 Securely fasten panels to supports using concealed fasteners.

.4 Locate joints over solid supports.

.5 Provide control joints as indicated on accepted Shop Drawings.

.6 Install flashings and trim to divert moisture away from building surfaces.

.7 Cut and flash openings. Provide adequate reinforcement, complete with collars and trim, to accommodate installation of penetrating components.

.8 Provide proper weatherproof seals at perimeter junctions. Seal joints as specified in Section 07 92 00.

3.4 FIELD QUALITY CONTROL

.1 Inspect completed installation for flaws and defects.

.2 Make Good observed flaws and defects.

.3 Request Consultant review only after flaws and defects have been corrected.

3.5 ADJUSTING AND CLEANING

.1 Touch up marks or abrasions as installation proceeds.

.2 Discard dented panels.

.3 Clean panels free of grime and dirt.

.4 Defective Products or workmanship, whenever found at any time prior to final acceptance of the Work will be rejected, regardless of previous acceptance.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage.

.3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 31 00 - Steel Decking.

.2 Section 05 40 00 - Cold-Formed Metal Framing.

.3 Section 07 62 00 - Sheet Metal Flashing and Trim.

.4 Section 07 92 00 - Joint Sealants.

.5 Section 09 21 16 - Gypsum Board Assemblies.

.6 Section 09 51 23 - Acoustical Tile Ceilings.

1.2 REFERENCES

.1 AAMA 2605-26: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.2 ASTM A641/A641M-19(2025): Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.3 ASTM C635/C635M-22: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.4 ASTM C636/C636M-19(2025): Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.5 CISCA Ceiling Systems Handbook, 2012 Edition.

.6 CSA S136-16 (R2021): North American Specification for the Design of Cold-Formed Steel Structural Members.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product characteristics, assembly details, and installation guidelines.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
.1 Large scale details of members and materials, layouts, trim and closure pieces, access panel sizes and locations, detail and locations of joints and gaskets, including joints necessary to accommodate thermal movement;
.2 Large scale details of brackets and anchorage devices and of connection details;
.3 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
.4 Dimensions and thicknesses;
.5 Description of materials including catalogue numbers, Product names, and manufacturer's name;
.6 Finish specifications; and
.7 Other pertinent data.

.3 Submit documentation of:
.1 Thicknesses, profiles, and descriptions of components used in assembly;
.2 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by manufacturer's design engineer.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate 200 mm long samples, illustrating linear metal plank profile, and available colour and pattern selections.

.3 Verification Samples: Duplicate 200 mm long samples for each linear metal plank, illustrating selected finish, fabrication, and anchorage methods.

1.6 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: In the following quantities for each profile and colour used:
.1 Planks: Minimum 24 linear metres.
.2 Trim and Mouldings: Minimum 5 linear metres.

1.7 QUALIFICATIONS

.1 Manufacturer's Design Engineer: A professional structural engineer experienced in designing linear metal soffit systems, licensed to practice at Place of the Work.

.2 Installer: A firm specializing in installing linear metal soffit systems, having minimum three years documented experience.

1.8 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up Panel: A 1 220 x 1 220 mm size mock-up panel, demonstrating plank profiles, textures and colours; jointing and gasketing techniques; metal flashings; method of attachment to substrate.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in manufacturer's original unopened packages clearly marked with manufacturer's name and identification numbers.

.3 Store Products in fully enclosed space above floor on skids to prevent warping, scratches, and damage from moisture, direct sunlight, and other surface contamination.

.4 Handle Products in a manner which prevents racking, chipping of edges, distortion, or other physical damage of any kind.

1.10 FIELD CONDITIONS

.1 Coordinate installation with facility services being incorporated into assembly.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Armstrong World Industries.
.2 CGC Inc.
.3 Hunter Douglas Saint-Gobain.
.4 Rockfon.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN AND PERFORMANCE CRITERIA

.1 Design assembly to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of soffit, calculated in accordance with applicable regulatory requirements. Conform to CSA S136.

.2 Design assembly as a vented, drainable assembly.

.3 Deflection Limits: Maintain integrity of panels and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components, or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.

.4 Design anchors, fasteners and braces so as to limit their structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.

.5 Plank Removal: Designed as a non-progressive system, allowing removal of any individual plank without necessitating removal of adjacent components.

.6 Structural Movement: Design system to accommodate movement of supporting structural framing without causing bowing, buckling, delamination, oil canning, excessive stress on fasteners, or any other detrimental effects.

.7 Thermal Movements: Design system to accommodate thermal movements from ambient and surface temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
.1 Temperature Change: 20 degrees C ambient, and 40 degrees C material surfaces.

2.3 COMPONENTS

.1 Linear Metal Planks: 0.81 mm thick aluminum; 100 mm wide, 22 mm high; square interlocking edges; faux-woodgrain powder coated finish; eg. PlanarMacro Square Edge by Rockfon.

.2 Filler Strips: 0.81 mm thick aluminum; 19 mm wide, 22 mm high; baked enamel finish.

.3 Panel Splices: 0.64 mm thick aluminum; 222 mm long, profile compatible with linear planks; faux-woodgrain powder coated finish.

.4 End Plugs: 0.64 mm thick aluminum; square edges; faux-woodgrain powder coated finish.

.5 Perimeter Caps: 0.64 mm thick aluminum; 50 mm ID, with 41 mm top flange and 25 mm bottom flange; faux-woodgrain powder coated finish.

.6 Wall Angles: 0.64 mm thick aluminum; 23.8 mm wide, 23.8 mm high, with hemmed edges; faux-woodgrain powder coated finish.

.7 Symmetrical Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, slotted at appropriate intervals to receive stabilizing components; baked enamel finish.

.8 Stabilizer Bars: To ASTM C635/C635M; 0.64 mm thick aluminum; minimum 910 mm long; baked enamel finish.

.9 Radius Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, with integral carrier tabs; baked enamel finish.

.10 Expansion Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, with integral carrier tabs spaced at 105 mm OC; baked enamel finish.

.11 Hanger Wire: To ASTM A641/A641M; 2.68 mm OD galvanized carbon steel hanger wire.

.12 Tie Wire: To ASTM A641/A641M; 1.21 mm OD galvanized carbon steel tie wire.

.13 Nails and Staples: Manufacturer's standard corrosion-resistant type.

.14 Joint Sealant: Exterior weatherseal sealant, SEAL-EXT as specified in Section 07 92 00.

2.4 FABRICATION

.1 Fabricate linear planks with edges formed to snap onto carriers with positive locking action.

2.5 FINISHES

.1 Faux-Woodgrain Powder Coated Finish on Aluminum: To AAMA 2605; electrostatically applied polyurethane powder with ink-based wood grain pattern; Akzo Nobel Interpon D3000 Series, colour as selected by Consultant.

.2 Baked Enamel Coating on Metal Components: One coat of zinc oxide primer sprayed and baked, followed by two coats of semi-gloss polyester enamel, sprayed and baked; Black colour.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify Products being installed above soffits have been completed.

3.2 PREPARATION

.1 Furnish layout for inserts, clips, and other support items being installed under other Sections.

.2 Field measure each area, and establish layout to balance borders and minimize out-of-square conditions.

3.3 INSTALLATION

.1 Layout Products in accordance with accepted Shop Drawings.

.2 Install carrier system to ASTM C636/C636M, and CISCA installation standards.

.3 Install symmetrical carriers at 865 mm OC, suspended from building structure with hanger wire spaced at 1 220 mm OC.

.4 Install stabilizer bars perpendicular to symmetrical carriers, spaced at 610 mm OC.

.5 Attach linear planks to main carrier tabs and connect with panel splices, with joints staggered in adjacent rows.

.6 Install slip-on mouldings and end plugs on exposed plank ends.

.7 Install wall angles on vertical surfaces intersecting ceiling system.

.8 Install filler strips into open reveal between linear planks.

.9 Install access panels in accordance with accepted Shop Drawings.

.10 Install flashings to divert moisture to exterior.

.11 Provide proper weatherproof seals at perimeter junctions. Seal joints as specified in Section 07 92 00.

3.4 TOLERANCES

.1 Maximum Deviation from Alignment: 6 mm in 6 000 mm.

.2 Maximum Deviation from Panel Flatness: 3 mm in 1 500 mm panel in any direction for assembled units (non-accumulative).

3.5 ADJUSTING

.1 Ensure moving parts move freely.

.2 Adjust components for uniform tolerance.

.3 Replace Products that are visibly scratched or dented.

.4 Defective Products or quality of work, whenever found at any time prior to final acceptance of the Work will be rejected, regardless of previous acceptance.

3.6 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean exposed surfaces free of grime and dirt using manufacturer's recommended materials and methods.

3.7 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation from damage.

.3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 31 00 - Steel Decking.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 07 26 00 - Vapour Retarders.

.5 Section 07 41 13 - Metal Roof Panels.

.6 Section 07 62 00 - Sheet Metal Flashing and Trim.

.7 Section 07 72 46 - Roof Walkways.

1.2 REFERENCES

.1 ASTM C1278/C1278M-24: Standard Specification for Fiber-Reinforced Gypsum Panel.

.2 ASTM D41/D41M-11(2023): Standard Specification for Asphalt Primer Used in Roofing, Damproofing, and Waterproofing.

.3 ASTM D1863/D1863M-05(2024): Standard Specification for Mineral Aggregate Used on Built-Up Roofs.

.4 ASTM D2178/D2178M-15a(2021): Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

.5 ASTM D4586/D4586M-07(2024): Standard Specification for Asphalt Roof Cement, Asbestos-Free.

.6 ASTM E84-26a: Standard Test Method for Surface Burning Characteristics of Building Materials.

.7 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.8 CRCA Roofing Specifications.

.9 CSA A123.3-05 (R2020): Asphalt Saturated Organic Roofing Felt.

.10 CAN/CSA-A123.4-04 (R2023): Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.

.11 CSA A123.21:20: Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.

.12 CSA A123.23-15 (R2020): Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced.

.13 CSA A231.1:19: Precast Concrete Paving Slabs.

.14 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.15 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.

.16 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.17 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.

.18 CAN/ULC-S706.1-2020: Standard for Wood Fibre Insulating Boards for Buildings.

1.3 PREINSTALLATION MEETINGS

.1 Conduct preinstallation meetings as specified in Section 01 30 00.

.2 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 Owner, Contractor, 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.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating degree of slope and layout of tapered insulation, flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
- .1 Include copy of manufacturer's CSA A123.21 Dynamic Wind Uplift Resistance Test Report Summary.

1.5 CERTIFICATES

.1 Manufacturer Certificates: Signed by roofing manufacturer verifying installer is approved, authorized or licensed by manufacturer to install specified Products.

.2 Manufacturer Letter of Compliance: Signed by roofing manufacturer verifying proposed roofing system, materials, wind uplift resistance, and extended warranty conforms to Contract Documents.

.3 Installer Certificates: Signed by installer verifying they have specified qualifications.

1.6 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past 5 years.
- .1 Include copy of manufacturer's CSA A123.21 Dynamic Wind Uplift Resistance Test Report.

1.7 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit manufacturer's field inspection reports as specified in Section 01 40 00.

.2 Manufacturer Field Inspection Reports: Manufacturer's written acceptance of roofing installation based on regular inspections.

1.8 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Operation and Maintenance Manual: Manufacturer's standard preventative maintenance guidelines and instructions; sufficient quantity for inclusion in operation and maintenance manual.

1.9 QUALIFICATIONS

.1 Applicator: A firm specializing in applying built-up bituminous roofing, having minimum 10 years documented experience, and a member of OIRCA.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Do not store insulation, roofing felts, or cants on roof. Keep materials elevated and under cover.

.3 Package roofing materials and identify on attached labels name of manufacturer, brand, contents, weight as applicable, and product and specification numbers.

.4 Protect edges of roll goods from damage. Take extra precaution with base sheet.

.5 Protect porous materials from moisture.

.6 Protect insulation from sunlight.

1.11 AMBIENT CONDITIONS

.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.

.6 Use appropriate winter grade adhesives and primers when undertaking installation during cold weather conditions.

1.12 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Installer's Extended Warranty: Standard OIRCA two year extended warranty, covering labour and materials necessary to repair defective roofing system, and covering damage to building and contents resulting from failure to resist penetration of water.

.3 Manufacturer's Extended Warranty: A no-dollar limit extended warranty against defects in quality of work and materials, covering labour, material, and workmanship for a period of 10 years after Ready-for-Takeover.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Elevate.
.2 Garland Company Inc.
.3 IKO Industries Limited.
.4 Johns Manville.
.5 Soprema Inc.
.6 Tremco Construction Products Group Canada.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN AND PERFORMANCE CRITERIA

.1 Design roof assembly to arrest water migration from entering building through roof membrane.

.2 Dynamic Wind Uplift Resistance (CSA A123.21): 1.5 kPa.

.3 Conform to CAN/ULC-S126 and CAN/ULC-S107.

2.3 MATERIALS

.1 Underlay Board: To ASTM C1278/C1278M, Type X; 15.9 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
.1 Combustibility (CAN/ULC-S114): Noncombustible.
.2 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index $\underline{<}$ 5.
.2 Smoke Developed Index = 0.
.3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.

.2 Vapour Retarder: Kraft paper asphaltic membrane, as specified in Section 07 26 00.

.3 Flat Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-3, minimum two layers, as specified in Section 07 21 00.

.4 Tapered Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-3 as specified in Section 07 21 00; slopes and thicknesses as indicated on the tapered insulation Shop Drawings.

.5 Cover Board: To ASTM C1278/C1278M; 12.7 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
.1 Combustibility (CAN/ULC-S114): Noncombustible.
.2 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index $\underline{<}$ 5.
.2 Smoke Developed Index = 0.
.3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.

.6 Bitumen: To CAN/CSA-A123.4, Types as follows:
.1 Slopes Up To 1:16: Type II.
.2 Slopes From 1:16 to 1:8: Type II.
.3 Slopes From 1:8 to 1:4: Type III.
.4 Securement of Perimeter and Flashing Membranes: Type III.

.7 Organic Felt: To CSA A123.3, Type 1; No. 15 asphalt saturated felts, perforated.

.8 Roofing Felts: To ASTM D2178/D2178M, Type IV; asphalt saturated glass fibre felts.

.9 Aggregate: Washed, commercial grade gravel; free of dust and foreign matter; and as follows:
.1 Gradation (ASTM D1863/D1863M): ≥ 10 mm and ≤ 15 mm OD.
.2 Colour: White.
.3 Initial Reflectance: ≥ 0.65.
.4 Emittance: ≥ 0.90.

2.4 ACCESSORIES

.1 Adhesives: As listed in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.2 Mechanical Fasteners: As listed in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.3 Nails: To ASTM F1667, Type I (NL); common wire, galvanized steel, large head roofing style; sufficient length to penetrate a minimum of 25 mm into substrate.

.4 Asphalt Primer: To ASTM D41/D41M, Type II; as listed in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.5 Asphalt Roof Cement: To ASTM D4586/D4586M; as listed in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.6 Sealing Compound: Rubber asphalt type.

.7 Roof Insulation Tape: Reinforced tape 150 mm wide as supplied by roofing membrane manufacturer.

.8 Flexible Flashing - Base Sheet: To CSA A123.23, Type A, Grade 3; 2.5 mm thick modified bituminous membrane, 130 g/m^2, self-adhering, self-sealing, glass fleece reinforced.

.9 Flexible Flashing - Cap Sheet: To CSA A123.23, Type B, Grade 1; 3.8 mm thick SBS modified bituminous membrane, 170 g/m^2, self-adhering, polyester reinforced; self-adhesive coating factory-applied to lower surface, ceramic mineral granules factory-embedded on upper surface, Light Grey colour.

.10 Fibreboard Cant: To CAN/ULC-S706.1, Type I, Grade 2; asphalt-impregnated fibreboard, suitable size to create a 75 x 75 mm size cant set at a 45 degree angle.

.11 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.

.12 Rooftop Walkway Pavers: To CSA A231.1; 610 x 610 mm size, 45 mm thick precast concrete paver units, Diamond pattern, Standard texture; Natural colour; eg. Concrete Roof Ballast Slabs by Brooklin Concrete Products.

.13 Walkway Paver Pedestals: Prefabricated, high density polyethylene adjustable paver pedestals and levelling plates, complete with integral spacer ribs on upper surface; eg. Model 7X Pave-El Pedestals by Envirospec, Inc.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure surfaces to receive roofing membrane are dry.

.3 Examine deck to ensure structural soundness, with no significant instances of corrosion or deterioration.

.4 Notify Consultant immediately if deck surface is corroded.

3.2 PREPARATION

.1 Clean deck surface to remove irregularities, old adhesive, dirt, rust, oil, and other deleterious materials that would impair roofing application.

3.3 UNDERLAY BOARD

.1 Mechanically fasten underlay boards over metal roof deck, using means and methods set out in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.2 Stagger underlay boards 150 mm.

.3 Install underlay boards with long axis perpendicular to deck ribs, with end joints fully supported.

.4 Firmly butt each board to surrounding boards. Do not jam or deform boards.

.5 Provide filler boards at 450 mm each direction.

.6 Apply no more underlay board than can be sealed with roof membrane in same day.

3.4 VAPOUR RETARDER

.1 Install roof vapour retarder membrane with flood coat mopping of hot bitumen, and as specified in Section 07 26 00.

.2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps. Seal seams.

.3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.

.4 Seal roof vapour retarder to roof membrane system, and to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building envelope.

.5 Apply no more vapour retarder than can be sealed with roof membrane in same day.

3.5 INSULATION

.1 Immediately after installing vapour retarder membrane, install insulation boards as specified in Section 07 21 00, and as described below. Ensure vapour retarder membrane is clean and dry.

.2 Ensure vapour retarder membrane is clean and dry.

.3 Adhere minimum two layers of rigid board insulation using means and methods set out in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.4 Secure insulation boards along roof perimeter edges and at corners using mechanical fasteners; quantities and spacings as required to comply with specified dynamic wind uplift resistance criteria.

.5 Lay subsequent layers of insulation with joints staggered 150 mm.

.6 Lay insulation boards with edges in moderate contact without forcing.

.7 Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

.8 Install tapered insulation boards where indicated and in accordance with accepted Shop Drawings.

.9 When recommended by insulation manufacturer, tape joints of insulation boards.

.10 Apply no more insulation than can be sealed with roof membrane in same day.

3.6 COVER BOARD

.1 Adhere single layer of cover board over insulation using means and methods set out in manufacturer's CSA A123.21 Dynamic Wind Uplift Test Report Summary.

.2 Stagger cover board seams with insulation board seams.

.3 Install drain sumps as indicated on Drawings.

.4 Prime cover boards.

.5 Apply no more cover board than can be sealed with roof membrane in same day.

3.7 ROOFING FELTS

.1 Install one-ply organic felt and 4 plies of roofing felts perpendicular to cover board joints, set in continuous moppings of hot bitumen.

.2 Align ply felts without stretching.

.3 Overlap starter strips 660 mm with first ply, then overlap each succeeding ply 625 mm. 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 felts over and terminate beyond cants and cut evenly.

.5 Apply bitumen in a continuous application, applied at a rate of 1.2 kg/m^2.

.6 Do not step or walk on roofing felts during or immediately after application until bitumen has set.

.7 Ensure minimum 6 mm bitumen over flow is visible at all edge and end laps.

.8 Install each felt layer into hot bitumen so that it is firmly and uniformly set, without voids. Thoroughly and effectively broom or roll felt layer to ensure full adhesion.

.9 Install two plies of roofing felt and bitumen glaze coat for cutoff at end of each Working Day's operation. Remove cutoff before resuming roofing.

.10 Terminate felt layers to outer edge of roof perimeter.

3.8 FLASHINGS AND ACCESSORIES

.1 Apply flexible flashings to seal membrane to vertical elements.

.2 Prime substrate prior to application of self-adhering membranes.

.3 Install prefabricated roofing control joints where indicated on Drawings.

.4 Coordinate installation of roof drains and related flashings.

.5 Install flexible flashing membranes in a two-ply application.

.6 Prime top and bottom surfaces of metal flashing flanges with asphaltic primer.

.7 Install accessory flashing in bed of plastic roofing cement over roofing membrane prior to application of flexible flashing membranes over primed flanges.

.8 Mop in and seal flanges of items penetrating roofing membrane.

3.9 ROOFTOP WALKWAY PAVERS

.1 Conform to layout indicated on Drawings.

.2 Install paver pedestals along perimeter and at corners of pavers, spaced in a grid pattern at regular intervals to support pavers at their corners.

.3 Install paver pedestals on levelling pads.

.4 Install pavers on pedestals level, flat, and without movement.

.5 Adjust pedestal heights to achieve a perfectly flat transition between adjacent pavers.

.6 Avoid lippage.

3.10 AGGREGATE SURFACING

.1 Apply uniform flood coat of bitumen at rate of 3.7 kg/m^2 and while hot, embed roofing aggregate at rate of 40 kg/m^2.

.2 Sweep away loose aggregate from 1 220 mm wide area along roof perimeters, at outside corners, and at detailed locations. Apply second flood coat of bitumen at a rate of 3.7 kg/m^2 and while hot, embed second application of roofing aggregate at rate of 40 kg/m^2.

.3 Evenly distribute aggregate and ensure bond with flood coat. Extend aggregate to bottom edge of cant strips.

.4 Butt aggregate to edge of rooftop pavers.

3.11 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Advise Consultant and roof inspector 48 hours prior to start of roofing operations.

.3 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect roofing installation (minimum twice per week), and confirm installation is proceeding in strict accordance with manufacturer's recommendations.

.4 Contractor Inspection: Inspect completed membrane and flashing for punctures, tears and discontinuously sealed seams. Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions and seal to roofing membrane. Re-seal seams where necessary.

3.12 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean drains of debris, ensuring free drainage.

.3 Clean adjacent roof surfaces, levels, and ground level areas of debris and excess Products.

3.13 PROTECTION

.1 Refer to Section 01 70 00.

.2 Adequately protect Products and the Work from damage by weather, traffic, and other causes.

.3 At the end of each Working Day, seal exposed edges of roofing membrane watertight.

.4 Protect adjacent parts of the Work from damage.

.5 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 05 23 - Masonry Accessories.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 07 41 13 - Metal Roof Panels.

.5 Section 07 42 93.13 - Extruded Aluminum Soffit Panels.

.6 Section 07 42 93.23 - Linear Metal Soffits.

.7 Section 07 51 00 - Built-up Bituminous Roofing.

.8 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 AAMA 2605-26: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A755/A755M-18: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

.4 ASTM B32-20: Standard Specification for Solder Metal.

.5 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.6 ASTM D1970/D1970M-25: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.7 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.8 SMACNA Architectural Sheet Metal Manual, Seventh Edition, 2012.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets for manufactured items, indicating catalogue numbers, materials, and manufacturer's names; and including finish specifications and other pertinent data.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
.1 Fascia, trim, and closure pieces;
.2 Anchorage devices;
.3 Connection and jointing details;
.4 Dimensions and thicknesses;
.5 Finishes, and
.6 Other pertinent data.

.3 Submit documentation of:
.1 Thicknesses, profiles, and descriptions of components.
.2 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project, including dynamic wind uplift resistance.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: 300 mm long sample, indicating design method of locking and method of anchoring and corner section fabricated from specified Products.

1.6 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing sheet metal flashing and trim, and licensed to practice at Place of the Work.

.2 Installer: A firm with persons specializing in fabricating and installing sheet metal flashing and trim, in accordance with SMACNA standard practices and details.

1.7 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up Panel: A 1 220 mm long, full-size mock-ups of each type of sheet metal flashing required, demonstrating interfaces with adjacent construction, and illustrating profiles, textures and colours; edge seaming and sealing techniques; and methods of attachment.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.8 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 5 years, protecting against wind damage, water leakage, joint spalling, and other defects.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of membrane underlayment having Product considered acceptable for use:
.1 GCP Applied Technologies, Inc.
.2 Henry (a Carlisle Company).
.3 Soprema Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Prefinished Sheet Steel: To ASTM A755/A755M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, galvanized; 0.76 mm thick before galvanizing; with monochromatic paint coating.

.2 Galvanized Sheet Steel: To ASTM A653/A653M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, galvanized; 0.61 mm thick before galvanizing.

.3 Sheet Aluminum: To ASTM B209/B209M, 3105 alloy, H14 temper; 0.61 mm uncoated metal thickness, with faux-woodgrain powder coating.

.4 Nails: To ASTM F1667, Type I (NL); common wire, corrosion-resistant type, material compatible with adjacent surfaces; sufficient length to penetrate a minimum of 25 mm into substrate.

.5 Cleats: 0.76 mm thick sheet steel; minimum 38 mm wide and interlocked with metal flashing; continuous in maximum 2 400 mm lengths.

.6 Starter Strips: 0.76 mm thick sheet steel; continuous in maximum 2 400 mm lengths.

.7 Back-up Plates: 0.91 mm thick prefinished sheet steel; minimum 300 mm wide where adjacent lengths of cap flashing meet.

.8 Screws, Bolts, Washers, and Expansion Shields: Non-ferrous metal compatible with adjacent surfaces. Exposed fastenings; same materials as metal surfaces through which they penetrate. Use cadmium plated screws with round heads suitable for soldering for galvanized work.
.1 Use screw-type fasteners with colour-matched hex heads and neoprene backed washers for exterior, visually exposed conditions.

.9 Solder: To ASTM B32; 50 percent block tin, 50 percent pig lead.

.10 Flux: Commercial hydrochloric acid cut with zinc, or 10-20 percent solution of orthophosphoric acid in water, for use with galvanized work.

.11 Membrane Underlayment: To ASTM D1970/D1970M; 1.0 mm thick, self-sealing, self-adhering, heat-resistant rubberized asphalt membrane, eg. Ice & Water Shield HT by GCP Applied Technologies, Inc.

.12 Primer: Water-based primer, eg. Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.

.13 Joint Sealant: Flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

.14 Flashing Paint: Quick drying asphaltic base paint; eg. Primer 910-02 by Henry (a Carlisle Company).

2.3 MANUFACTURED UNITS

.1 Pre-Insulated Stack Jack Flashings: 1.6 mm thick seamless, spun aluminum; 457 mm overall height with 356 mm high insulated sleeve; diameters to suit applications; complete with premoulded urethane insulation on inner side of sleeve and 102 mm wide bituminous painted deck flange; with removable 1.29 mm thick aluminum hood and perforated collar; eg. Model SJ-31 Vandal Proof Stack Jack Flashing by Thaler Roofing Specialties Products Inc.

.2 Flashing for Flexible Conduit: Goose neck shaped aluminum flashing pipe sleeve; 305 mm high, diameters to suit application; complete with 102 mm wide bituminous painted deck flange; Model MEF-2A/2A1/2A2 Liquid Tight Flexible Conduit Flashing by Thaler Roofing Specialties Products Inc.

.3 Flashing for "B" Vent Pipes with Split Collars: 1.6 mm thick seamless spun aluminum sleeve flashing with sloping sides to allow for air movement, 305 mm high, diameters to suit; complete with 50 mm wide perforated aluminum vent holes at top of sleeve for air circulation, 102 mm wide bituminous painted deck flange, and a 1.6 mm thick split aluminum collar, eg. Model MEF-4A "B" Vent Flashings by Thaler Roofing Specialties Products Inc.

.4 Through Wall Scuppers: 1.6 mm thick prefinished aluminum sheet, factory welded construction; prefabricated to custom sizes as indicated on Drawings; eg. Through Wall Scupper by W. P. Hickman Company.

2.4 FABRICATION

.1 Shop fabricate flashing components as much as possible to requirements of applicable requirements of SMACNA Architectural Manual.

.2 Form sheet metal on bending brake.

.3 Perform shaping, trimming, and hand seaming on bench, where practicable, using proper sheet metal working tools.

.4 Fabricate material in clean shops, located away from areas where carbon steel is torch cut, ground, or cut with abrasive wheels to ensure carbon steel dust will not be embedded in prefinished surfaces.

.5 Clean tools and dies which have been used on carbon steel prior to fabrication to prevent contamination of surface with carbon steel dust.

.6 Form sections square, true, and accurate to size. Fabricate flashings free from distortion, waves, twists, buckles, or other defects detrimental to appearance and performance.

.7 Allow for thermal movement when forming, installing, interlocking, and soldering sheet metal components to avoid buckling, fullness of metal straining of joints or seams.

.8 Limit maximum length of flashing pieces to 2 400 mm.

.9 Double back exposed edges at least 12 mm for appearance and stiffness.

.10 Fabricate flashings, copings, closures, plastic boxes, pipe sleeves, and flashings for roof mounted equipment to details shown, unless otherwise indicated.

.11 Wipe and wash clean soldered joints immediately after joint is soldered to remove acid.

.12 Where soldered joints are absolutely necessary and where approved for use in prefinished metal, clean paint off both surfaces before soldering for minimum area necessary.

2.5 FINISHES

.1 Shop Priming:
- .1 Clean surfaces of rust, scale, grease and foreign matter prior to shop priming.
- .2 Do not prime surfaces designated to come into direct contact with concrete, or where field welding is required.
- .3 Prime components with minimum two coats primer.

.2 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

.3 Monochromatic Paint Coating on Sheet Steel: To ASTM A755/A755M; two-coat silicone modified polyester (SMP) coil coating, factory-applied to 0.028 mm dry film thickness; eg. WeatherXL by The Sherwin-Williams Company, colour as selected by Consultant.

.4 Faux-Woodgrain Powder Coated Finish on Sheet Aluminum: To AAMA 2605; electrostatically applied polyurethane powder, with ink-based wood grain pattern; Akzo Nobel Interpon D3000 Series, colour as selected by Consultant.

3 Execution

3.1 PREPARATION

.1 Prime substrate designated to receive a self-adhered membrane underlayment.

.2 Secure membrane underlayment in place and lap joints 100 mm.

3.2 INSTALLATION

.1 Provide flashings required for proper execution and completion of the Work in an acceptable manner, including metal flashing around mechanical and other equipment occurring on roof.

.2 Install sheet metal flashings with joints lapped, locked, cleated with S-cleats and sealed, or soldered, as required.

.3 Hem exposed edges 12 mm.

.4 Type of joints used shall be adequate for various conditions, subject to approval.

.5 Fabricate exposed fastening in such a manner to prevent water penetration at point of fastening. Use exposed fastening methods only when concealed fastening methods are not possible.

.6 Provide starter strips where indicated or required to present true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation.

.7 Make end joints where adjacent lengths of metal flashing meet using 300 mm long back-up flashing secured in place before installing flashing.

.8 Apply beads of sealant on face of back-up plate to seal ends of metal flashing.

.9 Leave 12 mm wide space between end of adjacent lengths of metal flashings.

.10 Fabricate back-up of same material and finish as metal flashing with which it is being used. Make back-up plate exact profile of flashing allowing for thickness of flashing joints.

.11 Form metal fascia with inner edge extended over fascia top and down cant to meet roofing aggregate. Nail with roofing nails and neoprene washers at 300 mm OC. Avoid placing nails in face of fascia, through membrane or flashing.

.12 Interlock counter flashing pieces with prefinished metal base flashing and fold locking seam into position ensuring complete sealing. Continue counter flashing down to hemmed and sprung position at base of cant and junction of aggregate.

.13 Use standing seam corner details at sheet metal flashings on horizontal curb, divider, and parapet corner locations.

3.3 ADJUSTING

.1 Imperfections in sheet metal, such as holes, dents, creases, or oil-canning, will be rejected.

.2 Make Good damage.

.3 Wash entire installation down, and leave in neat condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 51 00 - Built-up Bituminous Roofing.

.2 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM A47/A47M-99(2022)e1: Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M-22: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.3 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A153/A153M-23: Standard Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware.

.v CSA A500:16 (R2021): Building Guards.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating profiles, sizes, connections, size and type of fasteners, and related accessories.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in protective cartons or crates.

.3 Store Products at Place of the Work under protective cover.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Delta Prevention.
.2 Kee Industrial Products, Ltd.
.3 Safety Rail Company.
.4 Skyline Group.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Roof Step and Crossover Assembly: Free-standing counter-weighted crossover platform system, to accommodate pedestrian egress on roof; eg. KeeWalk Step-Over by Kee Industrial Products, Ltd.

2.3 DESIGN CRITERIA

.1 Design assembly to CSA A500, resisting minimum load of 91 kg in any direction applied to top rail.

2.4 COMPONENTS

.1 Rails and Posts: To ASTM A53/A53M, 38 mm OD, Schedule 40 steel pipe, galvanized finish.

.2 Fittings: To ASTM A47/A47M; Kee Klamp type, including elbows, crossovers, wall flanges, tees, and couplings; galvanized finish.

.3 Step and Platform Flooring: High grade nylon treads.

.4 Mounting Bases: Steel, galvanized, complete with rubber pad on underside.

.5 Counterweights: Steel, galvanized, complete with rubber pad on underside.

.6 Fasteners: Stainless steel, Type 304 or 305 as required.

2.5 FABRICATION

.1 Shop fabricate components in largest practical sections to accommodate delivery to Place of the Work.

.2 Fabricate railing assembly to CSA A500.

.3 Plug upright tops with weather- and UV-resistant material.

.4 Assemble components with joints tightly fitted, and secured with set screws tightened to minimum 425N of torque.

.5 Accurately form components to suit installation.

2.6 FINISHES

.1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

3 Execution

3.1 INSTALLATION

.1 Securely install Products straight, level, and plumb.

.2 Assemble components with joints tightly fitted and secured with set screws tightened to minimum 425N of torque.

.3 Coordinate installation with roof membrane and sheet metal flashing installation.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 12 23 - Structural Steel for Buildings.

.2 Section 05 21 00 - Steel Joist Framing.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 07 84 00 - Firestopping.

.5 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 ASTM C612-25: Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.2 ASTM C847-18(2024): Standard Specification for Metal Lath.

.3 ASTM E84-26a: Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E119-26: Standard Test Methods for Fire Tests of Building Construction and Materials.

.5 ASTM E605/E605M-19(2023): Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

.6 ASTM E736/E736M-19(2023): Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

.7 ASTM E759/E759M-92(2023): Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

.8 ASTM E760/E760M-92(2023): Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.

.9 ASTM E761/E761M-92(2023): Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.

.10 ASTM E859/E859M-23: Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

.11 ASTM E937/E937M-93(2023): Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

.12 ASTM E1513/E1513M-93(2023): Standard Practice for Application of Sprayed Fire-Resistive Materials (SFRMs).

.13 AWCI Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials.

.14 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

.15 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.16 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.17 ULC List of Equipment and Materials.

1.3 SEQUENCING

.1 Perform fire protection work on a given floor prior to proceeding with fire protection work on next floor.

.2 Coordinate and schedule fire protection work to avoid delays in progress of the Work.

.3 Do not install board fire protection on structural members until piping and other construction behind fire protection has been completed, uninterrupted coverage can be provided and need for subsequent cutting and patching can be eliminated.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, certifying compliance with specified performance criteria.

1.5 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past 5 years.

1.6 QUALIFICATIONS

.1 Applicator: A firm specializing in applying spray-applied fire resistive coatings; licensed or certified as an applicator by Product manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products to Place of the Work in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaging shall bear UL labels for fire hazard and fire-resistance classifications.

.3 Store Products above ground, in a dry location, protected from weather. Remove damaged packages found unsuitable for use from Place of the Work.

1.8 AMBIENT CONDITIONS

.1 When prevailing outdoor temperature at Place of the Work is less than 4 degrees C, maintain minimum substrate and ambient temperature of 4 degrees C prior to, during and minimum 24 hours after application of spray-applied fire resistive material.

.2 When required to maintain progress of the Work, Provide heated protective enclosures to maintain temperatures. Refer to Section 01 50 00.

.3 Provide adequate ventilation of not less than 4 air changes per hour to allow proper drying of spray-applied fire resistive material during and subsequent to application.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Carboline.
.2 GCP Applied Technologies, Inc.
.3 Isolatek International.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Spray-Applied Fire Resistive Material
- .1 Deflection (ASTM E759/E759M): The material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.
- .2 Bond Impact (ASTM E760/E760M): The material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.
- .3 Cohesion / Adhesion (ASTM E736/E736M): The material applied over uncoated or galvanized steel shall have an average bond strength greater than 7.2 kPa.
- .4 Air Erosion (ASTM E859/E859M): $\leq$ 0.27 g/m^2.
- .5 Compressive Strength (ASTM E761/E761M): The material shall not deform more than 10 percent when subjected to a crushing force of 68.9 kPa.
- .6 Corrosion Resistance (ASTM E937/E937M): The material shall not promote corrosion of steel.
- .7 Combustibility (CAN/ULC S114): Noncombustible.
- .8 Surface Burning Characteristics (ASTM E84 or CAN/ULC S102): Class A
  - .1 Flame Spread Index = 0.
  - .2 Smoke Developed Index = 0.
- .9 Density (ASTM E605/E605M): The material shall meet the minimum individual and average density values as listed in the appropriate UL/ULC design or as required by the authority having jurisdiction, or shall have a minimum average density of 240 kg/m^3.

.2 Conform to procedures for conducting tests and reporting tested values to CAN/ULC S101.

2.3 MATERIALS

.1 Spray-Applied Fire Resistive Material (SFRM): Inorganic Portland cement-based dry mix spray-applied fire resistive material; eg. Cafco Blazeshield II by Isolatek International.

.2 Refractory Mineral Wool Board Fire Protection: Rigid boards to ASTM C612, Class 4; 144 kg/m^3 nominal density; produced from asbestos free materials by combining refractory mineral wool manufactured from slag with thermosetting resin binders; and having the following physical properties:
- .1 Thermal Resistance: RSI 0.76 @ 24 degrees C.
- .2 Surface Burning Characteristics (ASTM E84):
  - .1 Flame Spread Index = 15.
  - .2 Smoke Developed Index = 5.
- .3 Manufacturer and Product Name: eg. Cafco-board Mineral Wool Board Fire Protection by Isolatek International.

.3 Fastening Accessories: For each fire resistive assembly in which mineral wool board fire protection serves as rigid fire protection, provide a board fastening system complying with the related UL design or other acceptable testing and inspecting organization's report.

.4 Metal Lath: To ASTM C847; 1.4 kg/m^2 steel lath, galvanized.

.5 Water: Potable.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure surfaces to receive fire protection are free of oil, grease, loose mill scale, dirt, paints and primers (other than those listed and tested), and other foreign materials that could impair satisfactory bonding to the surface.

.3 Ensure clips, hangers, supports, sleeves, and other attachments to substrate are to be placed by others prior to application of spray-applied fire resistive materials.

.4 Ensure that the installation of ducts, piping, conduit, or other suspended equipment shall not take place until application of sprayed fire protection is complete in an area.

3.2 PREPARATION

.1 Prepare substrates in accordance with Underwriters' Laboratories of Canada (ULC) clarification entitled Sprayed-Applied Fire-Resistive Materials New Requirements for the Use of Sprayed-Applied Fire-Resistive Materials on Primed Steel Surfaces.

.2 Provide bonding agents and metal lath as required.

3.3 APPLICATION

.1 Apply Products to ASTM E1513/E1513M.

.2 Apply Products to the required thicknesses and densities necessary to achieve the fire resistance ratings indicated on Drawings.

.3 Do not apply Products to steel floor decks prior to the completion of concrete work on that deck.

.4 Do not apply Products to the underside of roof deck until the roof is completely installed and tight, penthouses are complete, mechanical units have been placed, and roof traffic has ceased.

.5 Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to be sprayed.

.6 Apply bonding materials as per the identified ULC fire resistance design and the manufacturer's written recommendations.

.7 Topcoat materials shall be the type recommended and approved by the manufacturer of each spray-applied fire resistive material required for the applications indicated.

.8 Install mineral wool board fire protection to comply with requirements for thicknesses, number of layers, construction of joints and corners, and fastening methods referenced in the appropriate fire resistance design indicated.

.9 Coordinate installation of board fire protection with other construction to minimize cutting into, or removal of, already installed board material.

3.4 FIELD QUALITY CONTROL

.1 Refer to Section 01 40 00.

.2 Test spray-applied fire resistive material for thickness and density to ASTM E605/E605M or the AWCI Standard Practice for the Testing and Inspection of Field-Applied Sprayed Fire-Resistive Materials.

3.5 ADJUSTING

.1 Make Good damaged fire protection.

3.6 PROTECTION

.1 Protect completed installation as specified in Section 01 70 00.

.2 Provide final protection and maintain conditions in a manner acceptable to Consultant and authorities having jurisdiction.

.3 Ensure installed Products are not damaged at time of final inspection.

.4 Make Good damaged Products before Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 03 41 13 - Precast Concrete Hollowcore Planks.

.3 Section 04 22 00 - Concrete Unit Masonry.

.4 Section 05 50 00 - Metal Fabrications.

.5 Section 07 81 00 - Applied Fireproofing.

.6 Section 07 92 00 - Joint Sealants.

.7 Section 09 21 16 - Gypsum Board Assemblies.

.8 Section 20 05 55 - Firestopping and Smoke Seal Systems.

1.2 REFERENCES

.1 ASTM C303-21: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.

.2 ASTM C1104/C1104M-19(2025): Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.3 ASTM E119-26: Standard Test Methods for Fire Tests of Building Construction and Materials.

.4 ASTM E2174-24: Standard Practice for On-Site Inspection of Installed Firestop Systems.

.5 ASTM E2393-20a: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.6 ASTM E3456-26: Standard Practice for On-Site Identification of Firestop Systems and Judgments.

.7 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

.8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.10 CAN/ULC-S115-2018: Standard Method of Fire Tests of Firestop Systems.

.11 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

.12 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.13 ULC List of Equipment and Materials.

1.3 PREINSTALLATION MEETINGS

.1 Prior to commencement of firestopping, arrange and conduct a preinstallation meeting as specified in Section 01 30 00.

.2 Preinstallation Meeting: Discuss proposed methods and materials to be used in instances.

.3 Representatives of Owner, Consultant, Contractor, installer, manufacturer, and authority having jurisdiction are to be in attendance.

.4 Do not conduct meeting unless identified parties are present.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Sealant manufacturer's standard installation instructions and standard drawings, indicating ULC or WHI test designations.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating sizes of openings, nature of penetrations, and tested method of firestop and smoke seal protection being proposed.
.1 Shop Drawings are to be sealed, signed and dated by manufacturer's design engineer.
.2 Submit Shop Drawings to Consultant and authority having jurisdiction for review and approval.

1.6 CERTIFICATES

.1 Submit certification as specified in Section 01 30 00.

.2 Certificate: Sealant manufacturer's letter of certification verifying that Products meet or exceed specified requirements.

1.7 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.

1.8 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit manufacturer's field inspection reports as specified in Section 01 40 00.

.2 Manufacturer's Field Inspection Reports: Manufacturer's written acceptance of installation based on regular inspections.

1.9 QUALIFICATIONS

.1 Manufacturer's Design Engineer: A registered professional engineer licensed to practice in Place of the Work and having minimum 10 years documented experience designing firestop and smoke seal systems.

.2 Installer: A firm specializing in installing firestop and smoke seal systems, approved or certified as an installer by Product manufacturer.

1.10 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-ups: One full-size mock-up of each penetration firestop system, fire-resistive joint system, perimeter fire containment system, and continuity head-of-wall joint system, complete with smoke seals required on Project. Include representative substrates and penetrating components, for each fire rating required at each type of wall, floor, and roof construction.

.3 Comply with project requirements as to thickness and density of application to achieve required fire rating.

.4 Accepted mock-ups will be used as the standard for acceptance of the Work.

.5 Remove and replace installed Product that does not conform to accepted mock-up.

.6 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products to Place of the Work in their original unopened packages.

.3 Store Products in enclosed shelter, preventing damage to containers.

1.12 AMBIENT CONDITIONS

.1 Do not apply sealants when temperature of substrate material and surrounding air is below 5 degrees C.

.2 Maintain sealant at minimum 18 degrees C for best workability.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 3M Company Canada.
- .2 Carboline.
- .3 Hilti Canada.
- .4 Nuco Inc.
- .5 Specified Technologies Inc.
- .6 Tremco.
- .7 The Rectorseal Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN AND PERFORMANCE CRITERIA

.1 Seal empty holes and penetrations at floors, fire rated walls and smoke barrier walls.

.2 Seal holes accommodating penetrating items such as cables, cable trays, pipes, ducts and conduits.

.3 Design firestopping system to maintain integrity of time rated construction by providing a seal against spread of heat, flame and smoke.

.4 Systems shall be ULC or ULI classified or listed by WHI for required time rating.

.5 Provide firestopping and smoke sealing systems to CAN/ULC S115 and as described below:
- .1 Asbestos free materials and systems fully capable of maintaining an effective barrier against gases, flame and smoke in compliance with CAN/ULC S115, not exceeding opening sizes stated.
- .2 Service Penetration Assemblies: Certified by CAN/ULC S115 and used by ULC Guide 40 U19. Service components listed as certified in this guide are noted under Label Service of ULC.

.6 Fire resistance rating of fire stopping material assembly must meet or exceed the fire resistance rating of the floor or wall section being penetrated.

.7 Provide an elastomeric seal at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control. Do not use cementitious or rigid seals at such locations.

.8 Damming and back up materials, supports and anchoring devices shall be to manufacturer's recommendations, and in strict accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.9 Firestopping compounds shall not contain volatile solvents or require special application to protect plastic pipe from firestopping compound.

2.3 MATERIALS

.1 Primer: As recommended by sealant manufacturer for specific material, substrate and end use.

.2 Firestop Accessories: To CAN/ULC S115; ULC labelled; firestop foams, boards, blocks, collars, wraps, puttys and plugs; as listed in tested assemblies.

.3 Firestop Insulation: To CAN/ULC S702, Type 2; mineral fibre manufactured from rock or slag, suitable for manual application; and having the following physical properties when tested to the identified standard:
.1 Density (ASTM C303): 72 kg/m^3.
.2 Combustibility (CAN/ULC S114): Noncombustible.
.3 Melt Temperature: > 1175 degrees C.
.4 Surface Burning Characteristics: To CAN/ULC S102, as follows:
.1 Flame Spread Index = 0.
.2 Smoke Developed Index = 0.
.5 Moisture Sorption (ASTM C1104/C1104M): 0.04 percent.
.6 Smoulder Resistance (CAN/ULC S129): 0.01 percent.

.4 Firestop Sealants: To CAN/ULC S115; ULC labelled; non-sagging type for vertical applications, and self-levelling type for floor applications; types as listed in tested assemblies.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Confirm compatibility of surfaces to receive sealant materials.

.3 Verify surfaces of openings are sound, clean, dry, and ready to receive application of sealant.

.4 Verify that penetration elements are securely fixed and properly located.

3.2 PREPARATION

.1 Protect adjacent surfaces and equipment from damage.

.2 Clean contact surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of sealant.

.3 Remove incompatible materials which affect bond by scraping, brushing, water or solvent cleaning, or sandblasting.

3.3 APPLICATION

.1 Install firestop insulation in compacted thicknesses required by ULC design. Compress insulation approximately 33 percent.

.2 Apply sealant in strict accordance with ULC certification.

.3 Coordinate and cooperate with adjacent, contiguous and related materials trades, such as concrete, masonry, gypsum board, plumbing, conduit, electrical wiring, communication systems, etc., to ensure a proper and timely installation.

.4 Seal holes and voids made by penetrating items to ensure an effective fire and smoke barrier.

.5 Seal intersections and penetrations of floors, ceilings, walls and columns.

.6 Seal around cutouts for facility services.

.7 Wrap non-insulated heated pipes that may be subject to movement with a non-combustible smooth material to permit the pipe to move without damaging the firestopping and smoke seal.

.8 Maintain the integrity of any insulation and vapour retarders on insulated pipes and ducts at the fire separation.

.9 Where floor openings exceed 100 mm in width and may be subjected to traffic or loading, install cover plate systems capable of supporting same loading as floor.

.10 Identify installed penetration firestop systems, fire-resistive joint systems, perimeter fire containment systems, and continuity head-of-wall joint systems to ASTM E3456.
.1 Affix firestop identification labels/tags to, or adjacent to, each installed system.

3.4 FIELD QUALITY CONTROL

.1 Perform field inspection as specified in Section 01 40 00.

.2 Inspect penetration firestop systems to ASTM E2174.

.3 Inspect fire-resistive joint systems and perimeter fire containment systems to ASTM E2393.

.4 Examine finished penetrations to ensure proper installation before concealing or enclosing any areas of work.

.5 Keep areas of work accessible until inspection has been completed.

.6 Manufacturer's Field Service: Inspect to verify and confirm that systems installation is in strict accordance with manufacturer's and ULC requirements.

.7 Correct defective work and re-inspect to verify compliance with requirements.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Immediately remove spots, smears, stains, residues, adhesives, etc., from installation, including from adjacent surfaces.

.3 Do not use Products containing volatile solvents.

.4 Leave the Work in a clean and satisfactory condition.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect firestop and smoke seal assemblies from damage until Ready-for-Takeover.

.3 Make Good damaged firestop and smoke seal assemblies immediately prior to Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 03 41 13 - Precast Concrete Hollow Core Planks.

.3 Section 04 05 23 - Masonry Accessories.

.4 Section 07 92 00 - Joint Sealants.

.5 Section 07 95 13 - Expansion Joint Cover Assemblies.

1.2 REFERENCES

.1 ASTM E1612/E1612M-94(2022): Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures.

.2 ASTM E1783/E1783M-24: Standard Specification for Preformed Architectural Strip Seals for Buildings and Parking Structures.

.3 ASTM E2393-20a: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

1.3 PREINSTALLATION MEETINGS

.1 Refer to Section 01 30 00.

.2 Preinstallation Meeting: One week prior to commencement of installation, conduct a preinstallation meeting with Contractor, Consultant, installer, and affected Subcontractors to review and discuss installation methods, conditions, adjacent construction, and anticipated structural movements.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, profiles, sizes, details, affected adjacent construction, anchorage, finishes, splices, and accessories.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating pertinent dimensions, construction, opening dimensions, and ULC listing numbers.

1.6 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: One full-size, 300 mm long sample of each specified Product.

1.7 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 30 00.

.2 Manufacturer's Instructions: WHMIS Safety Data Sheets (SDS).

1.8 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions; sufficient quantity for inclusion in operation and maintenance manual.

1.9 QUALIFICATIONS

.1 Applicators: A firm specializing in applying preformed joint seals, having minimum 5 years documented experience.

1.10 CERTIFICATIONS

.1 Submit manufacturer certifications as specified in Section 01 30 00.

.2 Certifications: Independent written documentation verifying the Products are:
.1 Capable of withstanding 65 degrees C for three hours while compressed down to the minimum of movement capability without evidence of bleeding of the impregnation medium from the material.
.2 Capable of self-expansion to the maximum movement capability dimension after being subjected to a heat stability test and allowed to cool to room temperature.
.3 Free of waxes and wax compounds using FTIR and DSC testing.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in original, intact, and labelled containers.

.3 Handle and protect Products to prevent damage and deterioration.

1.12 AMBIENT CONDITIONS

.1 Apply Products only when ambient air and substrate temperatures are 5 degrees C and rising.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Master Builders Solutions Canada, Inc.
.2 Nystrom Inc.
.3 Sika Emseal.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Preformed, Wall Expansion Joint Seal (PJS-1): To ASTM E1612/E1612M; pre-compressed, silicone and impregnated cellular foam core, with factory-applied silicone bellows, complete with epoxy adhesive and silicone sealant bands; as follows:
.1 Total Joint Movement Capability: Plus 30 percent, minus 25 percent nominal material size.
.2 Joint Seal Width: As indicated on Drawings.
.3 Manufacturer and Product Name: eg. DSM System by Sika Emseal.

.2 Preformed, Fire-Rated, Vandal-Resistant, Wall Expansion Joint Filler (PJS-2): To ASTM E1612/E1612M; 100 mm deep, suitable size for joint width indicated on Drawings; watertight, vandal-resistant sealant system, comprised of a fire retardant impregnated expanding foam backing, and hardened tamper-resistant bellows on both sides; accommodating joint movement of plus or minus 25 percent; fire rated for 2 hours when tested to UL2079; Intumescent Red colour on one side, and colours as selected by Consultant on opposite side; eg. Emshield SecuritySeal SSW2 by Sika Emseal.

.3 Preformed, Exterior Expansion Joint Filler (PJS-3): To ASTM E1783/E1783M; binary sealant system, comprised of a factory-applied low modulus silicone, acrylic-impregnated expanding foam sealant and closed-cell EVA foam; accommodating joint movement of plus or minus 50 percent, suitable size for joint width indicated on Drawings; eg. Seismic Colorseal by Sika Emseal, colours as selected by Consultant.

.4 Preformed, Acoustic Seal (PJS-4): Mass-loaded, fire-resistant foam core factory-coated with commercial-grade silicone on two sides; widths and depths as detailed on Drawings; QuietJoint SHH by Sika Emseal, colours as selected by Consultant.

.5 Secondary Joint Backing: Preformed expanding foam, accommodating movement of plus and minus 25 percent; size to suit joint size; Backerseal by Sika Emseal.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify surfaces are free of oil, grease, laitance, water repellents, dirt, rust, and other foreign substances.

.3 Ensure sufficient joint opening depth to receive full depth of specified joint filler.

3.2 PREPARATION

.1 Clean joint opening of contaminants and impurities.

.2 Repair spalled, irregular or unsound joint surfaces.

.3 Remove protruding roughness to ensure joint sides are smooth.

3.3 INSTALLATION

.1 Align work plumb, level and accurately fitted, and free from distortion or defects.

.2 Ensure Products are centered over expansion joint.

.3 Set Products to proper width for ambient air temperature at time of setting.

.4 Install horizontal expansion joint fillers slightly recessed from slab surface.

.5 Install vertical expansion joint fillers in joint, flush with or near to surface, into wet adhesive, and allow to expand to fill joint.

.6 Mitre expansion joint seals where material will be joined, and wipe silicone onto mitred face.

.7 Apply continuous band of silicone between substrate and silicone bellows.

3.4 FIELD QUALITY CONTROL

.1 Refer to Section 01 40 00.

.2 Inspect installed fire resistive joint systems to ASTM E2393.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove joint seal materials from adjacent surfaces.

.3 Leave work area broom clean.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Allow completed installation to cure for minimum 48 hours, longer if temperatures fall below 9 degrees C during curing period, before allowing traffic across joint.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 04 05 23 - Masonry Accessories.

.3 Section 06 20 00 - Finish Carpentry.

.4 Section 06 41 00 - Architectural Wood Casework.

.5 Section 07 13 26 - Self-Adhering Sheet Waterproofing.

.6 Section 07 26 00 - Vapour Retarders.

.7 Section 07 27 00 - Air Barriers.

.8 Section 07 41 13 - Metal Roof Panels.

.9 Section 07 42 93.13 - Extruded Aluminum Soffit Panels.

.10 Section 07 42 93.23 - Linear Metal Soffits.

.11 Section 07 62 00 - Sheet Metal Flashing and Trim.

.12 Section 07 84 00 - Firestopping.

.13 Section 07 91 00 - Preformed Joint Seals.

.14 Section 07 92 21 - Sprayed Foam Sealant.

.15 Section 08 12 13 - Hollow Metal Frames.

.16 Section 08 41 13 - Aluminum-Framed Entrances and Storefront.

.17 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.18 Section 08 51 13 - Aluminum Windows.

.19 Section 08 80 00 - Glazing.

.20 Section 09 21 16 - Gypsum Board Assemblies.

.21 Section 09 30 00 - Tiling.

.22 Section 09 51 23 - Acoustical Tile Ceilings.

.23 Section 22 42 00 - Plumbing Fixtures and Fittings.

1.2 REFERENCES

.1 ASTM C919-24: Standard Practice for Use of Sealants in Acoustical Applications.

.2 ASTM C920-18(2024): Standard Specification for Elastomeric Joint Sealants.

.3 ASTM C1193-25: Standard Guide for Use of Joint Sealants.

.4 ASTM C1330-23: Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.5 ASTM C1521-19(2025): Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

.6 CAN/CGSB-19.13-M87: Sealing Compound, One Component, Elastomeric, Chemical Curing.

.7 CAN/CGSB-19.17-M90: One Component Acrylic Emulsion Base Sealing Compound.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate samples of each specified joint sealant, illustrating available colour selections.

1.4 MANUFACTURER REPORTS

.1 Submit manufacturers' reports as specified in Section 01 40 00.

.2 Manufacturers' Reports: Manufacturer field review reports, as specified below.

1.5 QUALIFICATIONS

.1 Applicators: Workers experienced with applying joint sealants, having minimum three years documented experience.

1.6 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-ups: One full-size, 300 mm long mock-up of each required joint sealant applied to each required substrate, demonstrating joint width and tooled appearance. Allow to cure

.3 Conduct adhesion pull tests on mock-ups to ASTM C1521, Method A - Destructive Procedure. Sealant adhesion pull tests to fail only cohesively, not adhesively.

.4 Replace failed mock-ups, and re-test until successful results are achieved.

.5 Accepted mock-ups will be used as the standard for acceptance of the Work.

.6 Remove and replace installed Product that does not conform to accepted mock-up.

.7 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in manufacturer's sealed packages.

.3 Store Products in warm, dry conditions.

1.8 AMBIENT CONDITIONS

.1 Do not install solvent curing sealants in enclosed building spaces.

.2 Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.9 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 5 years, including coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of either adhesion or cohesion, or do not cure.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of exterior weatherseal sealants, exterior high-movement sealants, glazing sealants, interior general purpose sealants, and interior mildew-resistant sealants having Product considered acceptable for use:
.1 Dow Chemical Company.
.2 General Electric.
.3 Master Builders Solutions Canada, Inc.
.4 Tremco Construction Products Group.

.2 Manufacturers of exterior flashing sealants having Product considered acceptable for use:
.1 Henry (a Carlisle Company).
.2 Tremco Construction Products Group.
.3 W. R. Meadows of Canada Limited.

.3 Manufacturers of interior tiling sealants having Product considered acceptable for use:
.1 Mapei.

.4 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Seal gaps between dissimilar Products and equipment, visible or otherwise, to protect building components from air infiltration and moisture penetration.

2.3 MATERIALS

.1 Exterior Weatherseal Sealant (SEAL-EXT): To ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A and O; one-part, moisture curing, low modulus polyurethane sealant; accommodating joint movement of plus or minus 35 percent, with 30- to 90-minute skin time; eg. Dymonic FC by Tremco Construction Products Group, colours as selected by Consultant.

.2 Exterior High Movement Sealant (SEAL-EXT-HM): To ASTM C920, Type S, Grade NS, Class 50, Use NT, T, M, A, O, and I; one-part medium modulus, low VOC, UV stable, non-sag polyurethane sealant; accommodating joint movement of plus 100 percent and minus 50 percent, with 120-minute skin time; eg. Dymonic 100 by Tremco Construction Products Group, colours as selected by Consultant.

.3 Exterior Flashing Sealant (SEAL-EXT-FL): To ASTM C920, Type S, Grade NS, Class 35, Use NT; one-part, silyl-terminated polyether (STPE) polymer-based sealant; accommodating joint movement of plus or minus 35 percent; eg. 925 BES Sealant by Henry (a Carlisle Company), colour as selected by Consultant.

.4 Glazing Sealant (SEAL-GLZ): To CAN/CGSB-19.13-M, Type MG-2-25-A-L; one-part, moisture curing, acetoxy silicone sealant; eg. Proglaze by Tremco Construction Products Group, Clear colour.

.5 Interior General Purpose Sealant (SEAL-INT-GP): To CAN/CGSB-19.17-M; one-part, siliconized acrylic latex, mildew-resistant, accommodating joint movement of plus or minus 12-1/2 percent; eg. Tremflex 834 by Tremco Construction Products Group, colours as selected by Consultant.

.6 Interior Mildew-Resistant Sealant (SEAL-INT-MR): To ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; one-part, acetoxy silicone sealant, complete with integral fungicide; eg. Tremsil 200 by Tremco Construction Products Group, colours as selected by Consultant.

.7 Interior Tiling Sealant (SEAL-INT-TILE): Single-component, 100 percent silicone sealant; neutral cure, low odour type; Mapesil T Plus by Mapei, colours to match adjacent tile grout colours.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Isopropyl alcohol or xylene; non-corrosive and non-staining type, as recommended by sealant manufacturer; compatible with joint forming materials.

.3 Backer Rod: To ASTM C1330, Type B - Bi-cellular; rod diameter sized 130 - 150 percent larger than designated joint width.

.4 Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

3 Execution

3.1 PREPARATION

.1 Clean and prime joints.

.2 Remove loose materials and foreign matter which might impair adhesion of sealant.

3.2 APPLICATION

.1 Install joint sealants to ASTM C1193.

.2 Install acoustical sealants to ASTM C919.

.3 Apply sealant with pressure gun having proper size nozzle and extrusion nozzle where required.

.4 Use sufficient pressure to fill joints solid to joint filler.

.5 Shape nozzle to finish sealant in a neat concave bead.

.6 Apply sealant sufficiently in from normal face of joints to form a positive shadow line.

.7 Tool sealant smooth and slightly concave, free from ridges, wrinkles, air pockets, and embedded impurities.

.8 Ensure proper configuration and depth achieved. Depth of sealant at point of adhesion shall be not more than one-half the width.

.9 Install high movement weatherseal sealant (SEAL-EXT-HM) in areas where anticipated differential movement exceeds movement capabilities of other specified exterior weatherseal sealants.

3.3 FIELD QUALITY CONTROL

.1 Inspect completed sealant joints for adhesion and cohesion to ASTM C1521.

.2 Inspect completed sealant joints for holes, gaps, and areas where leaks could become present.

.3 Reject failed joints, joints filled with only skin bead, and joints having insufficient volume of sealant.

.4 Remove material from rejected joints, clean, and re-seal to attain proper width-to-depth joint coverage.

3.4 MANUFACTURER SERVICES

.1 Arrange for sealant manufacturer's representative to be present during mock-up adhesion pull tests, and prior to commencement of sealant installation.

.2 Consult with manufacturer's representative as to joint conditions.

.3 Arrange for manufacturer's representative to regularly inspect application (minimum twice per week).

.4 Submit written field review reports, confirming sealant installation is in strict accordance with manufacturer's recommendations.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove excess sealant and droppings using a cleaner which will not damage adjacent surfaces.

.3 Make Good surfaces that have become defaced or disfigured as a result of sealant application.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 40 00 - Cold-Formed Metal Framing.

.4 Section 07 21 00 - Thermal Insulation.

.5 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.

.6 Section 07 26 00 - Vapour Retarders.

.7 Section 07 27 00 - Air Barriers.

.8 Section 07 92 00 - Joint Sealants.

.9 Section 08 12 13 - Hollow Metal Frames.

.10 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.11 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.12 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

.1 SWI Sealant and Caulking Guide Specification.

.2 CAN/ULC-S710.1-2019: Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.3 CAN/ULC S710.2-11: Standard for Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Application.

.4 CAN/ULC-S711.1-2019: Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.5 CAN/ULC S711.2-11: Standard for Thermal Insulation - Bead Applied Two-Component Polyurethane Air Sealant Foam, Part 2: Application.

1.3 SEQUENCING

.1 Sequence installation of Products in conjunction with air barriers and vapour retarders.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product characteristics, performance criteria, and limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 30 00.

.2 Manufacturer's Instructions: Manufacturer's standard installation instructions, indicating preparation and installation requirements and techniques.

1.6 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in undamaged containers and original packaging, indicating name of manufacturer and Product.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 DuPont de Nemours, Inc.
.2 Henkel Canada Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Ensure continuity of building enclosure air barrier in conjunction with Products specified in other Sections.

.2 Seal gaps between building enclosure components and opening frames.

2.3 MATERIALS

.1 Sprayed Foam Sealant (SFS-1): One-component polyurethane sealant, to CAN/ULC-S710.1.

.2 Sprayed Foam Sealant (SFS-2): Two-component polyurethane sealant, to CAN/ULC-S711.1.

3 Execution

3.1 PREPARATION

.1 Ensure substrates are clean, dry, and free of oil, grease, dirt, excess mortar, and other contaminants.

3.2 INSTALLATION

.1 Install sprayed foam sealant in accordance with authorities having jurisdiction.

.2 Avoid overfilling restricted spaces.

.3 Seal gaps between air barrier membranes and frames installed in assembly openings.

.4 Apply sprayed foam sealant Type SFS-1 to cracks or openings 6 mm to 50 mm wide. Conform to CAN/ULC S710.2.

.5 Apply sprayed foam sealant Type SFS-2 to gaps over 50 mm wide, and to voids in hidden cavities. Conform to CAN/ULC S711.2.

3.3 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean extra material from adjacent surfaces.

.3 Leave suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 03 41 13 - Precast Concrete Hollow Core Planks.

.3 Section 04 22 00 - Concrete Unit Masonry.

.4 Section 07 51 00 - Built-up Bituminous Roofing.

.5 Section 07 62 00 - Sheet Metal Flashing and Trim.

.6 Section 07 84 00 - Firestopping.

.7 Section 07 91 00 - Preformed Joint Seals.

.8 Section 07 92 00 - Joint Sealants.

.9 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.2 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.5 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes (Metric).

.6 ASTM E119-26: Standard Test Methods for Fire Tests of Building Construction and Materials.

.7 ASTM E814-24: Standard Test Method for Fire Tests of Penetration Fire Stop Systems.

.8 CSA G40.20-13 (R2023): General Requirements for Rolled or Welded Structural Quality Steel.

.9 CSA G40.21-13 (R2023): Structural Quality Steel.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, component profiles and sizes, and applicable UL Classification or Warnock-Hersey Listings.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, affected adjacent construction, anchorage, finishes, splices, and accessories.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store Products as specified in Section 01 61 00.

.2 Provide temporary protective cover to anodized aluminum, stainless steel and bronze finished surfaces.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 The C/S Group.
- .2 InPro Architectural Products.
- .3 MM Systems Corporation.
- .4 Watson Bowman Acme Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESIGN AND PERFORMANCE CRITERIA

.1 Joint Covers: Permit restrained movement of joint without disengagement of cover. Describe special movement conditions.

.2 Fire Rated Joint Covers:
- .1 UL classified or WH listed.
- .2 Tested to ASTM E119 and ASTM E814, including hose stream test at full rated period.
- .3 Design expansion joint covers with fire rating not less than fire rating of adjacent construction.
- .4 Design expansion joint covers from inorganic materials, that will not create smoke or contribute fuel during a fire.

.3 Allowable Loads:
- .1 Normal Position:
  - .1 Uniform Load: 9.58 kPa.
  - .2 Concentrated Load: 8.90 kN.
  - .3 Deflection: $\leq$ 1.5 mm.
- .2 Fully Open Position:
  - .1 Uniform Load: 9.58 kPa.
  - .2 Concentrated Load: 8.90 kN.
  - .3 Stress: $\leq$ 193 053 kPa.
  - .4 Deflection: $\leq$ 3 mm.

.4 Spherical and Pin Type Centering Bars must be fully engaged with base member.

2.3 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063-T5 or 6061-T651 alloys.

.2 Sheet Steel: To CSA G40.20.

.3 Sections and Plates: To CSA G40.21.

.4 Stainless Steel: To ASTM A240/A240M, Type 304.

2.4 ACCESSORIES

.1 Water Barrier: Flexible polyvinyl chloride, EPDM.

.2 Fire Barrier: Ceramic fiber insulation.

.3 Flame Sealant: As specified in Section 07 84 00.

.4 Centering Bars: C-1074 tempered steel with protective coating.

.5 Fasteners: As recommended by joint cover manufacturer.

2.5 FABRICATION

.1 Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

.2 Fabricate special transitions, corner fittings, and end closures. Mitre and weld joints.

.3 Flexible Floor Joint Covers:
.1 Fasten cover plates through center of spring steel centering bars.
.2 Centering Bars: Complete with a corrosion resistant coating; attached to nylon spheres or steel pins, which are retained in tracks of extruded base members. Set centering bars diagonally at 250 mm OC maximum.
.3 Cover Plates: Aluminum with smooth or recessed surface.

.4 Roof Joint Covers: Provide sealing washers and gaskets, splice covers, counterflashing flanges, and end closures.

.5 Fire Rated Joint Covers: Complete with fire barrier and flame sealant to provide required fire rating.

2.6 FINISHES

.1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.3 Stainless Steel: To AISI No. 4 - Brushed.

.4 Aluminum - Floor and Roof Applications: Manufacturer's standard mill finish.

.5 Aluminum - Wall and Ceiling Applications: Anodized to AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.6 Expandable Gasket: Colours as selected by Consultant.

3 Execution

3.1 INSTALLATION

.1 Install joint covers plumb, level and accurately fitted, flush with adjacent surfaces, and free from distortion or defects.

.2 Rigidly anchor work to substrate.

.3 Set expansion joint system to proper width for ambient air temperature at time of setting.

.4 Provide water barriers at exterior joints and where otherwise indicated on Drawings. Provide drainage fittings where required.

3.2 ADJUSTING

.1 Adjust joint cover to freely accommodate joint movement.

3.3 CLEANING

.1 Remove manufacturer's standard protective wrap only after work in adjacent areas has been completed.

.2 Clean exposed surfaces with a suitable cleaner that will not harm factory applied finishes.

3.4 SCHEDULE

.1 Floor-to-Floor Joint Cover
  .1 50 mm Wide Expansion Joint - Fire Rated: eg. Flush Thinline GFT-200 with FB22 Fire Barrier by The C/S Group.

.2 Floor-to-Wall Joint Cover
  .1 50 mm Wide Expansion Joint - Fire Rated: eg. Flush Thinline GFTW-200 with FB22 Fire Barrier by The C/S Group.

.3 Wall-to-Wall Joint Cover
  .1 50 mm Wide Expansion Joint - Fire Rated: eg. Flush Thinline FWF-200 with FB24 Fire Barrier by The C/S Group.

.4 Wall-to-Wall Corner Joint Cover
  .1 50 mm Wide Expansion Joint - Fire Rated: eg. Flush Thinline FWFC-200 with FB24 Fire Barrier by The C/S Group.

.5 Ceiling-to-Ceiling Joint Cover
  .1 50 mm Wide Expansion Joint (ACT Ceiling): eg. Flush Thinline FCF-200 by The C/S Group.
  .2 50 mm Wide Expansion Joint (GB Ceiling): eg. Flush Thinline FWF-200 by The C/S Group.

.6 Ceiling-to-Wall Joint Cover
  .1 50 mm Wide Expansion Joint (GB Ceiling to CMU or GB Wall): eg. Flush Thinline FWFC-200 by The C/S Group.
  .2 50 mm Wide Expansion Joint - Fire Rated (GB Ceiling to GB Wall): eg. Flush Thinline FWFC-200 with FB24 Fire Barrier by The C/S Group.

.7 Exterior Roof-to-Roof Joint Cover
  .1 50 mm Wide Expansion Joint: eg. Roof Cover RJT-200 by The C/S Group.
  .2 50 mm Wide Expansion Joint: eg. Roof Cover BRJ-200 with Secondary Seal by The C/S Group.

.8 Exterior Wall-to-Wall Joint Cover
  .1 50 mm Wide Expansion Joint - Fire Rated: eg. Exterior Wall Cover SF200 with FB24 Fire Barrier by The C/S Group.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 05 10 - Masonry Mortaring and Grouting.

.3 Section 04 22 00 - Concrete Unit Masonry.

.4 Section 07 26 00 - Vapour Retarders.

.5 Section 07 27 00 - Air Barriers.

.6 Section 07 92 00 - Joint Sealants.

.7 Section 07 92 21 - Sprayed Foam Sealant.

.8 Section 08 13 13 - Hollow Metal Doors.

.9 Section 08 14 00 - Wood Doors.

.10 Section 08 71 00 - Finishing Hardware.

.11 Section 08 80 00 - Glazing.

.12 Section 09 21 16 - Gypsum Board Assemblies.

.13 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 AAMA/WDMA/CSA 101/I.S. 2/A440-26: North American Fenestration Standard / Specification for Windows, Doors and Skylights.

.2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM E283/E283M-26: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.4 CSA A500:16 (R2021): Building Guards.

.5 CSA W59:24: Welded Steel Construction.

.6 CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.

.7 CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).

.8 CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

.9 CSDMA Recommended Dimensional Standard for Steel Doors and Frames.

.10 CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.

.11 NFPA 80-2025: Standard for Fire Doors and Other Opening Protectives.

.12 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.13 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

.14 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.15 CAN/ULC-S105:2016 (R2020): Standard Specification for Fire Door Frames Meeting Performance Required by CAN/ULC-S104.

.16 CAN/ULC-S106-15 (R2020): Standard Method for Fire Tests of Window and Glass Block Assemblies.

.17 ULC List of Equipment and Materials.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets indicating frame components, available ratings, sizes and thicknesses.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating opening sizes, frame configurations, fire ratings, anchor types and spacings, locations of cut outs, reinforcing, and shop finishes.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

1.6 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of two years, covering against twisting, buckling, weld failure, and corrosion.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 All Steel Doors 2000 Limited.
- .2 Artek Door (1985) Limited.
- .3 Baron Metal Industries Inc.
- .4 Daybar Industries Limited.
- .5 Fleming Door Products Ltd.
- .6 Gensteel Doors.
- .7 Metal Door Limited.
- .8 Trillium Steel Doors Limited.
- .9 Vision Hollow Metal Limited.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Frame Assemblies: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104 and CAN/ULC-S106.

2.3 PERFORMANCE CRITERIA

.1 Exterior Hollow Metal Frames: To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
.1 Air Leakage of Glazed Frames (ASTM E283/E283M): $\leq$ 1.0 L/s•m^2 @ 75 Pa.
.2 Assembly Thermal Transmittance (ANSI/NFRC 100): U $\leq$ 2.15 W/m^2 degrees C.
.3 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 DESIGN CRITERIA

.1 Design Products designated to act as building guards by applicable regulatory requirements to CSA A500.

2.5 MATERIALS

.1 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Type B; cold-rolled sheet steel, with regular and paintable galvanneal coatings as noted; thicknesses as indicated.

.2 Bituminous Coating: Fibrous asphalt emulsion.

.3 Sprayed Foam Sealant: As specified in Section 07 92 21.

.4 Touch-up Primer: Zinc-rich alkyd primer.

.5 Welding Materials: To CSA W59.

.6 Joint Sealant: As specified in Section 07 92 00, types as follows:
.1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
.2 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.

2.6 MANUFACTURED UNITS

.1 Exterior Hollow Metal Door and Multi-Opening Frames: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; two-piece construction with continuous thermal break; sizes and configurations as indicated on Drawings; eg. TB Series Mercury 3 Energy Efficient Thermal Break Frame by Fleming Door Products Ltd.

.2 Interior Hollow Metal Double Egress Door Frames: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes as indicated on Drawings; eg. DE-Series Frame by Fleming Door Products Ltd.

.3 Interior Hollow Metal Door and Multi-Opening Frames: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes and configurations as indicated on Drawings; eg. M-Series Frame by Fleming Door Products Ltd.

2.7 ACCESSORIES

.1 Reinforcements: Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
.1 Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
.2 Hinge Reinforcements: 3.51 mm.
.3 Door Closer and Holder Reinforcements: 2.74 mm.

.2 Anchors: Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
.1 T-Strap Type: 1.30 mm.
.2 Stirrup-strap Type: 50 x 250 mm size, 1.60 mm thick.
.3 Jamb Floor Type: 1.60 mm thick.
.4 Stud Type: 1.00 mm thick.

.3 Jamb Spreaders: 1.00 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.

.4 Mortar Guard Boxes: 0.84 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.

.5 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper-proof screws.

.6 Weatherstripping for Thermally-Broken Frames: Compression type; S44 by Pemko.

.7 Threshold Saddles: Thermally broken aluminum threshold; 273x3AFG Thermal Barrier Saddle by Pemko.

.8 Bumpers: Resilient rubber.

.9 Thermal Break: Rigid neoprene or polyvinyl chloride (PVC) extrusion.

2.8 FABRICATION

.1 Fabricate frames as welded units.

.2 Conform to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.

.3 Fabricate fire-rated frames to CAN/ULC-S105.

.4 Provide fire labels to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.

.5 Fabricate frames with fixed mullions, to profiles shown, with hardware reinforcement plates welded in place.

.6 Welding
.1 Perform welding to CSA W59.
.2 Fill open joints, seams, and depressions with filler or by continuous brazing or welding.
.3 Grind exposed welds smooth and flush, to true sharp arrises and profiles.
.4 Sand welds to a smooth, true, uniform finish.

.7 Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame.

.8 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.

.9 Reinforce frames wider than 1 220 mm with roll formed steel channels fitted tightly into frame head, flush with top.

.10 Fit frames with channel or angle spreaders, minimum two per frame, to ensure proper frame alignment. Install stiffener plates to spreaders between frame trim where required to prevent bending of trim and to maintain alignment when setting and during construction.

.11 Provide adjustable T-strap anchors in frames to be installed in masonry openings, spaced at 600 mm OC.

.12 Where frames are required to terminate at finished floor, Provide plates for anchorage to floor slab.

.13 Prepare interior door frames for single stud door silencers, as follows:
.1 Single Door Frames: Three on strike jamb.
.2 Double Egress Door Frames: Two on head for each door leaf.

.14 Fabricate frames and screens to accommodate scheduled glazing. Secure glazing stops to frames with counter sunk oval head sheet metal screws.

.15 Prepare frames for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill, and tap components.

.16 Thermally-Broken Frames:
- .1 Provide wall and floor anchors suitable for installation, purpose made not to permit thermal conductivity.
- .2 Do not fix sections together with screws, grommets or other thermally conductive fastening device.
- .3 Provide full frame width drip caps.
- .4 Provide compression type weatherstripping.
- .5 Conform to accepted Shop Drawings.

2.9 FINISHES

.1 Paintable Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.

.2 Regular Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

3 Execution

3.1 INSTALLATION

.1 Install Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

.2 Install Products plumb, square, aligned, without twist, and at correct elevation.

.3 Install threshold saddles across bottom of exterior door frames.

.4 Coordinate with masonry and wallboard construction for anchor placement.

.5 Fill frames set in masonry walls and partitions solid with non-shrink grout or mortar, as specified in Section 04 05 10.

.6 Connect exterior frames to transition sheet membranes to achieve an airtight seal.

.7 Fill gaps between exterior frames and adjacent wall assemblies with sprayed foam sealant, as specified in Section 07 92 21.

.8 Seal gaps between frames and walls with joint sealant, as specified in Section 07 92 00.

3.2 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Field Inspection and Testing: Arrange for independent testing agency to test installed Products designated as building guards; verifying installed Products meet performance criteria required by applicable regulatory requirements.

.3 Make Good rejected Products not meeting required performance criteria.

.4 Re-test replacement Products at no additional cost to Owner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 08 12 13 - Hollow Metal Frames.

.2 Section 08 71 00 - Finishing Hardware.

.3 Section 08 80 00 - Glazing.

.4 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 AAMA/WDMA/CSA 101/I.S. 2/A440-26: North American Fenestration Standard / Specification for Windows, Doors and Skylights.

.2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM E283/E283M-26: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.4 CSA W59:24: Welded Steel Construction.

.5 CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.

.6 CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).

.7 CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

.8 CSDMA Recommended Dimensional Standard for Steel Doors and Frames.

.9 CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.

.10 NFPA 80-2025: Standard for Fire Doors and Other Opening Protectives.

.11 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.12 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

.13 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.14 CAN/ULC-S702.1-14 (R2019): Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.15 CAN/ULC-S705.1-18: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.

.16 ULC List of Equipment and Materials.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, component sizes and thicknesses, and available finishes.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating door elevations and sizes, internal reinforcement, fire ratings, closure method, size and location of cut outs, and shop finishes.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store hollow metal doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

1.6 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of two years, covering against twisting, buckling, delamination of steel stiffeners, weld failure, and corrosion.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 All Steel Doors 2000 Limited.
.2 Artek Door (1985) Limited.
.3 Baron Metal Industries Inc.
.4 Daybar Industries Limited.
.5 Fleming Door Products Ltd.
.6 Gensteel Doors.
.7 Metal Door Limited.
.8 Trillium Steel Doors Limited.
.9 Vision Hollow Metal Limited.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Doors: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

2.3 PERFORMANCE CRITERIA

.1 Exterior Hollow Metal Doors: To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
.1 Air Leakage of Glazed Doors (ASTM E283/E283M): $\leq$ 5.1 L/s•m^2 @ 75 Pa.
.2 Assembly Thermal Transmittance (ANSI/NFRC 100):
.1 Glazed Doors: U $\leq$ 3.94 W/m^2 degrees C.
.2 Opaque Doors: U $\leq$ 2.56 W/m^2 degrees C.
.3 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 MATERIALS

.1 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Type B; cold-rolled sheet steel, with regular and paintable galvanneal coatings as noted; thicknesses as indicated.

.2 Foamed-in-Place Insulation: To CAN/ULC-S705.1; injected polyurethane foam having a LTTR thermal resistance of RSI $\geq$ 0.9 per 25 mm of thickness.

.3 Semi-Rigid Board Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre semi-rigid board having an aged thermal resistance of RSI $\geq$ 0.68 per 25 mm of thickness.

.4 Touch-up Primer: Zinc-rich alkyd primer.

.5 Welding Materials: To CSA W59.

2.5 MANUFACTURED UNITS

.1 Exterior Hollow Metal Flush Doors: 45 mm thick, constructed as follows:
- .1 Door Faces: Sheet steel panels, 1.30 mm nominal coated thickness, flush design, paintable galvanneal finish.
- .2 Vertical Steel Stiffeners: Sheet steel profiles, 0.76 mm nominal coated thickness, 22 mm deep, interlocking design, regular galvanneal finish.
- .3 Door Edges: Tack welded.
- .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
- .5 Core: Foamed-in-place insulation.
- .6 Manufacturer and Product Name: eg. Trio-E by Fleming Door Products Ltd.

.2 Interior Hollow Metal Flush Doors - Fire Rated: 45 mm thick, fire rating as scheduled; constructed as follows:
- .1 Door Faces: Sheet steel panels, 1.60 mm nominal coated thickness, flush design, paintable galvanneal finish.
- .2 Vertical Steel Stiffeners: Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvanneal finish.
- .3 Door Edges: Continuously welded.
- .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
- .5 Core: Semi-rigid board insulation.

.3 Interior Hollow Metal Flush Doors - Non-Rated: 45 mm thick; constructed as follows:
- .1 Door Faces: Sheet steel panels, 1.60 mm nominal coated thickness, flush design, paintable galvanneal finish.
- .2 Vertical Steel Stiffeners: Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvanneal finish.
- .3 Door Edges: Continuously welded.
- .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
- .5 Core: Semi-rigid board insulation.

2.6 ACCESSORIES

.1 Reinforcements: Commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
- .1 Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
- .2 Hinge Reinforcements: 3.51 mm.
- .3 Door Closer and Holder Reinforcements: 2.74 mm.

2.7 FABRICATION

.1 Fabricate doors to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.

.2 Provide fire labels to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.

.3 Provide continuous faces free from joints, tool markings and abrasions; with hardware reinforcement plates welded in place.

.4 Welding
- .1 Perform welding to CSA W59.
- .2 Fill open joints, seams, and depressions with filler, or by continuous brazing, or welding.
- .3 Grind exposed welds smooth and flush, to true sharp arrises and profiles.
- .4 Sand welds to a smooth, true, uniform finish.

.5 Fabricate doors to accommodate scheduled glazing. Secure glazing stops to doors with counter sunk oval head sheet metal screws.

.6 Prepare doors for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill, and tap components.

.7 Reinforce and stiffen doors with vertical steel stiffeners spaced at 152 mm OC, continuous for full height of door, laminated as follows:
- .1 Exterior Doors: To inner door face.
- .2 Interior Doors: To both door faces.

.8 Completely fill door cores with specified core materials.

.9 Reinforce door edges with channel reinforcing.

.10 Bevel stiles minimum 3 mm.

.11 Door Edge Seams:
- .1 Continuously Welded: Continuously weld door edge seams to a smooth, seamless appearance.
- .2 Tack Welded: Tack weld door edge seams at 150 mm OC and fill remaining seam with body filler. Finish to a smooth, seamless appearance.

.12 Provide flush top edge and bottom closures on exterior doors, sealed watertight.

2.8 FINISHES

.1 Paintable Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.

.2 Regular Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

3 Execution

3.1 INSTALLATION

.1 Install doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

3.2 TOLERANCES

.1 Diagonal Distortion: $\leq$ 1.5 mm measured with straight edge, corner to corner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 06 20 00 - Finish Carpentry.

.2 Section 06 24 00 - High Pressure Decorative Laminate.

.3 Section 06 41 00 - Architectural Wood Casework.

.4 Section 08 12 13 - Hollow Metal Frames.

.5 Section 08 71 00 - Finishing Hardware.

.6 Section 08 80 00 - Glazing.

.7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ANSI A135.4-2004: Basic Hardboard.

.2 ANSI A208.1-2009: Particleboard.

.3 AWMAC NAAWS 5.0-2026: North American Architectural Woodwork Standards.

.4 CSA O141:23: Canadian Standard Lumber.

.5 ANSI/DHI A115.IG-1994: Installation Guide for Doors and Hardware.

.6 NFPA 80-2025: Standard for Fire Doors and Other Opening Protectives.

.7 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.8 CAN/ULC-S113:2016 (R2020): Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies.

.9 ULC List of Equipment and Materials.

.10 ANSI/WDMA I.S. 1A-13: Industry Standard for Interior Architectural Wood Flush Doors.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating door elevations, stile and rail reinforcement, cutouts, and internal blocking.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Pile Products flat on level supports to prevent warping.

.3 Protect face of first unit by placing plywood or cardboard between supports and unit face. Cover top unit in similar manner.

.4 Store Products in a dry, well-ventilated area.

.5 Seal top and bottom edges of Products stored for an extensive period of time.

1.5 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of three years, covering against warping beyond installation tolerances, and delamination or degradation of faces.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 Boccam Inc.
- .2 Boreal Architectural Ltd.
- .3 Door-Lam.
- .4 Jeld-Wen, Inc.
- .5 Lambton Door.
- .6 Marshfield Door Systems.
- .7 Masonite International Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Doors: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

2.3 MATERIALS

.1 Lumber: To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content.

.2 Particleboard: To ANSI A208.1; 448 kg/m^3 solid particleboard.

.3 Fire Rated Board: Solid non-combustible, inorganic composite board; ULC labelled.

.4 Agrifiber Board: To ANSI A208.1; core material fabricated from residual material from grain crop, similar in composition to particleboard; ULC labelled.

.5 Decorative Laminate: To ANSI/NEMA LD3; colours, textures and patterns as selected by Consultant; and as follows:
- .1 Non-Rated Doors: High pressure decorative laminate Type HPDL, Vertical Surface type, as specified in Section 06 24 00.
- .2 Fire Rated Doors: Flame-retardant high pressure decorative laminate Type HPDL-FR, Vertical Surface type, as specified in Section 06 24 00.

2.4 MANUFACTURED UNITS

.1 Solid Core Flush Wood Doors - Fire Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 45-, 60- or 90-minute rating as scheduled; 3-ply construction, as follows:
- .1 Lock Blocks, Top Rails, and Bottom Rails: Solid lumber, bonded to core material.
- .2 Stiles: 3 mm thick veneer, longitudinally laminated by hot pressing with Type 1 structural glue, (LVL), including 22 mm piece of hardwood, matched with faces, for total width of 107 mm.
- .3 Core: Fire rated board.
- .4 Face Assembly Adhesive: Type I - Waterproof.
- .5 Core Assembly Adhesive: Type II - Water-resistant.
- .6 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
- .7 Edges: To AWMAC NAAWS 5.0, Type D - Solid Wood edgeband, door face edge shows.
- .8 Door Faces: Decorative laminate.

.2 Solid Core Flush Wood Doors - 20-Minute Fire Rated: To CAN/ULC-S113 and ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 3-ply construction, as follows:
.1 Lock Blocks, Top Rails, and Bottom Rails: Solid lumber, bonded to core material.
.2 Stiles: 3 mm thick veneer, longitudinally laminated by hot pressing with Type 1 structural glue, (LVL), including 22 mm piece of hardwood, matched with faces, for total width of 107 mm.
.3 Core: Agrifiber board.
.4 Face Assembly Adhesive: Type I - Waterproof.
.5 Core Assembly Adhesive: Type II - Water-resistant.
.6 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
.7 Edges: To AWMAC NAAWS 5.0, Type D - Solid Wood edgeband, door face edge shows.
.8 Door Faces: Decorative laminate.

.3 Solid Core Flush Wood Doors - Non-Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 3-ply construction, as follows:
.1 Lock Blocks, Top Rails, and Bottom Rails: Solid lumber, bonded to core material.
.2 Stiles: 3 mm thick veneer, longitudinally laminated by hot pressing with Type 1 structural glue, (LVL), including 22 mm piece of hardwood, matched with faces, for total width of 107 mm.
.3 Core: Particleboard.
.4 Face Assembly Adhesive: Type I - Waterproof.
.5 Core Assembly Adhesive: Type II - Water-resistant.
.6 Glass Stop: Matching wood, flat bead type.
.7 Edges: To AWMAC NAAWS 5.0, Type D - Solid Wood edgeband, door face edge shows.
.8 Door Faces: Decorative laminate.

2.5 FABRICATION

.1 Fabricate Products to AWMAC NAAWS 5.0, Premium Grade.

.2 Provide and prepare sufficient amount of blocking in edges to accommodate installation of scheduled hardware.

.3 Fabricate fire-rated Products with sufficient wood blocking to fasten scheduled hardware.

.4 Fabricate paired doors with no bevel on meeting edges.

.5 Prepare doors to receive scheduled door hardware. Machine cut relief for hinges and closures. Core doors for handsets and cylinders. Coordinate with Section 08 71 00.

.6 Provide and prepare openings for glazing.

.7 Apply decorative laminate to AWMAC NAAWS 5.0, and as specified in Section 06 24 00.

2.6 FINISHES

.1 Apply one coat uncut shellac to door cutouts.

3 Execution

3.1 PREPARATION

.1 Arrange with Section 09 90 00 to finish glass stops, top rails, bottom rails, and stile edges to match decorative laminate door faces prior to door, glazing, and hardware installation.

3.2 INSTALLATION

.1 Install Products to ANSI/DHI A115.IG.

.2 Do not trim fire rated wood doors.

.3 Trim non-rated wood doors only as necessary, and as follows:
.1 Door Width: ≤ 5 mm.
.2 Door Height: Trimmed equally on top and bottom edges, to a combined maximum of 10 mm.

.4 Prepare doors to receive door hardware to AWMAC NAAWS 5.0.

3.3 TOLERANCES

.1 Distortions measured with straight edge over not more than 1 066 x 2 134 mm surface area, as follows:
.1 Diagonal Distortion: ≤ 6 mm measured from corner to corner.
.2 Vertical Distortion: ≤ 6 mm measured from top to bottom.
.3 Width Distortion: ≤ 6 mm measured from edge to edge.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 09 21 16 - Gypsum Board Assemblies.

.4 Section 09 90 00 - Painting and Coating.

.5 Section 26 08 10 - Access Panels.

1.2 REFERENCES

.1 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes (Metric).

.3 ASTM E119-26: Standard Test Methods for Fire Tests of Building Construction and Materials.

.4 NFPA 80-2025: Standard for Fire Doors and Other Opening Protectives.

.5 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.6 ULC List of Equipment and Materials.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, profiles, accessories, locations and dimensions.

1.4 CERTIFICATIONS

.1 Submit certification reports as specified in Section 01 30 00.

.2 Fire Test Certification Report: Certifying performance within specified fire rating requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00

.2 Store Products in a dry, protected, well-vented area.

.3 Remove protective wrapping immediately after installation.

1.6 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 5 years, covering parts against defects.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Acudor Access Doors.
.2 Bilco Canada.
.3 Cendrex.
.4 Nystrom, Inc.
.5 The Williams Brothers Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Assemblies: To NFPA requirements for fire rated class indicated in schedule.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; Cold-rolled steel sheet, thicknesses as specified below.

.2 Extruded Aluminum: To ASTM B221M, 6061-T5 alloy, mill finish; thicknesses as specified below.

.3 Insulation: To CAN/ULC-S702.1, Type 1; non-rigid mineral fibre insulation, made from rock or slag fibers.

.4 Gypsum Board: As specified in Section 09 21 16.

2.4 MANUFACTURED UNITS

.1 Gypsum Board Wall and Ceiling Access Panel - Fire-Rated: 1-1/2 hour B-label with maximum temperature rise of 110 degrees C; suitable for both horizontal or vertical installations; sizes as indicated on Drawings; and meeting the following characteristics:
.1 Door: 48 mm deep, 1.21 mm thick sheet steel, insulated with non-rigid mineral fibre insulation, completely filling door cavity.
.2 Box Frame: 1.52 mm thick sheet steel, complete with 25 mm wide, 0.61 mm thick galvanized steel perforated flange.
.3 Closer: Automatic, spring-type.
.4 Hinge: Fully concealed, 170 degree opening pivot-type.
.5 Latch: Self-latching direct action latch, opposite hinge.
.6 Lock: Ultra lock with key (Code 151).
.7 Finish: Powder coated paintable finish.
.8 Manufacturer and Product Name: eg. Model WB-FR DW Standard Drywall Fire Rated Access Door by The Williams Brothers Corporation.

.2 Gypsum Board Wall Access Panel - Non-Rated: Suitable for vertical installation in gypsum board partitions; sizes as indicated on Drawings; and meeting the following characteristics:
.1 Door: 1.52 mm thick sheet steel, recessed design to receive gypsum board infill.
.2 Box Return Frame: 1.52 mm thick sheet steel, complete with 25 mm wide, 0.61 mm thick galvanized steel perforated flange.
.3 Hinge: Fully-concealed rod type hinge.
.4 Latch: Flush, stainless steel cam.
.5 Lock: Medium barrel cylinder lock.
.6 Finish: Powder coated paintable finish.
.7 Manufacturer and Product Name: eg. Model WB-RDW Recessed Drywall Access Door by The Williams Brothers Corporation.

.3 Gypsum Board Ceiling Access Panel - Non-Rated: Suitable for horizontal installation in gypsum board ceilings; sizes as indicated on Drawings; and meeting the following characteristics:
.1 Door: 2.0 mm thick extruded aluminum, complete with 16 mm thick moisture resistant gypsum board infill, brush gasket, and safety chain.
.2 Box Return Frame: 2.0 mm thick extruded aluminum, concealed flange of depth to match adjacent ceiling board thickness.
.3 Hinge: Concealed pivot hinge, allowing for door removal.
.4 Latch: Push to open.
.5 Finish: Mill finish.
.6 Manufacturer and Product Name: eg. Model WB-NTG Trimless Gypsum Access Door by The Williams Brothers Corporation.

.4 Masonry Wall Access Panel - Fire-Rated: 1-1/2 hour B-label with maximum temperature rise of 110 degrees C; suitable for both horizontal or vertical installation; and meeting the following characteristics:
.1 Door and Trim: 48 mm deep, 1.21 mm thick sheet steel, with rolled safety edge on inside of door; insulated with non-rigid mineral fibre insulation, completely filling door cavity.
.2 Return Frame: 1.52 mm thick sheet steel, complete with 4 masonry strap anchors.
.3 Panel Closer: Automatic, spring-type.
.4 Hinge: Fully-concealed rod type hinge, 170 degree opening.
.5 Latch: Self-latching direct-action latch, opposite hinge.
.6 Lock: Ultra lock with key included with each door.
.7 Finish: Powder coated paintable finish.
.8 Manufacturer and Product Name: eg. Model WB-FRS-U Standard Ultra Fire Rated Access Door by The Williams Brothers Corporation.

.5 Masonry Wall Access Panel - Non-Rated: Suitable for both horizontal or vertical installation in masonry or concrete partitions or bulkheads; and meeting the following characteristics:
.1 Door: 1.90 mm thick sheet steel.
.2 Return Frame: 1.21 mm thick sheet steel, complete with 4 masonry strap anchors.
.3 Hinges: Fully-concealed offset type, 170 degree opening.
.4 Latch: Flush, stainless steel cam.
.5 Lock: Key cylinder lock with key (Code 151).
.6 Finish: Powder coated paintable finish.
.7 Manufacturer and Product Name: eg. Model WB-GP Premium General Purpose Access Door by The Williams Brothers Corporation.

2.5 FINISHES

.1 Aluminum: Standard factory mill finish.

.2 Powder Coated Paintable Finish: Electrostatically spray-applied polymer powder, White colour; paintable type.

3 Execution

3.1 PREPARATION

.1 Coordinate installation of access panels in masonry walls with Section 04 22 00.

.2 Coordinate installation of access panels in gypsum board partitions and ceilings with Section 09 21 16.

.3 Coordinate locations of access panels with facility services Subcontractors.

3.2 INSTALLATION

.1 Install Products straight, plumb and level.

.2 Install Products flush with adjacent surfaces.

.3 Install Products for long life under hard use.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 07 92 00 - Joint Sealants.

.3 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.4 Section 08 51 13 - Aluminum Windows.

.5 Section 08 71 00 - Door Hardware.

.6 Section 08 80 00 - Glazing.

.7 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA CW-10-26: Care and Handling of Architectural Aluminum from Shop to Site.

.2 AAMA 501.1-17: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.

.3 AAMA 502-21: Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

.4 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.5 AAMA SFM-1-14: Aluminum Storefront and Entrance Manual.

.6 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.7 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.8 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.9 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.10 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes (Metric).

.11 ASTM D3363-20: Standard Test Method for Film Hardness by Pencil Test.

.12 ASTM E283/E283M-26: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.13 ASTM E330/E330M-14(2021): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.14 ASTM E331-00(2023): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

.15 ASTM E783-02(2018): Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.16 ASTM E1105-15(2023): Standard Test Method for Field Measurement of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.17 CSA A440.4:19 (R2024): Window, Door, and Skylight Installation.

.18 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.19 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, component sizes, anchorage and fasteners, glazing, door hardware, internal drainage details and thermal break details.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
.1 Large scale details of members and materials, of brackets and anchorage devices, and of connection and jointing details;
.2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
.3 Dimensions and thicknesses;
.4 Glazing details, description of materials including catalogue numbers, Product names, and manufacturer's name;
.5 Aluminum alloy and temper designations;
.6 Finish specifications; and
.7 Other pertinent data.

.3 Submit documentation of:
.1 Thicknesses, profiles, and descriptions of components used in assembly;
.2 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project and will meet specified performance criteria.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.5 CERTIFICATES

.1 Submit certifications as specified in Section 01 40 00.

.2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

1.6 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.

1.7 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.8 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing aluminum-framed entrance systems, licensed to practice at Place of the Work.

.2 Fabricator and Installer: A firm specializing in fabricating and installing aluminum-framed entrance systems, having minimum 5 years documented experience.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Conform to AAMA CW-10.

.3 Take precautionary measures and adequately protect aluminum and aluminum finishes to prevent damage thereto during fabrication, storage, shipping, handling, and installation.

.4 Deliver, handle, and store units by methods approved by manufacturer. Protect from damage and staining.

1.10 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 5 years, covering the following:
.1 Finish: Replace any unit whose finish shows defects such as but not limited to delamination, blistering or excessive fading.
.2 Performance: Replace or repair any unit with air leakage, water leakage, defects, or malfunctions under normal usage.

.3 Installer's Extended Warranty: For a period of two years, protecting against air leakage, water leakage, operational defects, and malfunctions under normal usage.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Aerloc Industries Ltd.
.2 Alumicor.
.3 Alwind Industries, Ltd.
.4 Kawneer.
.5 Oldcastle BuildingEnvelope.
.6 Sherwood Windows, Ltd.
.7 Windspec Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Exterior Entrance Doors: Thermally-broken tubular aluminum extrusions, factory anodized finish, site glazed with sealed insulating glass units, complete with specified door hardware; hung in curtain wall framing as specified in Section 08 44 13.

.2 Interior Vestibule Doors and Frames: Tubular aluminum extrusions, factory anodized finish, site glazed with single pane tempered safety glass, complete with specified door hardware, anchorage, and attachment devices.

2.3 PERFORMANCE CRITERIA

.1 Exterior Entrance Doors: Meeting the following performance criteria:
  .1 Air Leakage (ASTM E283/E283M): $\leq$ 5.08 L/s•m^2 @ 75 Pa.
  .2 Water Penetration:
    .1 Static Pressure (ASTM E331): No penetration @ 479 Pa.
    .2 Dynamic Pressure (AAMA 501.1): No penetration @ 479 Pa.
  .3 Wind Load Resistance (ASTM E330/E330M): Limit mullion deflection to L/175 when measured at a cross pressure of 1 436 Pa.
  .4 Assembly Thermal Transmittance (ANSI/NFRC 100): U $\leq$ 3.94 W/m^2 degrees C.
  .5 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 DESIGN CRITERIA

.1 Design assemblies to AAMA SFM-1.

.2 Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, as calculated to requirements of applicable regulatory requirements.

.3 Design assemblies to drain water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within system to exterior.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063-T54 alloy.

.2 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.

.3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.

.4 Steel Sections: Shaped to suit mullion sections.

.5 Fasteners: Stainless steel, 300 Series.

.6 Thermal Break: Rigid polyamide.

.7 Glazing Materials: As specified in Section 08 80 00.

.8 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.

.9 Joint Sealants: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

.10 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

2.6 COMPONENTS

.1 Exterior Entrance Frames: As specified in Section 08 44 13.

.2 Interior Vestibule Frames: Extruded aluminum sections, 45 x 114 mm size profile; flush glazing stops; drainage holes; internal weep drainage system; eg. Trifab VG 450 by Kawneer.

.3 Exterior Entrance Doors: Extruded aluminum sections, 57.2 mm deep profile, 127 mm wide top rail and vertical stiles, 152 mm wide cross rail, 190 mm wide bottom rail; thermally broken with interior tubular section insulated from exterior; rectangular glazing stops; eg. 560 Insulclad by Kawneer.

.4 Interior Vestibule Doors: Extruded aluminum sections, 44.5 mm deep profile, 127 mm wide top rail and vertical stiles, 152 mm wide cross rail, 190 mm wide bottom rail; beveled glazing stops; eg. 500 Wide Stile by Kawneer.

.5 Compensating Receptors: 51 x 140 mm size, extruded aluminum sections, head and jamb types.

.6 Metal Flashing: 2.0 mm thick extruded aluminum, finish to match mullion sections where exposed.

.7 Glass: As specified in Section 08 80 00, Types as indicated on Door Schedule.

2.7 HARDWARE

.1 Door Handles: 25 mm OD aluminum tubing, ladder style, with factory anodized finish.

.2 Hinges: 114.3 x 101.6 mm size, commercial quality steel, radius corner standard template butt style, 5 knuckle construction with two stainless steel ball bearings and non-rising removable pin; 1-1/2 pairs per door leaf.

.3 Drop Arm Holder: Cast aluminum, surface-mounted, pivoting rubber-tipped holder-arm; anodized finish.

.4 Weatherstripping, Sill Sweep Strips, Thresholds: Manufacturers standard type to suit application, finish to match door and frame.

.5 All other finish hardware is specified in Section 08 71 00. This may include panic hardware, closers, powered door operators, locks, and cylinders.

2.8 FABRICATION

.1 Fabricate Products to AAMA SFM-1.

.2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.

.3 Make joints flush, hairline, and weatherproof.

.4 Arrange fasteners and attachments to conceal from view.

.5 Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

.6 Prepare doors and frames for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components as required.

2.9 FINISHES

.1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.2 Steel Door Hardware: To ANSI/BHMA 652 - Satin Chromium Plated.

.3 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.4 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.5 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

3 Execution

3.1 INSTALLATION

.1 Install Products to CSA A440.4.

.2 Permanently fasten frames to building structure.

.3 Align assembly plumb and level, free of warp or twist.

.4 Maintain assembly dimensional tolerances, aligning with adjacent work.

.5 Install hardware using templates provided.

.6 Install glass as specified in Section 08 80 00.

.7 Provide perimeter joint sealant as specified in Section 07 92 00.

3.2 TOLERANCES

.1 Deviation From Plumb and Level: $\leq$ 3 mm in 3 000 mm.

3.3 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Field Inspection and Testing: One set of tests on a completed exterior door installation, conducted by independent testing agency to AAMA 502, verifying compliance with specified performance criteria.

.3 Perform field tests as follows:
.1 Air Infiltration Test: To ASTM E783.
.2 Water Infiltration Test: To ASTM E1105.

.4 Make Good Products not meeting specified performance criteria.

.5 Re-test replacement Products at no additional cost to Owner.

3.4 ADJUSTING

.1 Adjust operating door panels, door hardware, and accessories for tight fit at contact points, and weatherstripping for smooth operation and weather tight closure.

.2 Lubricate hardware and moving parts.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean glass and aluminum surfaces.

.3 Do not scratch or damage surfaces.

.4 Do not remove protective cover from door units until after final cleaning operations have been completed.

3.6 PROTECTION

.1 Protect installed Products as specified in Section 01 70 00.

.2 Provide protective coatings on surfaces subject to damage.

.3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 05 40 00 - Cold-Formed Metal Framing.

.3 Section 07 26 00 - Vapour Retarders.

.4 Section 07 27 00 - Air Barriers.

.5 Section 07 84 00 - Firestopping.

.6 Section 07 92 00 - Joint Sealants.

.7 Section 07 92 21 - Sprayed Foam Sealant.

.8 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.9 Section 08 51 13 - Aluminum Windows.

.10 Section 08 80 00 - Glazing.

.11 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA CWM-19: The Curtain Wall Manual.

.2 AAMA CW-10-26: Care and Handling of Architectural Aluminum from Shop to Site.

.3 AAMA 501.1-17: Standard Test Method for Water Penetration of Windows, Curtain Walls and doors Using Dynamic Pressure.

.4 AAMA 502-21: Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

.5 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.6 AAMA 1503-09: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

.7 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.8 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.9 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.10 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.11 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.12 ASTM E90-23: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.13 ASTM E283/E283M-26: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.14 ASTM E330/E330M-14(2021): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.15 ASTM E331-00(2023): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

.16 ASTM E783-02(2018): Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.17 ASTM E1105-15(2023): Standard Test Method for Field Measurement of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.18 CAN/CGSB-79.1-M91: Insect Screens.

.19 CSA A500:16 (R2021): Building Guards.

.20 CAN/CSA-S157-05 (R2010): Strength Design in Aluminum.

.21 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.22 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
- .1 Large scale details of members and materials, of brackets and anchorage devices, and of connection and jointing details;
- .2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
- .3 Dimensions and thicknesses;
- .4 Glazing details, description of materials including catalogue numbers, Product names, and manufacturer's name;
- .5 Aluminum alloy and temper designations;
- .6 Finish specifications; and
- .7 Other pertinent data.

.3 Submit documentation of:
- .1 Compliance with AAMA CWM.
- .2 Thicknesses, profiles, and descriptions of components used in assembly.
- .3 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project, and will meet specified performance criteria.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.4 CERTIFICATES

.1 Submit certifications as specified in Section 01 40 00.

.2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

1.5 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.

1.6 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions; sufficient quantity for inclusion in operation and maintenance manual.

1.7 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing glazed aluminum curtain wall, licensed to practice at Place of the Work.

.2 Fabricator and Erector: A firm specializing in fabricating and erecting glazed aluminum curtain wall, having minimum 5 years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Conform to AAMA CW-10.

.3 Take precautionary measures and adequately protect aluminum and aluminum finishes to prevent damage thereto during fabrication, storage, shipping, handling and installation.

.4 Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.

1.9 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 5 years, covering the following:
.1 Finish: Replace any unit whose finish shows defects such as but not limited to delamination, blistering or excessive fading.
.2 Performance: Replace or repair any unit with air leakage, water leakage, defects, or malfunctions under normal usage.

.3 Installer's Extended Warranty: For a period of 5 years, protecting against air leakage, water leakage, operational defects, and malfunctions under normal usage.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Aerloc Industries Ltd.
.2 Alumicor.
.3 Alwind Industries, Ltd.
.4 Kawneer.
.5 Oldcastle BuildingEnvelope.
.6 Sherwood Windows, Ltd.
.7 Windspec Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Glazed Aluminum Curtain Wall: Extruded aluminum frame and operable vent sash sections, shop fabricated, with factory anodized finish; site glazed with sealed insulating glass units and insulated spandrel glass panels; complete with insect screens, operable vent hardware, door adapters, metal sills, metal flashings, metal closure panels, connection flanges, anchorages, and attachment devices.

.2 Configuration: As indicated on Window Schedule.

2.3 PERFORMANCE CRITERIA

.1 Glazed Aluminum Curtain Wall: To AAMA CWM; meeting the following performance criteria:
- .1 Air Infiltration (ASTM E283/E283M):
  - .1 Fixed: $\leq$ 0.3 L/s•m^2 @ 300 Pa.
  - .2 Operable Vent (Class AW-PG40-AP): $\leq$ 0.5 L/s•m^2 @ 300 Pa.
- .2 Water Penetration:
  - .1 Static Pressure (ASTM E331): No penetration @ 720 Pa.
  - .2 Dynamic Pressure (AAMA 501.1): No penetration @ 720 Pa.
- .3 Uniform Load (ASTM E330/E330M): Limit mullion deflection to L/175 when tested at a design load of 1 915 Pa, for both positive and negative directions.
- .4 Condensation Resistance Factor (AAMA 1503): $CRF_{frame} \geq 79$, $CRF_{glass} \geq 76$.
- .5 Sound Transmission Loss (ASTM E90): STC $\geq$ 31 dB, OITC $\geq$ 25 dB.
- .6 Assembly Thermal Transmittance (ANSI/NFRC 100):
  - .1 Fixed Units: U $\leq$ 2.15 W/m^2 degrees C.
  - .2 Operable Vents: U $\leq$ 2.56 W/m^2 degrees C.
- .7 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 DESIGN CRITERIA

.1 Design curtain wall assemblies to AAMA CWM.

.2 Design curtain wall assemblies to drain water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system to the exterior.

.3 Design curtain wall assemblies with glazing cavities compartmentalized horizontally to prevent air movement.

.4 Design intermediate members within units to be either solid or tubular design to suit wind loading, weight carrying requirements, and wind deflection limitations.

.5 Design coupling mullions to permit unit module construction and provide for thermal expansion. When required reinforce wind load carrying members with steel reinforcement suitably treated to prevent electrolytic action.

.6 Design light gauge aluminum products to CAN/CSA-S157.

.7 Mullion Deflection Limits: Maintain integrity of glass and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components, or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.

.8 Design anchors, fasteners and braces so as to limit their structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.

.9 Design glass not to exceed a statistical probability of failure of 8 units per 1000 units representing a safety factor of 2.5.

.10 Design frames so that edges of inner pane of insulating glass units do not fall more than 8 degrees C below temperature of the centre of inner pane.

.11 Design and supply floor edge angles for support of curtain wall mullions and provide the necessary anchorage to support eccentric loads on the angle. Arrange for angles to be cast in to the floor slabs. Submit a fully dimensioned plan drawing to locate angles.

.12 Design operable vents to restrict opening to not more than 100 mm.

.13 Design Products required to act as a building guard by applicable regulatory requirements to CSA A500.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy.

.2 Sheet Aluminum: To ASTM B209M, 5005-H32 alloy.

.3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.

.4 Steel Sections: Shaped to suit mullion sections.

.5 Fastener: 300 Series stainless steel.

.6 Screen Mesh: 18/16 aluminum mesh, Black colour.

.7 Bituminous Coating: Fibre asphalt emulsion.

.8 Thermal Break: Rigid polyamide.

.9 Vapour Retarder: As specified in Section 07 26 00.

.10 Air Barriers: As specified in Section 07 27 00.

.11 Sprayed Foam Sealant: As specified in Section 07 92 21.

.12 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.

.13 Joint Sealants: As specified in Section 07 92 00, Types as follows:
- .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
- .2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
- .3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.

.14 Glazing Materials: As specified in Section 08 80 00.

.15 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

2.6 COMPONENTS

.1 Frames and Mullions: Extruded aluminum sections, 64 mm wide, adequate depth to accommodate design loads, but not less than that indicated on Drawings; thermally broken with interior tubular section insulated from exterior; applied fiberglass pressure plates; complete with drainage holes, internal weep drainage system, continuous aluminum mounting flange, and special corner adapters as necessary; eg. 1600UT System 1 by Kawneer.

.2 Caps: Extruded aluminum; 64 mm wide, 19.1 mm deep; snap-on type.

.3 Operable Vent Sash: Extruded aluminum sections; top-hinged projecting out (TPO) design; thermally broken with interior tubular section insulated from exterior; applied glazing stops; vent sizes as indicated on Drawings.

.4 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams.

.5 Metal Flashings: 2.0 mm thick extruded aluminum, finish to match mullion sections where exposed.

.6 Metal Closure Panels: 1.2 mm thick aluminum sheet, sizes to suit spandrel panel openings; bent returns on all 4 sides to accommodate attachment to curtain wall frames; with factory anodized finish.

.7 Operable Vent Hardware:
- .1 Hinges: Stainless steel 4 bar hinges, complete with limit stop device.
- .2 Operator: Pivot shoe roto operator complete with removable crank handle.
- .3 Lockable Handles: Hook bolt lock handle, complete with sash mounted strike plate.
- .4 Weatherstripping: Manufacturers standard type to suit application, finish to match frame.

.8 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.

.9 Glass: As specified in Section 08 80 00, Types as indicated on Window Schedule.

2.7 FABRICATION

.1 Fabricate Products to AAMA CWM.

.2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.

.3 Make joints flush, hairline, and weatherproof.

.4 Arrange fasteners and attachments to conceal from view.

.5 Prepare components with internal reinforcement for operating hardware.

.6 Provide minimum two lockable handles per operable vent sash.

.7 Overlap and seal glazing flanges of abutting members for the entire depth and width of the flanges to provide a solid unbroken water barrier. Glass stops shall be screwless, lock-in type.

.8 Provide fully resilient settings for glass and panels by use of EPDM elastomeric glazing gaskets on both sides of glass installed in curtain wall frames.

.9 Provide connection flange to full perimeter of frame assembly, attached from interior side of frame with concealed fasteners cut flush with the face of the flange. Pre-drill fastener holes into flange to accommodate installation in the Work.

.10 Insect Screens
- .1 Fabricate screen frames of tubular extruded aluminum, to CAN/CGSB-79.1-M; prefinished to match curtain wall framing.
- .2 Secure mesh to screen frame with removable polyethylene spline.
- .3 Secure screen assemblies to curtain wall frames using mechanical fasteners as required by authorities having jurisdiction.

2.8 FINISHES

.1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify adjoining air and vapour seal materials are ready to receive work of this Section.

3.2 PREPARATION

.1 Apply heavy coat of bituminous paint on aluminum surfaces designated to come into direct contact with concrete, mortar, plaster, or dissimilar metals.

.2 Supply fastenings and anchors required to be built-in to adjacent work to other Sections.

3.3 INSTALLATION

.1 Install curtain wall assemblies to AAMA CWM.

.2 Install Products level, square, and plumb.

.3 Install Products properly aligned, and at proper elevations.

.4 Install Products free from distortion.

.5 Make joints neat, fine, and weather tight. Provide additional mouldings and closures necessary.

.6 Use appropriate fastening components compatible with material of supporting sub-structure.

.7 Install materials with clean cut edges, leaving spaces for expansion and contraction between edge of material and inside of frame as recommended by manufacturer.

.8 Fasten connection flange to wall assembly and connect transition sheet membranes to connection flange using continuous bead of flashing sealant prior to application of sprayed foam sealant.

.9 Install metal closure panels securely fastened to curtain wall frames for concealment of spandrel panel back pans, as indicated on Drawings.

.10 Install glazing as specified in Section 08 80 00.

.11 Install aluminum entrance doors in curtain wall framing using door adapters. Refer to Section 08 41 13.

.12 Fill gaps between curtain wall frames and adjacent wall assemblies with sprayed foam sealant, as specified in Section 07 92 21.

.13 Grind smooth exposed edges of aluminum sills, ensuring no sharp edges.

.14 Provide perimeter joint sealant as specified in Section 07 92 00.

3.4 TOLERANCES

.1 Deviation From Plumb and Level: $\leq$ 3 mm in 3 000 mm.

3.5 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Field Inspection and Testing: One set of tests on a completed installation at each floor level, conducted by independent testing agency to AAMA 502, and verifying compliance with specified performance criteria.

.3 Perform field tests as follows:
.1 Air Infiltration Test: To ASTM E783.
.2 Water Infiltration Test: To ASTM E1105.

.4 Field Testing Building Guards: Arrange for independent testing agency to test installed Products designated as building guards; verifying installed Products meet structural performance criteria required by applicable regulatory requirements.

.5 Commissioning: Conduct thermographic survey of curtain wall to determine any areas where thermal barrier is not continuous.

.6 Make Good installed Products not meeting specified performance criteria, and where thermographic survey indicates inadequate thermal resistance.

.7 Re-test replacement Products at no additional cost to Owner.

3.6 ADJUSTING

.1 Adjust operable vents, insect screens, hardware, and accessories for tight fit at contact points, and weatherstripping for smooth operation and weather tight closure.

.2 Lubricate hardware and moving parts.

3.7 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean glass and aluminum surfaces.

.3 Do not scratch or damage surfaces.

.4 Do not remove protective cover from framing until final cleaning operations.

3.8 PROTECTION

.1 Protect installed Products as specified in Section 01 70 00.

.2 Provide protective coatings on surfaces subject to damage.

.3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 05 40 00 - Cold-Formed Metal Framing.

.3 Section 07 26 00 - Vapour Retarders.

.4 Section 07 27 00 - Air Barriers.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 07 92 21 - Sprayed Foam Sealant.

.7 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.8 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.9 Section 08 80 00 - Glazing.

.10 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA CW-10-26: Care and Handling of Architectural Aluminum from Shop to Site.

.2 AAMA/WDMA/CSA 101/I.S. 2/A440-26: North American Fenestration Standard / Specification for Windows, Doors and Skylights.

.3 AAMA 502-21: Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

.4 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.5 AAMA 1503-09: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

.6 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.7 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.8 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.9 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.10 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.11 ASTM E90-23: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.12 ASTM E283/E283M-26: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.13 ASTM E330/E330M-14(2021): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.14 ASTM E331-00(2023): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

.15 ASTM E783-02(2018): Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.16 ASTM E1105-15(2023): Standard Test Method for Field Measurement of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.17 CAN/CGSB-79.1-M91: Insect Screens.

.18 CSA A440.4:19 (R2024): Window, Door, and Skylight Installation.

.19 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.20 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
- .1 Large scale details of members and materials, of brackets and anchorage devices, and of connection and jointing details;
- .2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
- .3 Dimensions and thicknesses;
- .4 Glazing details, description of materials including catalogue numbers, Product names, and manufacturer's name;
- .5 Aluminum alloy and temper designations;
- .6 Finish specifications; and
- .7 Other pertinent data.

.3 Submit documentation of:
- .1 Compliance with AAMA/WDMA/CSA 101/I.S. 2/A440;
- .2 Thicknesses, profiles, and descriptions of components used in assembly;
- .3 Engineering calculations verifying assembly has been designed, constructed, and attached to withstand forces anticipated for Project and will meet performance criteria required by applicable regulatory requirements.

.4 Shop Drawings, including engineering calculations, are to be stamped, signed, and dated by fabricator's design engineer.

1.4 CERTIFICATES

.1 Submit certifications as specified in Section 01 40 00.

.2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

1.5 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.

1.6 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions; sufficient quantity for inclusion in operation and maintenance manual.

1.7 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional engineer experienced in designing aluminum windows, licensed to practice at Place of the Work.

.2 Fabricator and Installer: A firm specializing in fabricating and installing aluminum windows, having minimum 5 years documented experience.

1.8 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up: One 1 220 x 1 220 mm size mock-up panel, including one corner cross section for each type of window assembly, illustrating sill and jamb section, and complete with thermal break, hardware, weatherstripping, glazing, insect screens, and shop-applied finishes.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Conform to AAMA CW-10.

.3 Take precautionary measures and adequately protect frames and frame finishes to prevent damage thereto during fabrication, storage, shipping, handling, and installation.

.4 Deliver, handle, and store units by methods approved by manufacturer. Protect from damage and staining.

.5 Deliver and store units carefully to avoid damage to window frame.

1.10 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 5 years, covering the following:
.1 Finish: Replace any window unit whose finish shows defects, such as but not limited to delamination, blistering or excessive fading.
.2 Performance: Replace or repair any window unit with air leakage, water leakage, defects, or malfunctions under normal usage.

.3 Installer's Extended Warranty: For a period of two years, protecting against air leakage, water leakage, operational defects, and malfunctions under normal usage.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Aerloc Industries Ltd.
.2 Alumicor.

.3 Alwind Industries, Ltd.
.4 Kawneer.
.5 Oldcastle BuildingEnvelope.
.6 Sherwood Windows, Ltd.
.7 Windspec Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Aluminum Windows: Extruded aluminum frame and operable vent sash sections, shop fabricated, with factory anodized finish; site-glazed with sealed insulating glass units; complete with insect screens, operable vent hardware, metal sills, metal flashings, connection flanges, anchorages, and attachment devices.

.2 Basis of Design: AA 6600 Thermal Window by Kawneer.

.3 Configuration: As indicated on Window Schedule.

2.3 PERFORMANCE CRITERIA

.1 Aluminum Windows: To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
.1 NAFS Performance Class:
.1 Fixed Unit: AW-PG70-FW.
.2 Operable Vent: AW-PG70-AP.
.2 Air Leakage (ASTM E283/E283M):
.1 Fixed Units: $\leq$ 0.23 L/s•m^2 @ 75 Pa.
.2 Operable Vents: $\leq$ 0.5 L/s•m^2 @ 75 Pa.
.3 Water Resistance (ASTM E331): No leakage at 720 Pa test pressure differential.
.4 Uniform Load Deflection (ASTM E330/E330M): $\leq$ L/175 at 3 352 Pa, for both positive and negative directions.
.5 Condensation Resistance Factor (AAMA 1503):
.1 Fixed Units: $CRF_{frame} \geq 77$, $CRF_{glass} \geq 72$.
.2 Operable Vents: $CRF_{frame} \geq 71$, $CRF_{glass} \geq 69$.
.6 Sound Transmission Loss (ASTM E90):
.1 Fixed Units: STC $\geq$ 38 dB, OITC $\geq$ 32 dB.
.2 Operable Vents: STC $\geq$ 35 dB, OITC $\geq$ 28 dB.
.7 Assembly Thermal Transmittance (ANSI/NFRC 100):
.1 Fixed Units: U $\leq$ 2.15 W/m^2 degrees C.
.2 Operable Vents: U $\leq$ 2.56 W/m^2 degrees C.
.8 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 DESIGN CRITERIA

.1 Design assembly to drain water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system to exterior.

.2 Design intermediate members within units to be either solid or tubular design to suit wind loading, weight carrying requirements, and wind deflection limitations.

.3 Design coupling mullions to permit unit module construction and provide for thermal expansion. When required, reinforce wind load carrying members with steel reinforcement suitably treated to prevent electrolytic action.

.4 Design operable vents to restrict opening to not more than 100 mm.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy.

.2 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.

.3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.

.4 Steel Sections: Shaped to suit mullion sections.

.5 Fastener: Stainless steel.

.6 Screen Mesh: 18/16 aluminum mesh, Black colour.

.7 Bituminous Coating: Fibered asphalt emulsion.

.8 Thermal Break: Rigid polyamide.

.9 Vapour Retarder: As specified in Section 07 26 00.

.10 Air Barriers: As specified in Section 07 27 00.

.11 Sprayed Foam Sealant: As specified in Section 07 92 21.

.12 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.

.13 Glazing Materials: As specified in Section 08 80 00.

.14 Joint Sealants: As specified in Section 07 92 00, Types as follows:
- .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
- .2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
- .3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.

.15 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

2.6 COMPONENTS

.1 Frames and Mullions: 1.78 mm thick extruded aluminum; 152 mm deep profile; thermally broken with interior tubular section insulated from exterior; applied glazing stops; drainage holes; internal weep drainage system; factory anodized finish.

.2 Operable Vent Sash: 1.78 mm thick extruded aluminum sections; 73 x 86 mm size profile, top-hinged projecting out (TPO) design; thermally broken with interior tubular section insulated from exterior; applied glazing stops; factory anodized finish.

.3 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams; factory anodized finish.

.4 Metal Flashing: 2.0 mm thick extruded aluminum, factory anodized finish where visually exposed.

.5 Operable Vent Hardware:
- .1 Concealed Hinges: Extruded aluminum concealed hinges, minimum two per sash, greater quantity when required by sash size.
- .2 Limit Stop: Heavy duty metal construction, manufacturer's standard design.
- .3 Operator: Pivot shoe roto operator complete with collapsable crank handle.
- .4 Locking Handles: Single handle multi-point locking, complete with sash mounted strike plate; Silver painted finish.
- .5 Weatherstripping: Manufacturers standard type to suit application, finish to match frame.

.6 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.

.7 Glass: As specified in Section 08 80 00, Types as indicated on Window Schedule.

2.7 FABRICATION

.1 Fabricate Products to AAMA/WDMA/CSA 101/I.S. 2/A440.

.2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.

.3 Make joints flush, hairline, and weatherproof.

.4 Arrange fasteners and attachments to conceal from view.

.5 Prepare components with internal reinforcement for operating hardware.

.6 Provide minimum two lockable handles per operable vent sash.

.7 Overlap and seal glazing flanges of abutting members for entire depth and width of flanges to provide a solid unbroken air and water barrier. Glass stops shall be screwless, lock-in type.

.8 Provide fully resilient settings for glass and panels by use of EPDM elastomeric glazing gaskets on both sides of glass installed in window frames.

.9 Provide connection flange to full perimeter of frame, attached from interior side of frame with concealed fasteners cut flush with flange face. Pre-drill fastener holes into flange to accommodate immediate installation in the Work.

.10 Insect Screens
- .1 Fabricate screen frames of tubular extruded aluminum, to CAN/CGSB-79.1-M; prefinished to match window frames.
- .2 Secure screen mesh to screen frames with removable polyethylene spline.
- .3 Secure screen assemblies to window frames using mechanical fasteners as required by authorities having jurisdiction.

2.8 FINISHES

.1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

2.9 SOURCE QUALITY CONTROL

.1 Perform shop inspection and testing as specified in Section 01 40 00.

.2 Shop Inspection and Testing: Random tests of fabricated window framing at point of manufacture, verifying compliance with specified performance requirements, conducted by independent testing agency.

3 Execution

3.1 PREPARATION

.1 Apply heavy coating of bituminous paint on aluminum surfaces placed in direct contact with concrete, mortar, plaster, or dissimilar metals.

.2 Provide fastenings and anchors required to be built in to adjacent work to other Sections.

3.2 INSTALLATION

.1 Install Products to CSA A440.4.

.2 Install Products level, square, and plumb.

.3 Install Products properly aligned and at proper elevations.

.4 Install Products free from distortion.

.5 Make joints neat, fine, and weathertight.

.6 Allow for expansion and contraction of components.

.7 Provide additional mouldings and closures necessary.

.8 Use appropriate fastening components compatible with material of supporting sub-structure. Conceal fasteners.

.9 Fasten connection flange to wall assembly and connect building envelope air barrier membrane to flange.

.10 Seal connection flange to transition sheet membranes with continuous bead of joint sealant prior to application of sprayed foam sealant.

.11 Provide trim panning and flashings of sufficient size to neatly finish frame to interior and exterior opening.

.12 Fill gaps between exterior frames and adjacent wall assemblies with sprayed foam sealant , as specified in Section 07 92 21.

.13 Install glass as specified in Section 08 80 00.

.14 Provide sills in place with anchoring devices located at ends and evenly spaced at 600 mm OC. Fasten expansion joint cover plates and drip deflectors with self-tapping stainless steel screws.

.15 Maintain 6 - 9 mm space between butted ends of continuous sills. For sills over 1 220 mm in length, maintain 3 - 6 mm space at each end.

.16 Install end dams at each sill.

.17 Grind smooth exposed edges of aluminum sills, ensuring no sharp edges.

.18 Provide joint sealants as specified in Section 07 92 00.

3.3 TOLERANCES

.1 Deviation From Plumb and Level: $\leq$ 3 mm in 3 000 mm.

3.4 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Field Inspection and Testing: One set of tests on a completed installation at each floor level, conducted by independent testing agency to AAMA 502, and verifying compliance with specified performance criteria.

.3 Perform field tests as follows:
.1 Air Infiltration Test: To ASTM E783.
.2 Water Infiltration Test: To ASTM E1105.

.4 Make Good Products not meeting specified performance criteria.

.5 Re-test replacement Products at no additional cost to Owner.

3.5 ADJUSTING

.1 Adjust operable vents, insect screens, hardware, and accessories for tight fit at contact points, and weatherstripping for smooth operation and weather tight closure.

.2 Lubricate hardware and moving parts.

3.6 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean glass and aluminum surfaces.

.3 Do not scratch or damage surfaces.

.4 Do not remove protective cover from framing until final cleaning operations.

3.7 PROTECTION

.1 Refer to Section 01 70 00.

.2 Provide protective coatings on surfaces subject to damage.

.3 Make Good damage.

END OF SECTION

PART 1 – GENERAL

1.1 WORK INCLUDED

.1 Supply finish hardware.

.2 It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and discrepancies shall be brought to the Consultant's attention during the bidding period.

1.2 RELATED SECTIONS

.1 06200 Finish Carpentry

.2 06400 Architectural Woodwork

.3 08100 Metal Door & Frames

.4 08200 Wood Doors

.5 08300 Special Doors

.6 08400 Entrances

.7 10650 Operable Partitions

.8 16100 Wiring Methods

.9 16400 Low Voltage Distribution

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED IN THIS SECTION

.1 Power supplies, compressor/control boxes, junction boxes installed by Division 16.

1.4 ALLOWANCES

.1 Allow for cash amount specified in Section 01200, hardware to cover cost of specification, drawings, training and inspection of products specified in this section.

1.5 REFERENCES

.1 Recommended locations for Architectural Hardware for Standard Steel Doors and Frames - Door and Hardware Institute

.2 Recommended locations for Architectural Hardware for Flush Wood Doors – Door & Hardware Institute

.3 NFPA 80-Standard for Fire Doors and Windows

.4 Sequence Format for Hardware Schedule – Door & Hardware Institute

.5 Key Systems and Nomenclature - Door & Hardware Institute

.6 Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications – Door & Hardware Institute

1.6 SUBMITTALS

.1 Updated Finish Hardware Schedule:
Prepare and submit within fifteen (15) days of a receipt of a [purchase order,] eight (8) complete detailed hardware schedules prepared in vertical format as detailed in Reference 1.5.3.

.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 Consultant's 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 may be incorporated into the work.

.4 Templates:
Furnish templates within fifteen (15) days after award of a purchase order.

.5 Keying Schedule
Provide three (3) copies of keying schedule for review prepared and detailed in Reference 1.5.5. Refer to attached Owner keying schedule. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Consultant.

.6 Wiring Diagrams
Furnish a written description of the functional use of all electrical hardware. Include door and frame elevations showing the location of each item of electrical hardware to be installed, including a diagram showing number and size of all conductors.

.7 Operations and Maintenance Data
Prior to Substantial Completion, furnish to the owner, three (3) copies of an owner's operation and maintenance manuals in a three ring binder with the following information:

.1 Maintenance instructions for each hardware item
.2 Catalogue cut sheets and Product Specifications or each product
.3 Parts list for each product
.4 Copy of final "as-built" finish hardware schedule
.5 Copy of final keying schedule

1.7 QUALITY ASSURANCE

.1 Review installation procedures with the hardware distributor's designated Installer(s). 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 Substitutes
Only approved products specified will be accepted. Make substitution request 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. The distributor to have on staff an Architectural Hardware Consultant (A.H.C.) who will be responsible for scheduling, detailing, ordering and co-ordination of the finishing hardware for this project. This individual shall be required for jobsite visits if so requested by the Consultant, Owner and or installer for any installation problems that may occur.

.4 Pre-Installation Meeting for Hardware: Prior to installation of hardware, arrange a meeting between manufacturer, distributor, supplier, installers and related trades to review materials, procedures and coordinating related work. Provide mock-up of hardware to be installed for review by the Consultant at this meeting. Where Ingersoll Rand manufacturers are used, Ingersoll Rand products shall be furnished and installed by an authorized Ingersoll Rand Distributor to insure quality compliance, service and Warranty of products. All Ingersoll Rand products are to be included in the mock-up as part of the meeting in Paragraph 4. An Architectural Hardware Consultant (A.H.C.) from Ingersoll Rand will assist the Consultant with the review of the mock-up at this meeting. The hardware supplier is to furnish the necessary arrangements for the attendance at this meeting of the Architectural Hardware Consultant (A.H.C.) from Ingersoll Rand. The approved mock-up is to set the standard of hardware installation for the remainder of the project.

.5 Finish and Security Hardware and Auto Operators to be installed by an Ingersoll Rand Distributor and Systems Integrator; the Distributor shall employ and use Ingersoll Rand trained and certified hardware, auto operator and security system installers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Marking and Packaging
All cartons shall be marked 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. Accessories, fastening devices and other loose items shall be enclosed 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.

1.9 WARRANTY

.1 Provide warranties by the accepted manufacturers:

Hardware Item	**Length of Warranty**
Mortise Hinges	Lifetime
Pivot Sets	2 yrs.
Locks	7 yrs.
Keypad Locks	1 yrs.
Exit Devices	3 yrs.
Door Closers -mechanical	10 yrs.
Door Operators - Electro mechanical	2 yrs.
Door Hold open Devices - Electro mechanical	2 yrs.
Overhead stops/holders	1 yr.
Floor/Wall stops	1 yr.
Electric Strikes/Key Switches/Power Supplies	1 yr.
Electromagnetic Lock Coils	Lifetime

1.10 MAINTENANCE

.1 Maintenance Service
After the building is occupied arrange an appointment with the Owner 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
The following items to be transferred by the General Contractor to the Owner in proper manufacturers cartons once the job has been completed:

.1 3 of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

PART 2 – PRODUCTS

2.1 MANUFACTURERS
Products listed in the finishing hardware schedule are from the manufacturers listed below:

ITEM
Full Mortise Hinges
Specified: Stanley
Alternate: Hager

Locksets, Latchsets/Deadbolts
Specified: Schlage
Alternate: None

Exit Devices
Specified: Von Duprin
Alternate: None

Keypad Locks
Specified: Schlage
Alternate: None

Pivots
Specified: Ives
Alternate: None

Surface/Flush Bolts
Specified: Stanley
Alternate: Hager

Door Closers
Specified: LCN
Alternate: None

Overhead Door Holders/Stops
Specified: Glynn Johnson
Alternate: None

Door Pulls/Flatware
Specified: Gallery Specialty Hardware
Alternate: Canadian Builders Hardware

Coat Hooks:
Specified: Frost
Alternate: None

Wall/Floor Stops
Specified: Gallery Specialty Hardware
Alternate: Canadian Builders Hardware

Weather/Smoke/Sound Seals
Specified: KN Crowder
Alternate: Hager

Door Sweeps/Thresholds
Specified: KN Crowder
Alternate: Hager

Automatic Door Operators/Actuators
Specified: Rhinotek
Alternate: Besam

Keyswitch/Magnetic Locks
Specified: Locknetics
Alternate: None

Electric Strikes
Specified: HES
Alternate: Von Durpin

Power Supplies
Specified: Locknetics, Von Duprin
Alternate: None

2.2 MATERIALS

.1 Screws and Fasteners:
All screws shall be matching finish to their product and shall be manufacturer's standard.

.1 Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use. Factory

furnished Fasteners shall be used to install all Hardware. Tech Screws or substitute fasteners are not acceptable and will be rejected.

.2 Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Consultant according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on wood doors shall be thru-bolted. All thresholds shall be fastened with machine screws and anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

.3 Design of all fastenings shall harmonize with the hardware as to material and finish.

.2 Materials (Note: Supply all products in a given category from the same manufacturer):

.1 Hinges

ANSI A156.1, 2000. Supply hinges with NRP option on all doors where the hinge barrel is exposed on the secured side of the door. Comply with the manufacturer's published recommendations regarding number of hinges, weight, height and width of hinge. Use two hinges on doors up to 5' (1.52m) and an additional hinge for each additional 30" (.76m) or fraction thereof. Doors 900mm wide and less, 114 mm high hinges, doors greater than 1100mm wide 127mm high hinges, heavy weight or standard weight as specified.
Supply standard weight and heavy weight concealed bearing hinges on all doors equipped with door closers; ferrous (steel) material for all interior and/or fire-rated doors and stainless steel for exterior doors as listed in the hardware groups.

As Specified: Stanley – CB179, CB199, CB168
Alternate: Hager – AB700, AB850, AB750

Continuous Hinges:

ANSI A156.26, 2000. Continuous hinges to be Markar 100 series edge mount continuous barrel-type aluminum hinges. Material 6063-T5 aluminum, clear satin finish (628). Cycle testing 1,500,000 repetitions exceeding ASTM standard 156.1, sized to door height. Barrel type hinge with ¼: diameter Teflon-coated stainless steel pin and long-life split bearings. Hinge length to suit door height.
Markar 300 series edge mount/guard continuous barrel-type stainless steel hinges. Material heavy duty 14 gauge 304 stainless steel. Cycle testing 1,500,00 repetitions exceeds ASTM standard 156.1. Barrel type hinge with ¼: diameter Teflon-coated stainless steel pin and long-life split bearings. Hinge length to suit door height. Installation video to be supplied for all series of continuous hinges to the hardware installer.

Supply as Specified: Gallery CH951 Stainless

.2 Pivots:

Centre/Offset Pivot
ANSI A156.17, 1999. High strength forging and casting for rated and non-rated doors combined with precision bearings for smooth operation. Available ¾" or 1 ½" offset, centre hung, heavy duty, intermediate and power transfer pivots with all exposed parts made of brass or stainless steel for maximum corrosion resistance. Stainless steel, machine screws standardwith positive locking vertical adjustment mechanism which allows the installer to precisely position the door and balance the load. Standard or custom powder coated finishes available.
Supply as Specified: Ives 7200 series

.3 Surface/Flush Bolts:

Surface Bolts:
ANSI A156.16. Surface bolt s to have 1" throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy duty steel and cUL listed up to three (3) hours when used on the inactive door of a pair up to 8' in height.

As Specified: Ives SB1630, finish noted in detailed hardware schedule.
Alternate: Hager 278D-6

Manual Flush Bolts-Metal Doors:
ANSI A156.16. 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 dustproof strikes with all flushbolts.

As Specified: Ives FB458
Alternate: Hager 282D

Manual Flush Bolt-Wood Doors:
ANSI A156.16. Manual flush bolt for wood doors to be cUL listed for 90min fire doors with 3/4" throw with a 7/8" vertical adjustment. Supply dustproof strikes with all flushbolts.

As Specified: Ives FB358
Alternate: Hager 283D

Automatic Flush Bolts-Metal Doors:
ANSI A156.16. Automatic flush bolts for metal doors to be fully automatic cUL listed for 3 hour fire doors, low actuation forces-top bolt has not spring tension, non –handed with ¾" throw with a 7/8" vertical adjustment. Optional rod lengths for non-rated openings as well as models with auxiliary fire latch that eliminates the bottom bolt for cUL listed doors. Supply dustproof strikes with all flushbolts.

As Specified: Ives FB30 series
Alternate: Hager 292D

Automatic Flush Bolts- Wood Doors:
ANSI A156.16. Automatic flush bolts for wood doors to be fully automatic cUL listed for 90min fire doors, low actuation forces-top bolt has not spring tension, non –handed with ¾" throw with a 7/8" vertical adjustment. Models with auxiliary fire latch that eliminates the bottom bolt for cUL listed doors (20min only). Supply dustproof strikes with all flushbolts.

As Specified: Ives FB40 series
Alternate: Hager 291D

.4 Locksets/Deadlocks/Privacy Sets:

.1 Grade 2 Cylindrical:
ANSI A156.2, 1996, Series 4000 Grade 2 heavy duty residential, light and medium duty commercial cUL listed for all functions up to 3-hour doors. Exposed trim wrought brass or bronze. Precision solid brass 6-pin cylinder with nickel silver keys available in all Schlage keyways. Cylindrical housing: internal cold rolled steel mechanism are corrosion treated for normal atmospheric conditions. Key removable outside knob for quick and easy cylinder replacement. Snap-on inside rose conceals mounting plate and screws with long spindle bearing surfaces that prevent knobs from becoming wobbly.

Supply as Specified: Schlage "A" series

.2 Grade 2 Cylindrical-Lever:
ANSI A156.2, 1996, Series 4000 Grade 2 standard duty commercial exterior and interior cUL listed for all functions up to 3-hour doors. Levers to be solid pressure cast zinc with no plastic inserts. Precision solid brass 6-pin cylinder with nickel silver keys available in all Schlage keyways. Grade 2 lever sets to have through bolts to prevent chassis rotation with internal components and chassis constructed of cold rolled steel with zinc dichromate plating to resist corrosion. Lever sets to have independent heavy duty compression springs as well as precision laser cut stainless steel spindles with interlocking on keyed side.

Supply as Specified: Schlage "AL" series

.3 Grade 1 Deadbolt:
ANSI A156.5, 2001 Grade 1 deadbolt supplied with solid brass or bronze trim rings and 1" throw high strength, steel alloy deadbolt with hardened steel roller that resists sawing and

kick-in attacks. Metal shield protects bolt from attack through the door as well as hardened steel balls that protect mounting screws from drill attack. Exclusive wood frame reinforcer protects wood jamb against kick-in attacks.

Supply as Specified: Schlage B 600 series

.4 Grade 1 Cylindrical:
ANSI A156.2, 1996, Series 4000 Grade 1 extra heavy duty residential, commercial, Institutional and industrial applications. All Grade 1 cylindrical lever sets to have independent heavy-duty compression spring cages with investment cast stainless steel sliders with compression springs and roller bearings as well as thru-bolted mechanism for interlock to the door. All levers to be solid with not plastic inserts.

Supply as Specified: Schlage “ND” series

.5 Grade 1 Mortise:

ANSI A156.13, 2002, Grade 1 Operational, Grade 1 Security, mortise lock for commercial and institutional buildings. Lock cases to have a high strength steel alloy cylinder retainer with a captured ¼-20 set screw. Lock case to be field reversible without chassis disassembly performs one of two simple operations. Removing the catch screw on the lock if required) and installing in opposite location on reverse side. Followed by pulling and rotating latchbolt 180 degrees. Supply locksets featuring lock cases manufactured. from 12 ga. steel with internal components of steel with a zinc dichromate plating for corrosion resistance. Case cover to be secured with four screws for increased rigidity. Locks are to feature a full ¾” throw two-piece stainless steel mechanical anti-friction latchbolt with 1” throw deadbolt constructed of sintered stainless steel. Deadbolt to remain a minimum of 5/8” within lock case when fully extended. All mortise locks are to feature external spring cages. Stop works functions to be by turn unit. Lock cases with stop works on edge of lock case will not be accepted. Spindles to be such that if forced it will twist first, then break (approx. 60 foot pounds of torque), thus preventing forced entry or severe internal damage to the lock case.

Supply as Specified: Schlage “L” series

.6 Mortise:
ANSI Grade 1 heavy-duty mortise type with three-piece, beveled stainless steel latchbolt with ¾” throw and equipped with an anti-friction latch. Chassis shall accommodate ANSI standard mortise lock prep with a 2 ¾” backset. Locksets shall be provided from the factory with the appropriate handing. Outside escutcheon to contain an integrated 6-button keypad to support 120 user capacity with visual red and green LED indicators to provide information on activation, operational system status, system error conditions and low power conditions. Electrical operation to be battery operated capable of 80,000 operating cycles using four non-proprietary “AA” alkaline batteries. Keypad lock to be capable of operation for exterior application, with escutcheon gasket as well as resistance to rust and foreign materials.

Supply as Specified: Schlage PRO5500 series

.5 Exit Devices/Device Trims/Mullions:

.1 Narrow Style:
ANSI A156.3, 2001, Grade 1 cUL listed for panic hardware and fire exit hardware.
Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Fits door stiles as narrow as 1 ¾”.

Supply as Specified: Von Duprin 35A series

.2 Heavy Duty
ANSI A156.3, 2001, Grade 1 cUL listed for panic hardware and fire exit hardware. Supply exit devices and fire exit devices featuring coil compression springs on all device mechanism subassemblies and dead latching mechanisms for all 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 and raised edge to minimize pinching. Roller strikes to be standard on all rim and surface vertical rod devices. 1,000,000cycle testing independently certified by ETL.

Supply as Specified: Von Duprin 98 series

.3 Device Trim

Supply device trim featuring recessed cylinder mounting and coil compression spring design with shear pin protection for all lever designs. Similar lever designs for exits as specified for locksets.

Supply as Specified Von Duprin 994 series

.4 Mullions Non-Rated:

Steel mullion prepared for two 264 or 299 strikes for use with all Von Duprin rim devices and key removable kit to provide quick removal to provide single door performance and security on double door applications.

Supply as Specified: Von Duprin KR4954

.5 Mullions Rated:

Fire rated cUL approved mullion for up to three hour openings up to 8' x 8' using Von Duprin rim devices prepared for 499F strikes. Supply with key removable kit to provide quick removal to provide single door performance and security on double door applications.

Supply as Specified: Von Duprin KR9954

.6 Door Closers:

Door closers to be Grade 1 ANSI A156. /UBC 7.2 and 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.
-hydraulic fluid of a type requires no seasonal adjustments, ULTRA X ^{TM} fluid has constant temperature control from 49^{o} C to –35^{o} 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.
-include high efficiency, low friction pinion bearings.
- size 1 manual door closers to provide less than 5 pounds opening force on a 900mm door leaf.
-closers with painted finishes shall exceed a minimum 100-hour salt spray test, as described in ANSI A156.and ASTM B117.
-closers detailed with plated finishes shall include plated covers (or finish plates) , arms and visible fasteners.

.1 Medium Duty Mechanical (Interior/Exterior):

ANSI A156.4, 2000, non-sized (1-6) and non-handed cylinder body to have 1 ¼" piston diameter with 5/8" single heat-treated shaft. Track closer cylinder body non-sized (2-4) or (1-2). Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN1460 series

.2 Heavy Duty Mechanical (Pull Side Mount):

ANSI A156.4, 2000, 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: LCN4010 series

.3 Heavy Duty Mechanical (Top Jamb Mount):
ANSI A156.4, 2000, 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: LCN4020 series

.4 Heavy Duty Mechanical (Multiple Applications):
ANSI A156.4, 2000, non-sized (1-6) and non-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 with "FAST" Power Adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN4040 series

.5 Heavy Duty Mechanical (Parallel Arm Mount):
ANSI 156.4, 2000, 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: LCN4110 series

.6 Heavy Duty Single Point Hold-Open (Pull and Push Side Mount):
ANSI A156.15, 2001, non-sized (1-4) and non-handed cylinder body to have 1 1/2" piston diameter with 11/16" double heat-treated shaft with adjustable single-point hold open function controlled by solenoid assembly located in a head frame mounted track. Track arm to have single lever arm with low friction track and roller assembly. Unit to have a momentary on/off switch board assembly for testing door release and also provides over-voltage protection.

Supply as Specified: LCN4040SE series

.7 Heavy Duty Electric Operator (Push Side Mount):
ANSI A156.19, 1997, non-sized (2-5) and non-handed cylinder body to have 1 1/2" piston diameter with 11/16" double heat-treated shaft with forged steel main arm. Power operator to include:

- Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.
- "Second Chance" function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. However if resistance still exists, door will pause and the unit will time out and door will close.
- "Breakaway" drive system: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.
- "Soft Start" motor control: required for controlled start once actuator is depressed to extend the service life of all drives components.
- "Built in Power Supply" to deliver 12V and 24V outputs up to a maximum of 1.0 amp.
- Certified by ULC for use on labeled doors.
- Independent adjustments for all electrically controlled functions within controller module.

Supply as Specified: LCN 4640 series

.8 Medium Duty LE Electric Operator: Barrier Free – conforms to ANSI A156.19, 1997,power operator to include:

- Designed for interior and exterior applications.
- Non-Handed, Push or Pull application.
- Manual opening force 8½ lb-force, closing force 5 lb-force.
- Manual "On/Off" Keyswitch switch on Frame.
- "On/Off" Toggle Switch not acceptable.
- Push 'N Go – as part of operator function – to be activated or deactivated by internal switch.
- Fail Safe, in event of power failure - allow door to operate manually with controlled spring close as though equipped with a #3 size manual door closer without damage to any operator components.
- Adjustments by microprocessor control for varying opening Speeds and adjustable Backcheck by eliminating the possibility of damage to door trim and/or walls.
- Auto Reverse on opening cycle – as a safety by reversing direction when coming into contact with an object.
- Microprocessor control adjustable Latching position.
- Control box to have as a standard 2-30 second adjustable time delay for maximum field condition flexibility.
- Control box and motor/gear box contained in aluminum housing, precision-machined gears.
- Motor, DC permanent magnet motor with shielded ball bearings.
- Forged steel operating arm, factory finished to match operator enclosure.
- 115V AC power supply.
- Decals, visible from either side, instructing the user to the operation and function of the door.
- Satisfactory operation between –34 degrees C and 71 degrees C.
- No exposed fasteners.
- UL/cUL Listed for Fire-Rated Doors.

Supply as Specified: **Dor-O-Matic "Benchmark"** - Standard 27" Aluminum Header.
OR
Dor-O-Matic "Benchmark Plus" - Full Length Aluminum Header up to 49".

"On/Off" -SPDT Narrow Style Keyswitch to mount on Jamb	**Locknetics**	653-04-NS
Mortise Cylinder:	**Schlage**	20-001GMK

.7 Actuators:

.1 Wall Type

Wall Actuator switch to be hard-wired, selected to suit traffic conditions and conform to the opening limits of the control. Round, stainless steel touch plate in either 4 ½" or 6" diameters. Engraved blue filled handicap symbol conforms to most accessibility codes. Units to include heavy grade components for vandal resistant mounting and weather resistant switch. Material - stainless steel or brass. Markings - select "Push to Operate Door", Wheel chair logo or plain face.

As specified:	**LCN**	7910-952 or 7910-956
Alternate	**Doromatic**	1204-900

.2 Jamb Type

Jamb switch to be hard-wired actuator with rectangular stainless steel touch plate, 1 ½" wide by 4 ½" high. Engraved blue filled handicap symbol conforms to most accessibility codes. Designed to mount in a frame cutout projecting approximately ½" from the frame. Units to include heavy grade components for vandal resistant mounting and weather resistant switch standard.

As specified:	**LCN**	7910-918
Alternate	**Doromatic**	1211-900

Notes: **1)** 110-115VAC Power to LE Operator header and tie-in to unit - by Division 16.

2) All Conduit, Low Voltage Wiring and Wall mounted back boxes to accommodate Actuators – by Division 16.

.8 Overhead Door Stops/Holders:

.1 Heavy Duty Surface Mounted:
ANSI A156.8, 2000, Grade 1. Surface overhead stops/holders shall be 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 90 series

.2 Heavy Duty Concealed Mounting:
ANSI A156.8, 2000, Grade 1. Concealed overhead stops/holders shall be non-handed for single or double-acting doors with a low profile channel, constructed of heavy guage brass material, is mortised in the door and jamb bracket is mortised in the doorframe. This allows for the 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

.3 Medium-Duty Surface Mounting:
ANSI A156.8, 2000, Grade 1. Surface overhead stops/holders shall be non-handed for single-acting doors with a 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 450 series

.9 Door Pulls/Flatware/Coat Hooks:

All Door Pulls are to be 25.4 mm diameter
All flatware to be of stainless steel material, .050 gauge.

Supply as Specified: Door Pull - GSH 1180-1, GSH 1009, GSH 1709

Cylinder Pull – GSH 980, GSH 980B, GSH 981

Kickplate - GSH80A (40mm less door width single door and 25mm less door width double doors)

Coat Hook – Frost 1150

Push Plates – GSH 81

.10 Floor/Wall Stops:

.1 Floor Stops (Doors without Threshold):
ANSI A156.6, 2000. Floor stops to be 1” overall height with 3/16” base height for use on doors without thresholds. Heavy-duty cast dome stop constructed of brass/bronze with gray, non-marring rubber bumper.

Supply as Specified: GSH 200
Alternate: CBH DS03

.2 Floor Stops (Doors with threshold or undercut doors)
ANSI A156.6, 2000. Floor stops to be 1” overall height with 9/16” base height for use on doors with thresholds or undercut doors. Heavy-duty cast dome stop constructed of brass/bronze with gray, non-marring rubber bumper.

Supply as Specified: GSH 218
Alternate: CBH DS04

.3 Wall Stops (No Button on Locking Hardware):
ANSI A156.16, 1997. Wall stops to be constructed of heavy-duty brass base with special retainer cup that makes the rubber stop tamper resistant. Convex design of rubber bumper.

Supply as Specified: GSH 240
Alternate: CBH DS08

.4 Wall Stops (Projecting Button on Locking Hardware):
ANSI A156.16, 1997. Wall stops to be constructed of heavy-duty brass base with special retainer cup that makes the rubber stop tamper resistant. Concave rubber bumper to avoid damage to locks with projecting buttons.

Supply as Specified: GSH 250
Alternate: CBH DS09

.11 Weather/Smoke Seals:

Head Seal

As Specified:	KN Crowder	W20N
Alternate	Hager 881SN	

Jamb Seal

As specified	KN Crowder	W16N
Alternate	Hager 880SN	

.12 Thresholds/Weatherstrip/Door Sweeps:

Door Sweep

As Specified:	KN Crowder	W24S

Threshold

As specified	KN Crowder	CT45
Alternate	Hager 421S	

.13 Sound Seals - Metal Doors:

Supply as Specified: KN Crowder CT-54

.14 Sound Seals – Wood Doors:

Supply as Specified: KN Crowder CF-51N

.15 Keyswitch/Electric Strikes/Magnetic Locks/Power Supplies:

.1 Keyswitch:
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. Standard stainless steel cover plate.

Supply as Specified: Locknetics 640 series

.2 Electric Strikes:
ANSI A156.31, 2001, Grade 1. Electric strikes to be cUL listed burglary-resistant and electric strike for fire doors and frames. A label for single doors and B label for double doors. Electric strikes to be stainless steel construction, non-handed available in 12V or 24V AC or DC with continuous duty solenoid and accept ¾" throw latchbolts. Strike box to be adjustable to compensate for any misalignment of the door or frame with two piece plug connector for ease of installation.

Supply as Specified: Von Duprin 6000 series

.3 Magnetic Locks:
ANSI A156.23, 1999, Grade 1. Electromagnetic locks to be field selectable dual voltage 12/24VDC with a minimum holding force of 1650lbs, residual magnetism within one second of 4LBF maximum and inductive kickback not to exceed 53 volts peak. Electromagnetic locks to be powered by filtered and regulated power supply. Electromagnetic locks used on labeled fire door assemblies shall be cUL listed as auxiliary locks, rated for A-label openings. Housings shall not project more than 2 ¾" into the door opening. Electromagnetic locks to be furnished with an adjustable mounting bracket for accurate installation and furnished with an integral circuit board with terminal strip for accurate wiring.

Supply as Specified: Locknetics 390+

.4 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: Locknetics 510

2.3 FINISHES

.1 Unless other wise specified, all finishes to be brushed chrome (626).

.2 Finishes are specified as follows:

Item	BHMA#	Description	Base Materials
Hinges	630	satin,stainless steel	stainless steel
Pivots	689	powder coat aluminum	steel
Lock Trim	626	satin chrome plated	brass/bronze
Exit Devices	626	satin chrome plated	brass/bronze
Dr Closer	689	powder coat aluminum	steel
Dr Pulls	630	satin stainless steel	stainless steel
Protective Plate	630	satin stainless steel	stainless steel
Door Stops/Holders			
Overhead	630	satin stainless steel	stainless steel
Wall/Floor	626	satin chrome plated	brass/bronze
Thresholds	628	anodized aluminum	aluminum
Weatherstrip	628	anodized aluminum	aluminum
Miscellaneous			
Coat hooks	626	satin chrome plated	brass/bronze
Signage	BLK	black	plastic
Mullions	628	anodized aluminum	steel
Key Switches	630	satin stainless steel	stainless steel
Electric Strikes	630	satin stainless steel	stainless steel
Magnetic Locks	628	anodized aluminum	steel

2.4 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

.1 Meet with the Consultant and Owner to finalize keying requirements and obtain keying instructions in writing as outlined in Division 1. Interior locks and cylinders shall be furnished in a new Schlage masterkey system.

.2 Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner's Representative prior to occupancy. The Owner will instruct the Contractor to void the operation of the construction keys.

.3 Permanent cylinders to be keyed by factory, combinated in sets or subsets, master keyed or grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the keyset symbol on all keyblanks for identification. These visual key control marks or codes will not include the actual key cuts.

.4 .1 Keying Handover: Prior to handing keys to the Owner, the Contractor shall organize the keys as follows:

.1 For each set of keys attach a hard plastic tag capable of being labeled.

.2 Each plastic tag is to have typewritten or computer generated labels indicating the relevant door number and room number.

.2 An itemized transmittal is to accompany all keys to be handed over.

.3 All keys complete with labeled tags are to be in the key cabinet. Provide complete cross-index system, place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide one each key cabinet and hinged panel type cabinet for wall mounting as noted in detailed hardware schedule. Key cabinet is to be properly secured to a wall in a location to be determined by the Board.

.5 Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability. Key Quantity: Furnish keys in the following quantities:

10 each	Temporary construction master keys.
3 each	Grand Master keys per grand master group.
6 each	Master keys per master group.
3 each	Change keys per cylinder or keyed alike group.
3 each	Extractor tools
6 each	weatherproof exterior grade padlocks keyed to MKAA

All keying requirements per Owner's Secondary and Elementary School Keying Schematics (attached at end of specification).

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 sufficiently 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 Consultant prior to installation of finished hardware.

3.2 INSTALLATION

.1 All installation is to be executed by employees of the Hardware supplier with a minimum of five (5) years experience in the installation of finishing hardware. Provide verification of the installer's qualifications to the Consultant for approval. All installers are to attend review meetings with the hardware manufacturers, distributors and supplier. Installation by the General Contractor's own forces and sub-contracts for the installation, of finishing hardware is not permitted.

.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 all 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 all 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 all manufactures installation instructions. Adjustment 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 handicapped 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.

.10 Counter sink through bolt of door pull under push plate during installation.

.11 Mount all closers, automatic operators and hold-open devices with through bolts, as indicated in the finish hardware schedule.

3.2 FIELD QUALITY CONTROL

.1 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.

.2 Upon completion of finish hardware installation, the Consultant, the Hardware Manufacturer, Hardware Supplier, Hardware Supplier’s installer, and General Contractor shall do a thorough “ walk through” of the Project to determine that all Finish and Security Products are; 1) furnished and installed in compliance with the Specification 2) acceptable to the Owner as to fit their requirements, final installation, adjustment, and correct applications. In the event the Consultant rejects any product or installation, the Hardware Supplier shall correct the condition at no expense to the Owner, until the Consultant gives final acceptance. The Hardware Supplier and the Contractor shall record and provide a list of all hardware deficiencies. The Hardware Manufacturer shall re-inspect when notified by the Hardware Supplier as to the clearing of deficiencies. The Hardware Supplier and the General Contractor shall certify in writing that all hardware items and their installation are in accord with requirements of Contract Documents. Final inspection must ensure all hardware items operate as per Hardware Manufacturer requirements. Coordinate final inspections with the Hardware Manufacturer’s representatives as required to establish warranties. All correspondence is to be sent directly to the Consultant and carbon copied to the Owner.

3.3 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 All hardware to be left clean and free of disfigurements.

.3 Instruct owner personnel in the proper operation, adjustment and maintenance of hardware.

.4 Check all locked doors against approved keying schedule.

3.4 PROTECTION

.1 Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturers warranty.

END

Notre Dame Catholic School Renovation & Addition

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Submittal Date: **November 11, 2026**

Openings Schedule

Hardware Group	Qty	Opening Number(s)	Location 1	To/ From	Location 2	Hand	Nominal Width	Nominal Height	Door Thickness	Door Mat'l	Frame Mat'l	Label
001	1	100A	EXTERIOR	FROM	VEST 100	LHRA/RHR	1050, 1050	2350	45	HM	HM	
001A	1	102A	EXTERIOR	FROM	VESTIBULE 102	LHR/RHRA	1050, 1050	2150	45	HM	HM	
002	1	100B	VEST 100	FROM	CORRIDOR 103	LHRA/RHR	1050, 1050	2150	45	HM	HM	
002A	1	101B	VEST 101	FROM	CORRIDOR 108	LHR/RHRA	1050, 1050	2150	45	HM	HM	
002A	1	102B	VEST 102	FROM	CORRIDOR 109	LHR/RHRA	1050, 1050	2150	45	HM	HM	
003	1	101A	EXTERIOR	FROM	VESTIBULE 101	LHR/RHRA	1050, 1050	2150	57	AL	AL	
003A	1	100C	EXTERIOR	FROM	ENTRANCE VESTIBULE EX 100	LHRA/RHRA	1075, 1075	2150	57	AL	AL	
004	1	103	CORRIDOR 104	TO/FROM	CORRIDOR 108	LHR-LHR	1050, 1050	2150	45	HM	HM	90 MIN
005	1	105	CORR. 103	TO	UNIVERSAL WC 105	LH	950	2150	45	HM	HM	20 MIN
006	1	106	CORR. 103	TO	CUST/STORAGE 106	RH	950	2150	45	HM	HM	45 MIN
007	1	107	EXTERIOR	FROM	EQUIPMENT STG 107	RH	1000	2350	45	HM	HM	
008	1	110	CORRIDOR 108	TO	STAFF WRK RM 110	LH	950	2150	45	WD	HM	20 MIN
009	1	111	CORRIDOR 108	TO	CLASSROOM 5 111	RH	950	2150	45	WD	HM	20 MIN
009	1	112	CORRIDOR 108	TO	CLASSROOM 6 112	LH	950	2150	45	WD	HM	20 MIN
009	1	113	CORRIDOR 108	TO	CLASSROOM 7 113	RH	950	2150	45	WD	HM	20 MIN
009	1	114	CORRIDOR 108	TO	CLASSROOM 8 114	LH	950	2150	45	WD	HM	20 MIN
009	1	115	CORRIDOR 108	TO	CLASSROOM 4 115	RH	950	2150	45	WD	HM	20 MIN
009	1	116	CORRIDOR 108	TO	CLASSROOM 3 116	LH	950	2150	45	WD	HM	20 MIN
009	1	117	CORRIDOR 108	TO	CLASSROOM 2 117	RH	950	2150	45	WD	HM	20 MIN
009	1	118	CORRIDOR 108	TO	CLASSROOM 1 118	LH	950	2150	45	WD	HM	20 MIN
010	1	119	CLASSROOM 5 111	TO	CLASSROOM 6 112	RH	950	2150	45	WD	HM	
010	1	120	CLASSROOM 8 114	TO	CLASSROOM 7 113	LH	950	2150	45	WD	HM	
010	1	121	CLASSROOM 4 115	TO	CLASSROOM 3 116	RH	950	2150	45	WD	HM	
010	1	122	CLASSROOM 1 118	TO	CLASSROOM 2 117	LH	950	2150	45	WD	HM	
011	1	TC111	CLASSROOM 5 111	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC112	CLASSROOM 6 112	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC113	CLASSROOM 7 113	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC114	CLASSROOM 8 114	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC115	CLASSROOM 4 115	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC116	CLASSROOM 3 116	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC117	CLASSROOM 2 117	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
011	1	TC118	CLASSROOM 1 118	FROM	TEACHER CLOSET	LHRA/RHRA	450, 450	2100	35	WD	WD	
012	1	MISC-1								-	-	

Hardware Schedule

Heading #001

1 Pair of doors 100A, EXTERIOR FROM VEST 100 LHRA/RHR

1050, 1050 x 2350 x 45 - HM DR x HM FR

FIXED MULLION/NO EXTERIOR CYLINDER

10	Standard Hinge	NRP-CB1961R (127 x 114) C32D (5 Hinges Per Leaf)	C32D
1	Electric Strike	9600-630-LBM	630-LBM
1	Power Supply	Power Supply - By Auto Operator Supplier	
2	Cylinder	20-001 x 31 Everest D145 x XQ11-949 CMK GMK 626	626
1	Exit Device	CD-98EO-626-1050 x 2350 Door 45-LHR-- 4' Bar	626
1	Exit Device	CD-98EO-626-1050 x 2350 Door 45-RHR-- 4' Bar	626
2	Door Pull	GSH 1180-2 TB C32D	C32D
1	Auto Operator	4000XL c/w On/Off/Ho Toggle 628 (Push) (LHR Leaf)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Relay	CX-33	
1	Surface Closer	4040XP EDA TB 689 (RHR Leaf)	689
2	Overhead Door Stop	105S C32D (110°)	C32D
2	Kick Plate	GSH 80A C32D (150 x 1000) TM	C32D
2	Threshold	CT-46 x 1050	
2	Head Seal	W-20N-CA x 1050 (Install Prior To Closer)	CA
4	Jamb Seal	W-23-CA x 2350	CA
2	Door Sweep	W-24S-CA x 1050	CA
1	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- ALL 120V & CONDUIT WITH PULL STRINGS FOR ELECTRICAL DEVICES BY ELECTRICAL CONTRACTOR.
- COMPLETE HOOK UP OF AUTO OPERATOR PUSH BUTTONS BY AUTO DOOR OPERATOR SUPPLIER/DIVISION 08710.
- AUTO OPERATOR SUPPLIER TO SUPPLY & INSTALL ALL LOW VOLTAGE WIRING FOR PUSH BUTTONS AS REQUIRED.
- INSIDE PUSH BUTTON ALWAYS ACTIVE. EXTERIOR PUSH BUTTON TO BE ACTIVATED WHEN EXIT DEVICES ARE DOGGED OPEN (UNLOCKED)

Heading #001A

1 Pair of doors 102A, EXTERIOR FROM VESTIBULE 102 LHR/RHRA

1050, 1050 x 2150 x 45 - HM DR x HM FR

8	Standard Hinge	NRP-CB1961R (127 x 114) C32D	C32D
1	Electric Strike	9600-630-LBM	630-LBM
1	Power Supply	Power Supply - By Auto Operator Supplier	
2	Cylinder	20-001 x 31 Everest D145 x XQ11-949 CMK GMK 626	626
1	Exit Device	CD-98EO-626-1050 x 2150 Door 45-LHR-- 4' Bar	626
1	Exit Device	CD-98EO-626-1050 x 2150 Door 45-RHR-- 4' Bar	626
2	Door Pull	GSH 1180-2 TB C32D	C32D
1	Auto Operator	4000XL c/w On/Off/Ho Toggle 628 (Push) (RHR Leaf)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Relay	CX-33	
1	Surface Closer	4040XP EDA TB 689 (LHR Leaf)	689
2	Overhead Door Stop	105S C32D (110°)	C32D
2	Kick Plate	GSH 80A C32D (150 x 1000) TM	C32D
2	Threshold	CT-46 x 1050	
2	Head Seal	W-20N-CA x 1050 (Install Prior To Closer)	CA
4	Jamb Seal	W-23-CA x 2150	CA
2	Door Sweep	W-24S-CA x 1050	CA
1	Opening Schematic	Opening Schematic - By UC Access	

Heading #002

1 Pair of doors 100B, VEST 100 FROM CORRIDOR 103 LHRA/RHR

1050, 1050 x 2150 x 45 - HM DR x HM FR

FIXED MULLION

8	Standard Hinge	CB1901R (127 x 114) C26D (4 Hinges Per Leaf)	C26D
2	Door Pull	GSH 1180-2 TB C32D	C32D
2	Push Plate	GSH 81A C32D (101 x 406) TM	C32D
1	Surface Closer	4040XP EDA TB 689 (RHR Leaf)	689
1	Auto Operator	7000 c/w On/Off/Ho Toggle 628 (Push) (LHR Leaf)	628
2	Push Button	CM-7536/4 Clear	Clear
2	Kick Plate	GSH 80A C32D (150 x 1010) TM	C32D
2	Overhead Door Stop	105S C32D (110°)	C32D
1	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- ALL 120V & CONDUIT WITH PULL STRINGS FOR ELECTRICAL DEVICES BY ELECTRICAL CONTRACTOR.
- COMPLETE HOOK UP OF AUTO OPERATOR PUSH BUTTONS BY AUTO DOOR OPERATOR SUPPLIER/DIVISION 08710.
- AUTO OPERATOR SUPPLIER TO SUPPLY & INSTALL ALL LOW VOLTAGE WIRING FOR PUSH BUTTONS AS REQUIRED.

Heading #002A

1 Pair of doors 101B, VEST 101 FROM CORRIDOR 108 LHR/RHRA
1 Pair of doors 102B, VEST 102 FROM CORRIDOR 109 LHR/RHRA

1050, 1050 x 2150 x 45 - HM DR x HM FR

FIXED MULLION

16	Standard Hinge	CB1901R (127 x 114) C26D (4 Hinges Per Leaf)	C26D
4	Door Pull	GSH 1180-2 TB C32D	C32D
4	Push Plate	GSH 81A C32D (101 x 406) TM	C32D
2	Surface Closer	4040XP EDA TB 689 (LHR Leaf)	689
2	Auto Operator	7000 c/w On/Off/Ho Toggle 628 (Push) (RHR Leaf)	628
4	Push Button	CM-7536/4 Clear	Clear
4	Kick Plate	GSH 80A C32D (150 x 1010) TM	C32D
4	Overhead Door Stop	105S C32D (110°)	C32D
2	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- ALL 120V & CONDUIT WITH PULL STRINGS FOR ELECTRICAL DEVICES BY ELECTRICAL CONTRACTOR.
- COMPLETE HOOK UP OF AUTO OPERATOR PUSH BUTTONS BY AUTO DOOR OPERATOR SUPPLIER/DIVISION 08710.
- AUTO OPERATOR SUPPLIER TO SUPPLY & INSTALL ALL LOW VOLTAGE WIRING FOR PUSH BUTTONS AS REQUIRED.

Heading #003

1 Pair of doors 101A, EXTERIOR FROM VESTIBULE 101 LHR/RHRA

1050, 1050 x 2150 x 57 - AL DR x AL FR

FIXED MULLION

10	Standard Hinge	NRP-CB1961R (127 x 114) C32D (5 Hinges Per Leaf)	C32D
1	Electric Strike	9400-630-LBM	630-LBM
1	Removable Mullion	5654 x 2150 -628	628
1	Exit Device	CD-35A-EO-626-1050 x 2150 Door 57mm-LHR- 4' Bar	626
1	Exit Device	CD-35A-EO-626-1050 x 2150 Door 57mm-RHR- 4' Bar	626
2	Cylinder	20-001 x 31 Everest D145 x XQ11-949 CMK GMK 626	626
2	Keying	50-211-CK	
2	Keying	50-210-GMK	
2	Door Pull	GSH 1180-2 #4B Mtg C32D (57mm Door)	C32D
1	Auto Operator	4000XL c/w On/Off/Ho Toggle 628 (Push) (RHR Leaf)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Relay	CX-33	
1	Surface Closer	4040XP EDA TB 689 (LHR Leaf)	689
1	Mounting Plate	4040XP-18PA 689	689
1	Spacer	4040XP-61 689	689
2	Overhead Door Stop	105S C32D (110°)	C32D
2	Threshold	CT-46 x 2150	
2	Weatherstripping	Weatherstrip - By Aluminum Door Supplier	
2	Door Sweep	W-24S-CA x 1075	CA
1	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- ALL 120V & CONDUIT WITH PULL STRINGS FOR ELECTRICAL DEVICES BY ELECTRICAL CONTRACTOR.
- COMPLETE HOOK UP OF AUTO OPERATOR PUSH BUTTONS BY AUTO DOOR OPERATOR SUPPLIER/DIVISION 08710.
- AUTO OPERATOR SUPPLIER TO SUPPLY & INSTALL ALL LOW VOLTAGE WIRING FOR PUSH BUTTONS AS REQUIRED.
- INSIDE PUSH BUTTON ALWAYS ACTIVE. EXTERIOR PUSH BUTTON TO BE ACTIVATED WHEN EXIT DEVICES ARE DOGGED OPEN (UNLOCKED)

Heading #003A

1 Pair of doors 100C, EXTERIOR FROM ENTRANCE VESTIBULE EX 100 LHRA/RHRA

1075, 1075 x 2150 x 57 - AL DR x AL FR

REMOVABLE HARDWARE MULLION

10	Standard Hinge	NRP-CB1961R (127 x 114) C32D (5 Hinges Per Leaf)	C32D
1	Electric Strike	9400-630-LBM	630-LBM
1	Removable Mullion	5654 x 2150 -628	628
1	Exit Device	CD-35A-EO-626-1075 x 2150 Door 57mm-LHR- 4' Bar	626
1	Exit Device	CD-35A-EO-626-1075 x 2150 Door 57mm-RHR- 4' Bar	626
2	Cylinder	20-001 x 31 Everest D145 x XQ11-949 CMK GMK 626	626
2	Keying	50-211-CK	
2	Keying	50-210-GMK	
2	Door Pull	GSH 1180-2 #4B Mtg C32D (57mm Door)	C32D
1	Auto Operator	4000XL c/w On/Off/Ho Toggle 628 (Push) (Confirm Which Leaf To Receive Auto Operator)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Relay	CX-33	
1	Surface Closer	4040XP EDA TB 689 (LHR Leaf)	689
1	Mounting Plate	4040XP-18PA 689	689
1	Spacer	4040XP-61 689	689
2	Overhead Door Stop	105S C32D (110°)	C32D
2	Threshold	CT-46 x 2150	
2	Weatherstripping	Weatherstrip - By Aluminum Door Supplier	
2	Door Sweep	W-24S-CA x 1075	CA
1	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- ALL 120V & CONDUIT WITH PULL STRINGS FOR ELECTRICAL DEVICES BY ELECTRICAL CONTRACTOR.
- COMPLETE HOOK UP OF AUTO OPERATOR PUSH BUTTONS BY AUTO DOOR OPERATOR SUPPLIER/DIVISION 08710.
- AUTO OPERATOR SUPPLIER TO SUPPLY & INSTALL ALL LOW VOLTAGE WIRING FOR PUSH BUTTONS AS REQUIRED.
- INSIDE PUSH BUTTON ALWAYS ACTIVE. EXTERIOR PUSH BUTTON TO BE ACTIVATED WHEN EXIT DEVICES ARE DOGGED OPEN (UNLOCKED)

Heading #004

1 Pair of doors 103, CORRIDOR 104 TO/FROM CORRIDOR 108 LHR-LHR

1050, 1050 x 2150 x 45 - HM DR x HM FR - 90 MIN

DOUBLE EGRESS / NO CENTRE MULLION

7	Standard Hinge	CB1901R (127 x 114) C26D (4 Hinges Per Leaf)	C26D
1	Electric Hinge	CE58-CB1901R (127 x 114) C26D	C26D
1	Power Supply	PS902- 900-4RL	
1	Exit Device	9847EO-F LBR 626-1050 x 2150 Door 45-LHR 4' Bar	626
1	Exit Device	QEL-9847EO-F-626-1050 x 2150 Door 45-LHR- LBR-- 4' Bar	626
1	Auto Operator	7000 c/w On/Off/Ho Toggle 628 (Push)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Relay	CX-33	
1	Surface Closer	4040XP EDA TB 689	689
1	Magnetic Holder	SEM 7850 689 (Advise Voltage)	689
2	Kick Plate	GSH 80A C32D (150 x 1010) TM	C32D
2	Weatherstripping	W-66-BL x 5400	BL
2	Door Sweep	W-24S-CA x 1050	CA
1	Opening Schematic	Opening Schematic - By UC Access	

NOTE:
- MAGNETIC DOOR HOLDERS & AUTO OPERATOR TO RELEASE UPON ACTIVATION OF FIRE ALARM.
- MAGNETIC HOLDER INSTALLED ON DOOR OPENING INTO CORRIDOR 104.
- AUTO OPERATOR INSTALLED ON DOOR OPENING INTO CORRIDOR 108.

Heading #005

1 Single door 105, CORR. 103 TO UNIVERSAL WC 105 LH

950 x 2150 x 45 - HM DR x HM FR - 20 MIN

3	Standard Hinge	CB1901R (114 x 101) C26D	C26D
1	Lockset	ND96 P6 RHO 626 Everest D145 14-042 CMK GMK	626
1	Keying	50-211-CK	
1	Keying	50-210-GMK	
1	Electric Strike	1500C-630-LM (Fail Secure)	630-LM
1	Power Supply	CX-PS13 V3	
1	Auto Operator	7000 c/w On/Off/Ho Toggle 628 (Pull)	628
2	Push Button	CM-7536/4 Clear	Clear
1	Restroom Control Kit	CX-WC17 (Less Door Contact)	
1	Emergency Call Kit	CX-WEC10	
1	Kick Plate	GSH 80A C32D (305 x 910) TM	C32D
1	Wall Stop	GSH 250B C32D	C32D
1	Weatherstripping	W-66-BL x 5300	BL
1	Door Sweep	W-24S-CA x 950	CA
1	Opening Schematic	Opening Schematic - By UC Access	

MODE OF OPERATION:
1. TO OPEN DOOR ACTIVATE THE DOOR BY THE EXTERIOR BARRIER FREE PUSH PLATE AND DOOR WILL SLOWLY POWER OPEN. TIME OUT AND SLOWLY CLOSE.
2. TO LOCK DOOR FOR PRIVACY ACTIVATE PUSH TO LOCK SWITCH, POWER WILL BE CUT TO EXTERIOR BARRIER PUSH PLATE CREATING PRIVACY.
3. ALSO ON ACTIVATION OF THE INTERIOR PUSH TO LOCK SWITCH (#2).
4. TO EXIT WASHROOM ACTIVATE INTERIOR BARRIER FREE PUSH PLATE AND THE DOOR WILL SLOWLY OPEN (#3).
5. MANUAL NON B/FREE.
6. IN NON FIRE RATED APPLICATION, IF THE WASHROOM IS VACANT THE DOOR CAN BE MANUALLY PUSHED OPEN AS THE ELECTRIC STRIKE WILL NOT ENGAGE.
7. IN A FIRE RATED APPLICATION A KEY WILL BE REQUIRED TO OPERATE THE DOOR MANUALLY (#1). THE KEY WILL UNLOCK THE STOREROOM FUNCTION LOCKSET AS THE ELECTRIC STRIKE MUST BE ENGAGED TO MEET THE FIRE CODE REQUIREMENT FOR SELF LATCHING.
#1 - DOOR CAN ALSO BE OPENED IN A FIRE RATED APPLICATION BY EXTERIOR ACTUATOR IF ROOM IS NOT OCCUPIED.
#2 - THE EXTERIOR "AURA" PUSH PLATE WILL CHANGE ILLUMINATION FROM GREEN TO RED ADVISING THAT THE DOOR IS LOCKED AND THE ROOM IS OCCUPIED. AS WELL THE ILLUMINATED PUSH TO LOCK BUTTON. THE INTERIOR PUSH PLATE IS NOT ILLUMINATED.
#3 - THE SYSTEM WILL ALSO RESET IF THE DOOR IS OPENED MANUALLY WITH THE DOOR LEVER.

NOTE:
- DO NOT USE DOOR CONTACT - UTILIZE LBM IN ELECTRIC STRIKE.
- 120V & LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR.
- OCCUPIED & EMERG KIT TO BE INSTALLED TO CONTROL. THE PRIVACY OF THE OCCUPANT, IN CONJUNCTION WITH AUTO DOOR OPERATOR AS WELL AS PROVIDED EMERGENCY RESPONSE CAPABILITIES, INCLUDING ALARMS INSIDE & OUTSIDE OF WASHROOM.
- ELECTRIC STRIKE TO BE TIED INTO AUTOMATIC DOOR OPERATOR AS WELL AS BOTH INTERIOR ACTUATORS & EXTERIOR ACTUATOR.
- DOOR OPERATOR TO BE INSTALLED BY A FACTORY TRAINED INSTALLER AS PART OF THE FINISHING HARDWARE CONTRACT. ALL WIRES TO BE RUN BY THE ELECTRICAL CONTRACTOR.

Heading #006

1 Single door 106, CORR. 103 TO CUST/STORAGE 106 RH

950 x 2150 x 45 - HM DR x HM FR - 45 MIN

3	Standard Hinge	CB1901R (114 x 101) C26D	C26D
1	Lockset	ND96 P6 RHO 626 Everest D145 CMK GMK	626
1	Surface Closer	4040XP REGARM TB 689 (Pull Side)	689
1	Kick Plate	GSH 80A C32D (150 x 910) TM	C32D
1	Wall Stop	GSH 250B C32D	C32D
1	Weatherstripping	W-66-BL x 5300	BL
1	Door Sweep	W-24S-CA x 950	CA

Heading #007

1 Single door 107, EXTERIOR FROM EQUIPMENT STG 107 RH

1000 x 2350 x 45 - HM DR x HM FR

5	Standard Hinge	CB1901R (127 x 114) C26D (5 Hinges Per Leaf)	C26D
1	Dead Lock	L460 Everest D145 626 CMK GMK (Key / Thumbturn Function)	626
1	Hospital Pull	GSH 2616H 76 x 406 C32D (Cut For Cyl)	C32D
1	Hospital Pull	GSH 2616H 101 x 406 C32D (Cut For TT)	C32D
1	Surface Closer	4040XPT STDTRK 689 (Pull Side)	689
1	Kick Plate	GSH 80A C32D (150 x 950) TM	C32D
1	Wall Stop	GSH 250B C32D	C32D
1	Threshold	CT-46 x 1000	
1	Weatherstripping	W-23-CA x 1/1000 + 2/2350	CA
1	Door Sweep	W-24S-CA x 1000	CA

Heading #008

1 Single door 110, CORRIDOR 108 TO STAFF WRK RM 110 LH

950 x 2150 x 45 - WD DR x HM FR - 20 MIN

3	Standard Hinge	CB1901R (114 x 101) C26D	C26D
1	Lockset	ND94 P6 RHO 626 Everest D145 CMK GMK	626
1	Surface Closer	4040XPT STDTRK 689 (Pull Side)	689
1	Kick Plate	GSH 80A C32D (150 x 910) TM	C32D
1	Wall Stop	GSH 250B C32D	C32D
1	Weatherstripping	W-66-BL x 5300	BL
1	Door Sweep	W-24S-CA x 950	CA

Heading #009

1 Single door 111, CORRIDOR 108 TO CLASSROOM 5 111 RH
1 Single door 112, CORRIDOR 108 TO CLASSROOM 6 112 LH
1 Single door 113, CORRIDOR 108 TO CLASSROOM 7 113 RH
1 Single door 114, CORRIDOR 108 TO CLASSROOM 8 114 LH
1 Single door 115, CORRIDOR 108 TO CLASSROOM 4 115 RH
1 Single door 116, CORRIDOR 108 TO CLASSROOM 3 116 LH
1 Single door 117, CORRIDOR 108 TO CLASSROOM 2 117 RH
1 Single door 118, CORRIDOR 108 TO CLASSROOM 1 118 LH

950 x 2150 x 45 - WD DR x HM FR - 20 MIN

DOUBLE KEYED - SAFE SCHOOL LOCK

24	Standard Hinge	CB1901R (114 x 101) C26D	C26D
8	Lockset	ND98 P6 RHO 626 Everest D145 CMK GMK	626
8	Kick Plate	GSH 80A C32D (150 x 910) TM	C32D
8	Wall Stop	GSH 250B C32D	C32D
8	Weatherstripping	W-66-BL x 5300	BL
8	Door Sweep	W-24S-CA x 950 - Confirm Smoke Seal Required	CA

Heading #010

1 Single door 119, CLASSROOM 5 111 TO CLASSROOM 6 112	RH
1 Single door 120, CLASSROOM 8 114 TO CLASSROOM 7 113	LH
1 Single door 121, CLASSROOM 4 115 TO CLASSROOM 3 116	RH
1 Single door 122, CLASSROOM 1 118 TO CLASSROOM 2 117	LH

950 x 2150 x 45 - WD DR x HM FR

COMMUNICATING LOCK - KEYED BOTH SIDES

12	Standard Hinge	CB1901R (114 x 101) C26D	C26D
4	Lockset	ND72 P6 RHO 626 XN12-002 Everest D145 CMK GMK	626
4	Overhead Door Stop	104S 32D (90°)	C32D
4	Kick Plate	GSH 80A C32D (150 x 910) TM	C32D

Heading #011

1 Pair of doors TC111, CLASSROOM 5 111 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC112, CLASSROOM 6 112 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC113, CLASSROOM 7 113 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC114, CLASSROOM 8 114 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC115, CLASSROOM 4 115 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC116, CLASSROOM 3 116 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC117, CLASSROOM 2 117 FROM TEACHER CLOSET	LHRA/RHRA
1 Pair of doors TC118, CLASSROOM 1 118 FROM TEACHER CLOSET	LHRA/RHRA

450, 450 x 2100 x 35 - WD DR x WD FR

TEACHERS CLOSET/FIXED CABLE/ADVISE DOOR WIDTH & HEIGHT

48	Standard Hinge	CB179 (89 x 89) C26D	C26D
16	Lockset	ALX70 P6 SAT 626 - 10-013 Everest D145 CMK GMK	626
16	Keying	50-211-CK	
16	Keying	50-210-GMK	

NOTE:
- ENSURE INSIDE SHELF DOES NOT INTERFERE WITH LEVER OPERATION.
- BALANCE OF HARDWARE BY MILLWORK SUPPLIER.
- INSTALLATION OF ALL HARDWARE TO BE DONE BY MILLWORK SUPPLIER.
- ARCHITECT TO CONFIRM QUANTITY OF TEACHER & STORAGE CLOSETS

Heading #012

1 Elevation MISC-1

__ x __ x __ - - DR x - FR

MICELLANEOUS

4	Key	Master Keys 49-002 MK-BB	
100	Key Blanks	Key Blanks 35-002D D Family	
10	Key	Master Keys 49-002 MK-AA	
5	Change Key	Everest Change Key D Family 48-002D A1	
3	Extractor Tool	35-057	
7	Keys	Everest Construction Keys 48-008 D000 "AA"	
3	Keys	Everest Construction Keys 48-008 D000 "BB"	
1	Bitting List	50-123	
1	Magnetic Holder	SEM 7810-517 689	689
5	Key	Construction Master Keys 48-008 MK-BB	
1	Key Tags	H8036 STV200	
1	Labour	Labour To Install Hardware	
6	Key	Everest Grand Master Key 49-002 Everest D Family GMK A	
20	Change Key	Everest Change Key D Family 48-0020D AA1	

NOTE:
- KEY QUANTITY TO BE CONFIRMED BY SMCDSB.
- ALL KEYS TO BE PROVIDED WITH LABELLED TAG AND ARE TO BE ARRANGED ON THE MARKERS & HOOKS IN THE KEY CABINET BY DIVISION 08710.
- CONFIRM QUANTITY OF KEY CABINET REQUIRED.

1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.

.2 Section 08 12 13 - Hollow Metal Frames.

.3 Section 08 13 13 - Hollow Metal Doors.

.4 Section 08 14 00 - Wood Doors.

.5 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

.6 Section 08 44 13 - Glazed Aluminum Curtain Wall.

.7 Section 08 51 13 - Aluminum Windows.

.8 Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

.1 AAMA 800-16: Voluntary Specifications and Test Methods for Sealants.

.2 ANSI Z97.1-2009: Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.3 ASTM C509-06(2021): Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.

.4 ASTM C864-05(2019): Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

.5 ASTM C1036-25: Standard Specification for Flat Glass.

.6 ASTM C1115-17: Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.

.7 ASTM C1281-16(2023): Standard Specification for Preformed Tape Sealants for Glazing Applications.

.8 ASTM C1376-21a: Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.

.9 ASTM C1503-24: Standard Specification for Silvered Flat Glass Mirror.

.10 ASTM E1300-24: Standard Practice for Determining Load Resistance of Glass in Buildings.

.11 CAN/CGSB-12.1-2026: Safety Glazing.

.12 CAN/CGSB-12.8-2026: Insulating Glass Units.

.13 CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

.14 GANA Glazing Manual.

.15 GANA GIB 01-0300: Proper Procedures for Cleaning Architectural Glass.

.16 GANA 89-1-6: Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifier.

.17 IGMA TM-3000-90(16): North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

.18 IGMA TM-4510-18(19): IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.

.19 IWFA-LT-105: The Use of Window Films on Insulating Glass Windows.

.20 ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.

.21 ANSI/NFRC 200-2023: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

.22 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.23 CAN/ULC-S106-15 (R2020): Standard Method for Fire Tests of Window and Glass Block Assemblies.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating structural, physical and environmental characteristics, thickness and size limitations, and special handling and installation requirements.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Duplicate 300 x 300 mm size samples of each specified sealed insulating glass unit and insulated spandrel glass panel, illustrating colouration and design.

1.5 CERTIFICATES

.1 Submit certificates as specified in Section 01 30 00.

.2 Certificate of Compliance: Manufacturer's standard certificate of compliance, attesting fire-rated glazing materials comply with CPSC requirements.

1.6 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 30 00.

.2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past two years.

1.7 QUALITY ASSURANCE

.1 Conform to glazing installation methods and quality standards specified in:
.1 GANA Glazing Manual,
.2 IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use, and
.3 IGMA TM-4510, IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.

.2 Select glazing compounds and sealants in accordance with glass manufacturers' instructions.

1.8 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranties:
.1 Sealed Insulating Glass Units: For a period of 10 years, covering complete replacement of units experiencing seal failure or interpane dusting and misting.
.2 Interior Glass Units: For a period of 5 years, covering complete replacement of units experiencing visual defects that affect visual appearance or transparency of glass unit.
.3 Mirrored Glass Units: For a period of 5 years, covering complete replacement of units experiencing deterioration or delamination of reflective coating that affects reflectivity of mirrored unit.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of single pane glass and sealed insulating glass units having Product considered acceptable for use:
.1 Cardinal Glass Industries.
.2 Guardian Glass.
.3 Saint-Gobain Glass.
.4 Vitro Architectural Glass.

.2 Manufacturers of fire-rated ceramic glass having Product considered acceptable for use:
.1 Nippon Sheet Glass Co., Ltd.
.2 Schott North America, Inc.

.3 Manufacturers of decorative window film having Product considered acceptable for use:
.1 3M Company Canada.
.2 Avery Dennison.
.3 Madico, Inc.

.4 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 REGULATORY REQUIREMENTS

.1 Fire-rated Glass: Each lite to bear a permanent, non-removable label designating the type of glass, fire rating and UL mark.

2.3 DESIGN CRITERIA

.1 Design glass Products to ASTM E1300.
.1 Determine necessary glass thickness to withstand dead loads and positive and negative live loads acting normal to plane of glass.
.2 Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

.2 Design Products installed as exterior glazing to contribute to continuity of building enclosure air and vapour seals.

2.4 PERFORMANCE CRITERIA

.1 Sealed Insulating Glass Units (SIG-CLR-1): Having the following tested physical properties:
.1 Visible Light Transmittance (VLT): 70 percent.
.2 Visible Light Reflectance:
.1 Exterior: 11 percent.
.2 Interior: 12 percent.
.3 Coefficient of Heat Transmission, Winter, Argon-Filled (ANSI/NFRC 100): U = 1.36 W/m^2 degrees C.
.4 Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC = 0.39.
.5 Colour Rendering Index: CRI = 95.

2.5 SINGLE PANE GLASS

.1 Float Glass (GL-1): To ASTM C1036, Type I; Clear, glazing quality, 6 mm thick unless noted otherwise.

.2 Patterned Glass (GL-2): To CAN/CGSB-12.1, Class A; tempered safety glass, figured one surface with Frosted pattern; 6 mm thick unless noted otherwise.

.3 Tempered Safety Glass (GL-3): To CAN/CGSB-12.1, Class A; Clear float glass that has been fully tempered horizontally to achieve a net strength of not less than 4 to 5 times greater than regular annealed glass; 6 mm thick unless noted otherwise.

.4 Sheet Glass (GL-4): To ASTM C1036, Type I; Clear, glazing quality, 3 mm thick unless noted otherwise.

.5 Mirrored Float Glass (GL-5): To ASTM C1503; Clear float glass, with silvered coating evenly applied over rear face; complete with polished edges; sizes as scheduled or as noted on Drawings; 4 mm thick unless noted otherwise.

.6 Mirrored Tempered Safety Glass (GL-6): To ASTM C1503; Clear tempered safety glass, with silvered coating evenly applied over rear face; complete with polished edges; sizes as scheduled or as noted on Drawings; 6 mm thick unless noted otherwise.

.7 Fire-Rated Ceramic Glass (GL-7): Fire-rated and impact safety-rated glass ceramic with surface-applied safety film; having impact safety rating meeting ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II; and as follows:
.1 Thickness: 5 mm.
.2 Style: Clear.
.3 Grade: Standard.
.4 Visible Light Transmittance: 88 percent.
.5 Visible Light Reflectance: 9 percent,
.6 Fire Rating (CAN/ULC S104 and CAN/ULC-S106): 90 minutes.
.7 Manufacturer and Product Name: eg. FireLite NT by Nippon Sheet Glass Co., Ltd.

2.6 SEALED INSULATING GLASS UNITS

.1 Sealed Insulating Glass Units (SIG-CLR-1): To CAN/CGSB-12.8; double pane with warm edge seal; comprised as follows:
.1 Outer Pane: 6 mm thick Clear tempered safety glass (GL-3), sputtered Low-E coating on #2 surface.
.2 Interpane Space: Filled with minimum 90 percent Argon gas.
.3 Inner Pane: 6 mm thick Clear tempered safety glass (GL-3).
.4 Overall Thickness: 25 mm.
.5 Manufacturer's Name and Product: eg. Solarban 60 (2) Clear + Clear by Vitro Architectural Glass.

2.7 INSULATED SPANDREL GLASS PANELS

.1 Insulated Spandrel Glass Panels (SGP-CLR-1): Single pane insulated infill panel; comprised as follows:
.1 Outer Pane: Clear tempered safety glass (GL-3), with opaque coating on #2 surface.
.2 Insulation: Mineral fibre semi-rigid board insulation, Type INS-SR-1 as specified in Section 07 21 00, total thickness necessary to achieve total RSI $\geq$ 0.74, and secured to inner liner.
.3 Inner Liner: 1.5 mm thick galvanized sheet steel panel, sealed at edges, corners and fasteners.

2.8 COATINGS AND FILMS

.1 Low-E Coating: To ASTM C1376, Kind CV; magnetron sputtered vacuum deposition (MSVD) coating; eg. Solarban 60 Solar Control Low-E by Vitro Architectural Glass.

.2 Opaque Coating: 0.2 mm thick water-based silicone elastomeric coating; passing GANA 89-1-6; eg. Opaci-Coat-300 by ICD High Performance Coatings, two standard colours, and two custom colours as selected by Consultant.

.3 Decorative Window Film (FILM-DEC): Polyester film with acrylic pressure-sensitive adhesive backing accommodating subsequent removal without the use of heat; as follows:
.1 Overall Thickness: 0.089 mm.
.2 Colour: White.
.3 Opacity: Translucent.
.4 Finish: Matte.
.5 Pattern Design: Fabric / Washi.
.6 Shading Coefficient: 0.89.
.7 Solar Heat Absorbance: 14 percent.
.8 Visible Light Reflectance: 15 percent.
.9 Visible Light Transmittance: 79 percent.
.10 UV Transmittance: 0 percent.
.11 Manufacturer and Product Name: eg. Fasara Series, SH2PTYA - Yamato by 3M Company Canada.

2.9 ACCESSORIES

.1 Warm Edge Seal: Polyisobutylene primary seal with a secondary seal comprised of either silicone, butyl, polysulphide or urethane, as recommended by sealed insulating glass unit manufacturer for each particular glazing application.

.2 Dense Compression Gasket: Moulded or extruded gaskets, made from neoprene or EPDM to ASTM C864, or thermoplastic polyolefin rubber to ASTM C1115; of profile and hardness required to maintain watertight seal.

.3 Soft Compression Gasket: To ASTM C509, Type II; moulded or extruded, closed-cell, integral-skinned gaskets made from neoprene, EPDM or thermoplastic polyolefin rubber; Black colour; profile and hardness required to maintain watertight seal.

.4 Back-Bedding Mastic Glazing Tapes: To ASTM C1281 and AAMA 800, preformed, butyl-based elastomeric tape with 100 percent solids content; non-staining and non-migrating in contact with non-porous surfaces; with or without spacer rod; packaged on rolls with release paper backing.

.5 Expanded Cellular Glazing Tapes: Closed cell, PVC foam tape, factory-coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; to AAMA 800 for the following types:
.1 Tape Acts as Primary Seal: Type 1.
.2 Tape Used in Combination with Full-Bead of Sealant: Type 2.

.6 Glazing Tape for Fire-rated Glass Applications: Fiberfrax Alumino-Silicate Fiber glazing tape by Unifrax Corporation.

.7 Setting Blocks: Elastomeric material, having a Shore A durometer hardness of 85, plus or minus 5.

.8 Setting Blocks for Fire-rated Glass Applications: Calcium silicate.

.9 Spacers: Elastomeric blocks or continuous extrusions, having a Shore A durometer hardness sufficient to maintain glass lites in place both during and after installation.

.10 Edge Blocks: Elastomeric material of sufficient hardness to limit glass lateral movement.

.11 Glazing Sealant: SEAL-GLZ as specified in Section 07 92 00.

.12 Metal Channel Trim: 0.41 mm thick Series 430 stainless steel J-trim; 7.6 mm deep, 22 mm high back leg, 7.9 mm high front leg, and 6.3 mm deep channel to accommodate 6 mm thick glass; eg. SS960 by C. R. Laurence Co. Inc.

.13 Wall Adhesive: Chemically compatible with glass coating and wall substrate.

.14 Cleaners, Primers and Sealers: Types recommended by sealant and gasket manufacturers.

2.10 FABRICATION

.1 Fabricate sealed insulating glass units to IGMA TM-4510.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify openings for glazing are correctly sized, within tolerance and clean.

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.

3.3 INSTALLATION

.1 Conform to GANA Glazing Manual.

.2 Install exterior glazing forming part of building envelope to IGMA TM-3000 to achieve airtight and watertight seal.

.3 Protect glass edges from damage during handling and installation. Remove damaged glass Products from the Place of the Work and dispose of in accordance with the authorities having jurisdiction. Damaged glass is defined as glass with edge damage or other imperfections that, when installed, could weaken the glass and impair performance and appearance.

.4 Install setting blocks in sill rabbets, sized and located in accordance with GANA Glazing Manual. Set blocks in heel bead of glazing sealant.

.5 Do not exceed edge pressures stipulated by glass manufacturer for installing glass lites.

.6 Provide spacers for glass lites where length plus width is larger than 1 270 mm.

.7 Provide edge blocking necessary to prevent glass lites from moving sideways in glazing channel, in accordance with GANA Glazing Manual.

.8 Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sight line of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit the opening.
   .1 Cover vertical framing joints by applying tapes first to heads and sills, and then to jambs.
   .2 Cover horizontal framing joints by applying tapes first to jambs, and then to heads and sills.
   .3 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant.

.4 Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.

.9 Gasket Glazing: Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- .1 Insert soft compression gasket between glass and frame or fixed stop such that it is securely in place, with joints miter cut and bonded together at corners.
- .2 Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.
- .3 Install gaskets so they protrude evenly past face of glazing stops.
- .4 Compress gaskets to produce weather tight seal without developing bending stress in glass.
- .5 Seal gasket joints with compatible sealant.

.10 Wall-Mounted Glass Mirrors
- .1 Ensure wall surface is flat.
- .2 Install top and bottom metal channel trim, secured rigidly to wall construction.
- .3 Provide setting blocks and shims as required to level and adjust mirrored glass faces continuously flush with adjacent mirrored glass panels.
- .4 Set mirrored glass panels plumb and level on wall surface, using beads of adhesive.
- .5 Adjust top metal channel trim to glass edge for snug fit.

3.4 WINDOW FILM APPLICATION

.1 Clean glass surfaces using recommended cleaners and methods prior to film application.

.2 Securely adhere decorative window films in locations and patterns indicated on Drawings.

.3 Ensure no air pockets, creases, folds, marks, delaminations or other visual disfigurements appear in completed window film application.

.4 Conform to IWFA-LT-105, visual acceptance standard.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove glazing materials from finish surfaces.

.3 Remove non-permanent labels upon Ready-for-Takeover.

.4 Clean glass surfaces to GANA GIB 01-0300.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.

.3 Protect glass from contact with contaminating substances resulting from subsequent construction operations.

.4 Protect window film from damage by installing tape warning strips or barricades to prevent contact. Maintain protection until Ready-for-Takeover.

.5 Remove and replace Products that have been damaged, including but not limited to having been broken, chipped, cracked or abraded; regardless of cause before Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 05 40 00 - Cold-Formed Metal Framing.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 06 20 00 - Finish Carpentry.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 08 12 13 - Hollow Metal Frames.

.7 Section 08 31 00 - Access Door and Panels.

.8 Section 09 51 23 - Acoustical Tile Ceilings.

.9 Section 09 81 00 - Acoustic Insulation.

.10 Section 09 90 00 - Painting and Coating.

.11 Section 21 13 00 - Fire Protection Sprinkler System.

.12 Section 23 30 00 - HVAC Air Distribution.

.13 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 ASTM A641/A641M-19(2025): Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M-23: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 ASTM C475/C475M-17(2022): Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.5 ASTM C514-04(2020): Standard Specification for Nails for the Application of Gypsum Board.

.6 ASTM C635/C635M-22: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.7 ASTM C645-24: Standard Specification for Nonstructural Steel Framing Members.

.8 ASTM C754-20: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.9 ASTM C840-25: Standard Specification for Application and Finishing of Gypsum Board.

.10 ASTM C954-22: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.11 ASTM C1002-20: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.12 ASTM C1047-19: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.13 ASTM C1264-19(2024): Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.

.14 ASTM C1396/C1396M-24: Standard Specification for Gypsum Board.

.15 ASTM C1658/C1658M-24: Standard Specification for Glass Mat Gypsum Panels.

.16 ASTM E90-23: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.17 CGC Gypsum Construction Handbook.

.18 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.19 CISCA Ceiling Systems Handbook, 2012 Edition.

.20 GA-214-2021: Levels of Finish for Gypsum Panel Products.

.21 GA-226-2019: Application of Gypsum Board to Form Curved Surfaces.

.22 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

.23 ULC List of Equipment and Materials.

1.3 QUALIFICATIONS

.1 Installers: A firm specializing in erecting metal wall and ceiling framing and installing gypsum board, having minimum 5 years documented experience.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Conform to ASTM C1264.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of metal framing having Product considered acceptable for use:
- .1 Bailey Metal Products Limited.
- .2 CGC Inc.
- .3 Dietrich Metal Framing.

.2 Manufacturers of drywall grid system having Product considered acceptable for use:
- .1 Armstrong World Industries.
- .2 CertainTeed Canada, Inc.

.3 Manufacturers of gypsum board having Product considered acceptable for use:
- .1 CertainTeed Canada, Inc.
- .2 CGC Inc.
- .3 G-P Gypsum Corporation.

.4 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Interior Partitions: Vertical non-load bearing metal stud framing clad with wall boards mechanically-fastened or adhered on one or both sides, and including acoustical insulation and accessories where indicated.

.2 Suspended Ceilings: Horizontal non-load bearing channels and framing carrying mechanically-fastened ceiling boards, and including acoustical insulation and accessories where indicated.

.3 A non-load bearing (non-structural) member is defined as a member in a steel-framed system which is limited to transverse (out-of-plane) load of not more than 480 Pa, a superimposed axial load, exclusive of sheathing materials, of not more than 1460 N/m, or a superimposed axial load of not more than 890 N.

.4 A load bearing (structural) stud may be used in a non-load bearing application; however, non-load bearing members (studs or track) may never be used in a load bearing (axial or lateral loading) application.

2.3 PERFORMANCE CRITERIA

.1 Provide metal wall framing systems with maximum design limit of 240 Pa and maximum allowable deflection of L/360.

.2 Provide metal ceiling framing systems with maximum allowable deflection of L/240.

.3 Fire-Resistance Rated Assemblies: Provide Products and construction identical to those tested in listed assemblies. Refer to CAN/ULC-S101.

.4 Sound Rated Assemblies: Provide Products and construction identical to those tested in listed assemblies. Refer to ASTM E90.

2.4 METAL FRAMING

.1 Metal Wall Studs: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; C-Shape with 32 mm wide flange, complete with serrated faces and knock-outs for electrical fitments; depths as indicated on Drawings.

.2 Metal Shaft Wall Studs: To ASTM C645; 0.836 mm thick sheet steel; galvanized or galvalumed finish; CH- and E-Shapes, complete with serrated faces and knock-outs for electrical fitments; depths as indicated on Drawings.

.3 Metal Floor and Ceiling Tracks: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with 32 mm wide flanges; depths as indicated on Drawings.

.4 Metal Shaft Wall Floor and Ceiling Tracks: To ASTM C645; 0.836 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with 32 mm wide flanges; depths as indicated on Drawings.

.5 Metal Ceiling Deflection Tracks: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with long legs, designed to accommodate structural deflections; depths as indicated on Drawings.

.6 Furring: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; and as described below:
  .1 C-Shaped Furring Channels: 13 mm wide flange, 19 mm deep unless noted otherwise on Drawings.
  .2 Hat-Shaped Furring Channels: 13 mm wide flange, 22 mm deep unless noted otherwise on Drawings.

.3 Z-Shaped Furring Channels: With slotted or non-slotted web, 32 mm face flange, 22 mm wall attachment flange; depth as indicated on Drawings.
.4 Resilient Furring Channels: Designed to reduce sound transmission; 13 mm deep unless noted otherwise on Drawings.

.7 Carrying Channels: To ASTM C754; 1.37 mm thick cold-formed steel with galvanized or galvalumed finish; having minimum yield strength of 228 MPa; C-Shape with 13 mm flange width, 38 mm deep unless noted otherwise on Drawings.

.8 Furring Brackets: 0.79 mm thick sheet steel; galvanized or galvalumed finish; adjustable, with corrugated-edge.

.9 Flat Strap and Backing Plates: 0.455 mm thick sheet steel; galvanized or galvalumed finish; lengths and widths as indicated on Drawings.

.10 Channel Bridging: 0.455 mm thick sheet steel; galvanized or galvalumed finish; 13 mm wide flange, 19 mm deep unless noted otherwise on Drawings.

.11 Drywall Grid System: To ASTM C635/C635M, Class HD; rated and non-rated assemblies; eg. Drywall Grid System by Armstrong World Industries, profiles as follows:
.1 Main Beams: 38 x 38 mm T-Shape beams, factory-formed with 0.455 mm thick galvanized steel to ASTM C645.
.2 Cross Tees: 38 x 38 mm T-Shape cross tees, factory-formed with 0.455 mm thick galvanized steel to ASTM C645.
.3 Mouldings: 32 x 32 mm L-shaped angle mouldings, factory-formed with 0.455 mm thick galvanized steel to ASTM C645.
.4 Trims and Clips: Transition clips, attachment clips, adapter clips, splice clips, spacer clips and drywall clips; factory-formed steel profiles; as recommended by system manufacturer.

.12 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.

.13 Tie Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 1.21 mm OD steel wire.

2.5 BOARDS

.1 Gypsum Lightweight Wall Board (GB-LWT-1): To ASTM C1396/C1396M; 12.7 mm thick; paper facers, tapered edges; maximum 6.1 kg/m^2 weight; eg. Sheetrock Ultralight Panels by CGC Inc.

.2 Gypsum Lightweight Ceiling Board (GB-LWT-2): To ASTM C1396/C1396M; 12.7 mm thick; paper facers, eased edges; maximum 6.5 kg/m^2 weight; eg. Sheetrock Ultralight Sag-Resistant Interior Ceiling Board Panels by CGC Inc.

.3 Gypsum Lightweight Firecode Board (GB-LWT-3): To ASTM C1396/C1396M, Type X; 15.9 mm thick; paper facers, tapered edges; maximum 8.8 kg/m^2 weight; eg. Sheetrock Ultralight Panels Firecode X by CGC Inc.

.4 Gypsum Moisture-Resistant Board (GB-MR): To ASTM C1396/C1396M, Type X; 15.9 mm thick; with water- and mould-resistant gypsum core and paper facers, tapered edges; eg. Sheetrock Mold Tough FireCode X Panels by CGC Inc.

.5 Gypsum Shaft Liner Board (GB-SL): To ASTM C1658/C1658M, Type X; 25 mm thick; double bevelled edges; silicone treated gypsum core, with coated glass mat facers both sides; eg. Sheetrock Glass-Mat Liner Panels by CGC Inc.

2.6 ACCESSORIES

.1 Foam Gasket: 3.2 mm thick adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement; width to suit track depth.

.2 Corner Beads, Casing Beads, Control Joints and Edge Trim: To ASTM C1047; metal type.

.3 Reveals and Trim Reglets: To ASTM C1047; extruded aluminum profiles; as indicated on Drawings.

.4 Nail Fasteners: To ASTM C514; galvanized steel.

.5 Steel Drill Screws: To ASTM C954; galvanized steel.

.6 Self-Tapping Screws: To ASTM C1002; galvanized steel, Types as follows:
.1 For Securement to Metal Framing: Fine Thread, Type S.
.2 For Securement to Gypsum Backing Board: Coarse-pitch High-thread, Type G.

.7 Adhesive: To CAN/CGSB-71.25-M.

.8 Joint Tape: Fiberglass joint tape, 50 mm wide, self-adhering type; eg. Mould Resistant Fiberglass Drywall Tape by CGC Inc.

.9 Joint Compound: To ASTM C475/C475M; ready-mixed drying type drywall compound; eg. Synko Brand Classic All Purpose Drywall Compound by CGC Inc.

.10 Acoustic Insulation: Mineral fibre acoustical batt insulation, as specified in Section 09 81 00.

.11 Acoustical and Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

.12 Water: Potable.

2.7 MIXING

.1 Thoroughly mix joint and skim coat materials to a homogenous mixture with trowelling consistency.

2.8 FINISHES

.1 Galvanized Coating on Metal Framing Components: To ASTM A653/A653M, Coating Designation Z120; hot dipped zinc alloy coating.

.2 Galvalumed Coating on Metal Framing Components: To ASTM A792/A792M, Coating Designation AZM150; hot dipped aluminum-zinc alloy coating.

3 Execution

3.1 PREPARATION

.1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure.
.1 Ensure inserts and other provisions for anchorages to building structure have been installed to receive hangers at the required spacing.
.2 Supply concrete inserts and other devices to other related Sections for installation in advance.

.2 Before sprayed fireproofing is applied, attach offset anchor plates or ceiling track to surfaces designated to receive sprayed fireproofing. Where offset anchor plates are required, Provide continuous plates fastened to building structure at maximum 600 mm OC.

.3 Once sprayed fireproofing has been applied, remove them only to the extent necessary for installation of non-load bearing steel framing. Do not reduce thickness for sprayed fireproofing below that required for fire-resistance ratings indicated. Protect adjacent sprayed fireproofing from damage.

3.2 METAL WALL FRAMING

.1 Install metal wall framing to ASTM C754 and the CGC Gypsum Construction Handbook.

.2 Where metal framing is installed directly against exterior masonry walls or dissimilar metals at exterior walls, Provide foam gasket between metal framing and exterior wall.

.3 Install studs with flanges pointing in same direction.

.4 Space metal studs in straight runs at maximum 400 mm OC.

.5 Install track floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions of structure.

.6 Where framing extends to overhead structural supports, Provide deflection track to create a slip-type head joints to produce joints at tops of framing system that prevent axial loading of finished assemblies due to deflection of structure.

.7 Screw vertical studs at door opening jambs to jamb anchor clips at door frames. Install track section for cripple studs at head and secure to jamb studs.
- .1 Provide two studs at each jamb.
- .2 Provide cripple studs at head adjacent to each jamb stud, with a minimum 13 mm clearance from jamb stud to allow for installation of control joint in finished assembly.

.8 Provide framing below sills of openings to match framing required above opening heads.

.9 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated. Support closures and make partitions continuous from floor to underside of solid structure.

.10 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

.11 Curved Walls and Partitions: Conform to GA-226, and as follows:
- .1 Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
- .2 Begin and end each arc with a stud, and space intermediate studs equally along arcs at maximum 150 mm OC.
- .3 On straight lengths of not less than two studs at ends of arcs, place studs at maximum 150 mm OC.

.12 Attach furring directly to concrete or masonry with stub nails, screws designed for masonry attachment, or power-driven fasteners; spaced at 610 mm OC.

.13 Z-Furring Members:
- .1 Erect insulation vertically and hold in place with Z-furring members spaced at 610 mm OC.
- .2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners; spaced at 610 mm OC.
- .3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel.
- .4 At interior corners, space second member no more than 305 mm from corner and butt insulation to fit.

.14 Unless indicated otherwise, Provide supplementary framing and furring to conceal pipes, conduit and ducts.

.15 Provide supplementary framing and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and other similar components.

.16 Install bracing at terminations in assemblies.

.17 Do not bridge building control joints and expansion joints with non-load bearing steel framing members. Frame both sides of joints independently.

.18 Installation Tolerances: Install framing members so fastening surfaces vary not more than 3 mm from the plane formed by the faces of adjacent framing members.

3.3 SUSPENDED CEILING FRAMING

.1 Install ceiling framing to ASTM C754 and CISCA installation standards.

.2 Isolate suspension system from building structure. Prevent transfer of loading imposed by structural movement.

.3 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum.

.4 Size supplemental suspension members and hangers to support ceiling loads within established performance limits.

.5 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or similar devices.

.6 Secure wire hangers by looping and wire tying, either directly to structure or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate; and in a manner that will not cause hangers to fail or deteriorate.

.7 Do not attach hangers to steel roof decking, or to rolled-in hanger tabs of composite steel floor decking.

.8 Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

.9 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.10 For fire-resistance-rated assemblies, wire tie furring channels to supports.

.11 Installation Tolerances: Level to within 3 mm in 3 600 mm, measured lengthwise on each member that will receive finishes, and transversely between parallel members that will receive finishes.

3.4 ACOUSTICAL ACCESSORIES

.1 Install resilient channels at maximum 600 mm OC.

.2 Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around facility service components located within or behind partitions, and tight to items passing through partitions.

.3 Install acoustical sealant within designated sound-rated partitions.

3.5 BOARD INSTALLATION

.1 Install boards to ASTM C840 and CGC Gypsum Construction Handbook.

.2 Install gypsum ceiling board perpendicular to supports.

.3 Screw fasten boards to furring or framing.

.4 Install shaft liner gypsum board on metal shaft wall stud and track framing.

.5 Double Layer Applications: Place first layer perpendicular to framing or furring members. Place second layer perpendicular to first layer.

.6 Place corner beads at external corners. Place edge trim where gypsum board abuts dissimilar materials. Fasten with nail attachment, unless specified otherwise.

.7 Provide bulkheads where changes of ceiling or height occur.

.8 Install access panels when and where directed by affected Subcontractors. Refer to Section 08 31 00.

3.6 BOARD FINISHING

.1 Tape, fill, and sand exposed joints, edges, and corners to a smooth surface.

.2 Leave surfaces smooth, even, plumb, and true.

.3 Leave surfaces ready to receive final finishes specified in other Sections.

.4 Unless specified otherwise, finish gypsum board to GA-214, Level 4.
.1 Provide Level 1 finish on concealed surfaces, such as in plenum spaces above ceilings or concealed behind casework.
.2 Provide Level 5 finish on glass mat faced gypsum surfaces designated to receive a painted finish.

3.7 CONTROL JOINTS

.1 Provide control joints where indicated on Drawings, and where:
.1 Ceiling, partition or furring abuts a structural element,
.2 Ceiling, partition or furring abuts dissimilar construction,
.3 Construction changes within plane of the partition or ceiling,
.4 Partition or furring run exceeds 9 000 mm.
.5 Ceiling dimensions exceed 15 000 mm in either direction,
.6 Wings of "L-", "U-" and "T"-shaped ceiling areas are joined, and
.7 Expansion or control joints occur in the structural elements of the building.

.2 Break continuity of gypsum board and framing system at control joints.

.3 Provide continuous control joint profile.

3.8 RELIEF JOINTS

.1 Provide relief joints where indicated on Drawings and where gypsum board assemblies abut dissimilar construction.

.2 Stop gypsum board 6 mm from abutting construction at dissimilar building elements, unless indicated otherwise.

.3 Provide thermal break where gypsum board comes into contact with frames. Adhere self-adhering tape to casing bead and compress during installation of gypsum board.

.4 Provide reveal mouldings where gypsum board ceilings meet curved wall surfaces, and where indicated on Drawings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 07 92 00 - Joint Sealants.

.3 Section 09 65 19 - Resilient Tile Flooring.

.4 Section 22 13 13 - Sanitary Drains.

.5 Section 22 44 13 - Plumbing Fixtures.

1.2 REFERENCES

.1 ANSI A108.01:2023: General Requirements: Subsurfaces and Preparations by Other Trades.

.2 ANSI A108.4:2023: Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.

.3 ANSI A108.5:2023: Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

.4 ANSI A108.10-1999: Installation of Grout in Tilework (Reaffirmed 2022).

.5 ANSI A108.13-2005: Installation of Load Bearing, Bonded, Waterproof Membrane for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).

.6 ANSI A108.17-2005: Installation of Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).

.7 ANSI A118.1:2023: Specifications for Dry-Set Portland Cement Mortar.

.8 ANSI A118.4:2023: Specifications for Modified Dry-Set Cement Mortar.

.9 ANSI A118.7-2010: Specifications for Polymer Modified Cement Grouts for Tile Installation (Reaffirmed 2016).

.10 ANSI A118.10:2023: Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

.11 ANSI A118.12-2014: Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation (Reaffirmed 2024).

.12 ANSI A136.1-2008: Specifications for Organic Adhesives for Installation of Ceramic Tile (Reaffirmed 2013).

.13 ANSI A137.1-2022: Specifications for Ceramic Tile.

.14 ASTM C627-18(2024): Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.

.15 ASTM C847-18(2024): Standard Specification for Metal Lath.

.16 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.17 ASTM F3191-26: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

.18 CAN/CGSB-25.20-95: Surface Sealer for Floors.

.19 TTMAC Specification Guide 09 30 00 - Tile Installation Manual (2025).

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: A 300 x 300 mm size panel, complete with selected grout colour; mounted to 19 mm thick plywood backer.

1.4 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Latest edition of TTMAC Hard Surface Maintenance Guide; sufficient quantities for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

.1 Supply additional two percent of each tile type and colour; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name, and
.3 Product colour and pattern.

.2 Package tiles neatly in original containers, to prevent damage.

1.6 QUALIFICATIONS

.1 Installers: Skilled mechanics trained and experienced in tiling, and registered as members of TTMAC.

1.7 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products in a dry area, protected from freezing, staining, and damage.

.3 Store cementitious materials on a dry surface.

1.8 AMBIENT CONDITIONS

.1 Do not install tiles at temperatures less than 12 degrees C.

.2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of mortars, grouts, and adhesives having Product considered acceptable for use:
.1 Custom Building Products.
.2 Flextile.
.3 Laticrete.
.4 Mapei.
.5 Proma Adhesives, Inc.
.6 TEC.

.2 Manufacturers of tile-setting accessories having Product considered acceptable for use:
.1 Bengard.
.2 Profilitec.
.3 Schlüter Systems (Canada) Inc.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 PERFORMANCE CRITERIA

.1 Traffic Level Performance (ASTM C627): Moderate Class.

2.3 TILE MATERIALS

.1 Porcelain Floor Tile (PFT): To ANSI A137.1; 305 x 305 mm size porcelain tile, matte finish; Taurus Graniti as distributed by Olympia Tile International or Vitra Dotti Series as distributed by Centura Floor and Wall Fashions; up to three colours as selected by Consultant.

.2 Cut Base Tile: 100 mm high, site-cut from floor tile, minimum one factory-formed edge along tile's length; type, size, colour, and texture to match adjacent flooring material.

2.4 MORTAR AND GROUT MATERIALS

.1 Dry-Set Portland Cement Mortar: To ANSI A118.1.

.2 Latex-Portland Cement Mortar: To ANSI A118.4.

.3 Grout: To ANSI A118.7; rapid-setting type, polymer-modified sanded grout; eg. Ultracolor Plus FA by Mapei, colours as selected by Consultant.

2.5 ACCESSORIES

.1 Crack Isolation Membrane: Loadbearing membrane, to ANSI A118.12, High Performance Rating.

.2 Reinforcing Mesh: 50 x 50 mm size; 1.6 mm thick steel wire mesh; welded fabric, galvanized.

.3 Metal Lath: To ASTM C847; 1.4 kg/m^2 galvanized steel lath.

.4 Tape: 50 mm fibre mesh tape, as recommended by backer board manufacturer.

.5 Organic Adhesive: To ANSI A136.1, Type 1 for wet areas and Type 2 for dry areas.

.6 Latex Additive: Formulated for use in portland cement mortars and grout.

.7 Water: Clean, cold and potable.

.8 Joint Sealants: As specified in Section 07 92 00, Types as follows:
- .1 Tiled and Grouted Surfaces: Interior tiling sealant, Type SEAL-INT-TILE.
- .2 Metal Trims to Adjacent Non-Tiled Surfaces - Dry Areas: Interior general purpose sealant, Type SEAL-INT-GP.
- .3 Metal Trims to Adjacent Non-Tiled Surfaces - Wet Areas: Interior moisture-resistant sealant, Type SEAL-INT-MR.

.9 Tile Sealer: To CAN/CGSB-25.20, Type 1 - Penetrating.

2.6 MANUFACTURED COMPONENTS AND ACCESSORIES

.1 Edge and Transition Strips: Roll-formed stainless steel edge strips, 3 mm wide at top edge; with integral perforated anchoring leg for setting the strip into the setting material; height as required; brushed finish; eg. SCHIENE-EB by Schlüter Systems (Canada) Inc.

.2 Tapered Transition Strips - To Other Floor Finishes: Roll-formed stainless steel transition strips; profile and height as indicated; with integral perforated anchoring leg for setting the strip into the setting material; sloped transition and decorative edge strip for transition from tile to lower finish; brushed finish; eg. RENO-EBU by Schlüter Systems (Canada) Inc.

.3 Tapered Transition Strips - To Concrete Floors: Extruded aluminum transition strips; with integral perforated anchoring leg for setting the strip into the setting material; sloped transition and decorative edge strip for transition from tile to lower finish; height as required; satin anodized finish; eg. RENO-RAMP AE by Schlüter Systems (Canada) Inc.

.4 Decorative Edge Trim: Extruded aluminum decorative edge trim with integral perforated anchoring leg for setting the strip into the setting material; complete with pre-formed corners; satin anodized finish; eg. RONDEC-DB 14 AE by Schlüter Systems (Canada) Inc.

.5 Tile Expansion and Control Joints for Thin-Set Applications: Roll formed stainless steel profiles joined by a soft CPE movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed; height as required to suit application; insert colour as selected by Consultant; eg. DILEX-EKSN by Schlüter Systems (Canada) Inc.

.6 Uncoupling Membrane: To ANSI A118.10; 3 mm thick high density polyethylene membrane with grid structure of 12 x 12 mm square cavities, each cut back in dovetail configuration, and polypropylene anchoring fleece laminated to underside; eg. DITRA by Schlüter Systems (Canada) Inc.

2.7 MIXES

.1 Scratch Coat (by volume): One part Portland cement, 4 parts sand and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.

.2 Slurry Bond Coat: Mix Portland cement and water to a creamy, paste-like consistency. Include latex additive where required by TTMAC Detail.

.3 Levelling Coat (by volume): One part Portland cement, 4 parts sand and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer's instructions.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Ensure substrates have been prepared to ANSI A108.01.

.3 Ensure substrate surfaces are clean, dimensionally stable, cured, and free of contaminants such as oil, sealers, and curing compounds.

.4 Ensure concrete has cured for minimum 28 days.

.5 Ensure concrete slabs have not been treated with proprietary curing compounds.

.6 Ensure concrete slabs are steel trowelled to a Fine Broom finish.

.7 Ensure concrete slabs have been finished with maximum permissible variation of 3 mm in 3 000 mm from required plane and not more than 1.5 mm in 305 mm when measured from high points in surface.

.8 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER $\leq$ 1.45 kg per 93 m^2 for 24 hours.

.9 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

3.2 PREPARATION

.1 Protect surrounding work from damage or disfiguration.

.2 Thoroughly clean substrates to ensure removal of grease, oil, and dust film.

.3 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test.

.4 Apply latex modified cementitious levelling coat wherever concrete slab does not meet specified tolerance for flatness and levelness, and where slight irregularities exist. Limit levelling coat thickness to less than 8 mm.

.5 Install crack isolation membrane as required by TTMAC Details, to ANSI A108.17. If membrane is applied over rough surface, apply 6 mm thick sand-bed under membrane.

.6 Install uncoupling membrane as required by TTMAC Details, to ANSI A108.13.

3.3 INSTALLATION

.1 Install Products to TTMAC Specification Guide 09 30 00, as scheduled below.

.2 Apply tile using water-resistant organic adhesives to ANSI A108.4.

.3 Apply tile using dry-set Portland cement mortar, latex-Portland cement mortar, or large-format tile mortar, to ANSI A108.5.

.4 Install tiles with straight, uniform joints, to tile manufacturers' recommended joint widths.

.5 Fit tile units around corners, fitments, fixtures, drains, and other built-in objects to maintain uniform joint appearance.

.6 Make cut edges smooth, even, and free from chipping. Do not split tile.

.7 Lay out tiles according to patterns indicated on Drawings. Ensure perimeter and cut tiles are minimum half size.

.8 Set tiles in place while bond coat is wet and tacky, prior to skinning over. Slide tile back and forth to ensure a proper bond and level surface. Avoid lippage.

.9 Clean backs of tiles and back butter tiles to ensure a 95 percent bond coverage.

.10 Clean excess mortar from surface prior to final set.

.11 Sound tiles after setting materials have cured and replace hollow sounding tile before grouting.

.12 Exterior Surfaces and Wet Areas (Thin Set Method): Notch adhesive in straight lines, backbutter tile and set on freshly trowelled thin-set mortar. Move tile back and forth perpendicular to notches.

.13 Install site-cut tiles with site-cut edges concealed within either a grouted joint or a metal trim. Visually expose only factory-made edges.

.14 Keep two-thirds the depth of grout joints free of setting material.

.15 Seal around penetrating components, along unfinished edges and terminations, along gaps between metal trims and adjacent materials, and as indicated on Drawings using appropriate joint sealants, as specified in Section 07 92 00.

3.4 MOVEMENT JOINTS

.1 Install control and expansion joints to TTMAC Detail 301MJ.

.2 Keep control joints and expansion joints free of setting materials.

.3 In addition to the guidelines outlined in TTMAC Specification Guide 09 30 00, Provide movement joints over cold joints, saw cuts, at columns, and at wall plane changes.

3.5 TILE-SETTING ACCESSORIES INSTALLATION

.1 Install tile-setting accessories in continuous lengths, to level straight lines by pressing the perforated anchoring leg of the accessory solidly into the tile setting adhesive.

.2 Butt ends of units tightly together with hairline joint. Trowel an additional layer of tile setting material over the anchored leg of the accessory prior to placement of tiles.

.3 Unless specified otherwise, solidly embed tiles over anchoring leg of installed trim with surface of tile flush with top of tile-setting accessories.

.4 Leave 3 mm joint between tile and tile-setting accessories for filling with grout.

.5 Install pre-formed corners, end-caps, and trim at changes in direction and at terminations. Mitered joints will be rejected.

.6 Expansion and Control Joints: Solidly embed tiles over installed edge strips with joint surface either flush with top of joint or 1 mm below top of tile.

3.6 GROUTING

.1 Allow proper setting time prior to grouting.

.2 Preseal tiles requiring protection from grout staining.

.3 Apply cementitious grout to ANSI A108.10.

.4 Force grout into joints to ensure dense finish.

.5 Remove excess and polish with clean cloths.

3.7 FIELD QUALITY CONTROL

.1 Inspect completed work and replace broken, cracked, or damaged tile.

3.8 TOLERANCES

.1 Level tiles to a 1 mm tolerance over 3 mm wide joint.

3.9 CLEANING

.1 Refer to Section 01 74 00.

.2 Apply tile sealer to floor tiles.

3.10 PROTECTION

.1 Protect finished areas from traffic until setting materials have sufficiently cured.

.2 Protect grouted areas from traffic for 24 hours after grouting.

.3 Provide protective covering until Ready-for-Takeover.

.4 Protect tile base from impact, vibration, heavy hammering on adjacent and opposite walls for at least 14 days after installation.

3.11 SCHEDULE

.1 Tile Bonded to Concrete Slab - Thin-Set Method: TTMAC Detail 311F (A - Interior/Exterior), or (C - Crack Concrete Interior/Exterior - Full Coverage).

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies.

.2 Section 09 81 00 - Acoustic Insulation.

.3 Section 21 13 00 - Fire Protection Sprinkler System.

.4 Section 23 30 00 - HVAC Air Distribution.

.5 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A641/A641M-19(2025): Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.4 ASTM C635/C635M-22: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.5 ASTM C636/C636M-19(2025): Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.6 ASTM E1264-23: Standard Classification for Acoustical Ceiling Products.

.7 CISCA Ceiling Systems Handbook, 2012 Edition.

.8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 ULC List of Equipment and Materials.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Duplicate 140 x 290 mm size sample of each specified acoustic ceiling tile, indicating texture, pattern, colour, and edge profile.

1.4 EXTRA STOCK MATERIALS

.1 Supply additional two percent of each lay-in ceiling tile, colour, and pattern; clearly marked to identify:
- .1 Manufacturer's name,
- .2 Product's name, and
- .3 Product colour and pattern.

.2 Store bundles in original undamaged packages, in a warm, dry area.

1.5 QUALIFICATIONS

.1 Installer: A firm specializing in installing suspended metal ceiling grid and lay-in tile ceilings, having minimum three years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products undamaged original containers.

.3 Store Products in warm, dry area.

2 Products

2.1 MANUFACTURERS

.1 Substitution Procedures: No substitutions allowed.

2.2 MATERIALS

.1 Acoustic Ceiling Tile (ACT): To ASTM E1264, Type A, Form A1.2, Pattern C, E & K; wet-formed mineral fiber non-sagging lay-in tile, complete with anti-mould and mildew treatment, and sag resisting treatment; as follows:
.1 Size: 610 x 1 220 mm size.
.2 Thickness: 15 mm.
.3 Pattern: Medium texture, non-directional fissured.
.4 Edge: Square.
.5 Weight: 5.6 kg/m^2.
.6 Finish: Factory-applied latex paint, White colour.
.7 Fire Resistance (CAN/ULC-S102): Class A.
.8 Noise Reduction Coefficient: NRC $\geq$ 0.55.
.9 Light Reflectance: LR $\geq$ 0.83.
.10 Manufacturer and Product Name: USG Radar Basic by CGC Inc.

.2 Suspended Ceiling Grid: To ASTM C635/C635M, Class HD; commercial quality, cold rolled steel, non-fire rated; main tees, cross tees and grid adapters with exposed 24 mm T-shape, 38 mm high; die cut and interlocking components, with baked enamel finish; USG Donn Brand DXL by CGC Inc.

.3 Exposed Perimeter Trim: Extruded aluminum, knife edge design, straight profile, 60 mm high, 200 mm wide; complete with pre-mitred inside and outside corner units, hanging clips, connector clips, splice clips, alignment clips, hold-down clips, and adjustable trim clips; White baked enamel finish.

.4 Transition Mouldings: Cold-rolled galvanized steel profiles, with baked enamel finish in colour to match ceiling grid; types as follows:
.1 Shadow Reveal Transition Moulding: 10 mm shadow reveal with 24 mm horizontal flange.
.2 F-Vertical Transition Moulding: 52 mm wide F-shaped profile.
.3 Straight Transition Moulding: Suitable for elevation changes, complete with outside corners, inside corners, splice plates, drywall trims, and connector clips; heights as indicated on Drawings.

.5 Accessories: Stabilizer bars, clips, splices, edge mouldings, shadow mouldings, caps, cross tree plugs, threaded studs, cloud accessory kits, and hold down clips required for suspended grid system; same material and finish as ceiling grid.

.6 Support Channels and Hangers: Galvanized steel, to rigidly secure ceiling system with maximum deflection of L/360.

.7 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.

.8 Tie Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 1.21 mm OD steel wire.

2.3 FINISHES

.1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped, zinc alloy coating.

.2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped, zinc alloy coating.

.3 Baked Enamel Coating on Ceiling Grid and Trim: One coat of zinc oxide primer sprayed and baked followed by two coats of semi-gloss enamel sprayed and baked; White colour.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify layout of hangers will not interfere with other work.

.3 Verify ducts, pipes, fittings, and other penetrations have been properly installed.

3.2 SUSPENDED CEILING GRID

.1 Install suspended ceiling grid system to ASTM C636/C636M and CISCA installation standards.

.2 Provide support channel and hanger assemblies necessary for suspended planks.

.3 Suspend planks from support assembly using caps, cross tree plugs, and threaded studs, mounted at height above finished floor as indicated on Drawings.

.4 Hang suspended ceiling grid directly from structural elements, independent of walls, columns, metal deck, ducts, pipe fittings, and conduit. Provide additional support channels and hangers as required.

.5 Space hangers at maximum 1 220 mm OC along supporting grillage, and not more than 150 mm OC from ends. Do not place hangers in front of access panels.

.6 Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers to span the extra distance.

.7 Install additional hangers and reinforcing to accommodate loads being carried.

.8 Provide suspension hanger at each corner of suspended fixtures, and at maximum 610 mm OC around perimeter of fixture.

.9 Locate ceiling grid system on room axis leaving equal border units according to reflected ceiling plan.

.10 Install main tees suspended at maximum 1 220 mm OC and maximum 600 mm from wall.

.11 Install cross tees and grid adapters perpendicular to main tees, and interlock with main tees.

.12 Frame around fixtures and openings.

.13 Install edge moulding at intersection of ceiling and vertical surfaces.

.14 Install exposed perimeter trim at exposed system edges.

.15 Form expansion joints as detailed. Form to accommodate plus or minus 25 mm movement. Maintain visual closure.

3.3 ACOUSTIC CEILING TILES

.1 Fit acoustic ceiling tiles within grid, free from damaged edges.

.2 Neatly cut acoustic ceiling tiles to accommodate necessary penetrations.

.3 Cut and rabbet acoustic ceiling tiles at border areas and vertical surfaces.

.4 Lay directional patterned units one way with pattern parallel to longest room axis. Fit border neatly against abutting surfaces.

.5 Install hold-down clips to retain ceiling tiles tight to grid system within 6 000 mm of exterior door.

3.4 TOLERANCES

.1 Deviation from Flat and Level Surface: $\leq$ 3 mm in 3 000 mm.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 09 21 16 - Gypsum Board Assemblies.

.4 Section 09 30 00 - Tiling.

.5 Section 09 65 19 - Resilient Tile Flooring.

1.2 REFERENCES

.1 ASTM F1861-21(2025): Standard Specification for Resilient Wall Base.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate 100 mm long samples, illustrating manufacturer's complete line of available colour selections.

1.4 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

.1 Extra Stock Materials: Supply additional 5 percent of each Product, colour, and pattern; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name, and
.3 Product colour and pattern.

.2 Package extra stock materials neatly in original containers, to prevent damage.

.3 Stack extra stock materials not more than four boxes high.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver and store Products undamaged in original wrapping or cartons.

.3 Store Products for minimum three days prior to installation in a warm, dry room.

.4 Stack Products not more than four boxes high.

1.7 AMBIENT CONDITIONS

.1 Maintain ambient air temperature of 20 degrees C three days prior to, during and 48 hours after installation.

.2 Maintain ambient air relative humidity level between 35 percent and 55 percent RH.

.3 Do not install Products in conditions of high humidity or where exposed to cold drafts.

.4 In hot weather, protect Products from direct sunlight.

.5 Provide adequate ventilation.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Armstrong World Industries.
.2 Tarkett Johnsonite.
.3 Roppe Corporation.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Resilient Straight Base (RB-STR): To ASTM F1861, Type TP, Group 1, Style A - Straight; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; colours as selected by Consultant.

.2 Resilient Coved Base (RB-COVE): To ASTM F1861, Type TP, Group 1, Style B - Cove; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; complete with pre-moulded end stops and external corners; colours as selected by Consultant.

.3 Resilient Transition Strips (RTS): Thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; colour as selected by Consultant.

.4 Adhesive: Non-flammable, solvent free contact adhesive, neoprene water-based formulation, Off-white colour; eg. Johnsonite 946 Premium Contact Adhesive by Tarkett Johnsonite.

.5 Substrate Filler: Premixed latex filler; White colour.

.6 Primers: Waterproof type.

.7 Sealer: Enviro Solutions Barricade Floor Sealer #82.

.8 Wax: Swish Green and Clean Floor Finish Wax.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify surfaces are dry, true, even, and smooth.

.3 Verify surfaces are free of paint, grease, and oil.

.4 Verify surfaces free of gaps, holes, and depressions.

3.2 PREPARATION

.1 Clean substrate to remove deleterious matter which would impair adhesion of Products.

.2 Prepare substrate to a smooth and flat surface, as follows:
.1 Remove ridges and bumps by grinding or other means.
.2 Fill low spots, cracks, joints, holes and other defects with filler.
.3 Apply, trowel and float filler to leave smooth, flat, hard surface.
.4 Prohibit traffic until filler is cured.
.5 Vacuum clean substrate.

.3 Prime substrate as and when recommended to ensure proper adhesion of Products.

3.3 INSTALLATION

.1 Install base on solid backing.

.2 Bond Products tight to surfaces.

.3 Mitre internal corners.

.4 At exposed ends and external corners, conform to the following:
.1 Coved Base: Use pre-moulded units.
.2 Straight Base: V-cut back of base strip to two-thirds its thickness and fold to desired shape.

.5 Scribe and fit base to door frames and other interruptions.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean installed Products.

.3 Seal Products using minimum two coats sealer.

.4 Wax Products using minimum two coats wax.

3.5 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation with suitable and durable materials.

.3 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 09 30 00 - Tiling.

.3 Section 09 65 13 - Resilient Base and Accessories.

1.2 REFERENCES

.1 ASTM F710-26: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.2 ASTM F1066-25: Standard Specification for Vinyl Composition Floor Tile.

.3 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.4 ASTM F2678-16(2026): Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring.

.5 ASTM F3191-26: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

.6 ASTM F3441-24a: Standard Guide for Measurement of pH Involving Resilient Flooring Installations.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate 300 x 300 mm size samples of each specified Product, illustrating manufacturer's complete line of available colours and patterns.

1.4 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

.1 Supply additional 5 percent of each resilient tile, colour, and pattern; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name, and
.3 Product colour and pattern.

.2 Package extra stock materials neatly in original containers, to prevent damage.

.3 Stack extra stock materials not more than four boxes high.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver and store Products undamaged in original wrapping or cartons.

.3 Store Products for minimum three days prior to installation in warm dry room.

.4 Stack Products not more than four boxes high.

1.7 AMBIENT CONDITIONS

.1 Maintain ambient air temperature of 20 degrees C three days prior to, during and 48 hours after installation.

.2 Maintain ambient air relative humidity level between 35 percent and 55 percent RH.

.3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts.

.4 In hot weather, protect flooring from direct sunlight.

.5 Provide adequate ventilation.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Amtico.
.2 Armstrong World Industries.
.3 Tarkett Johnsonite.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Vinyl Composition Tile (VCT): To ASTM F1066, Composition 1, Class 2; reinforced resilient vinyl tile, as follows:
.1 Thickness: 3.2 mm.
.2 Tile Size: 305 x 305 mm.
.3 Colours: As selected by Consultant.
.4 Manufacturer and Product Name: eg. Standard Excelon - Imperial Texture by Armstrong World Industries.

.2 Adhesive: Water-based / latex resin adhesive, Clear colour; eg. S-515 Tile Strong Adhesive by Armstrong World Industries.

.3 Cementitious Underlayment Patching Compound: Self-drying, hydraulic cement-based underlayment, having a trowel-applied consistency; mould- and mildew-resistant; capable of achieving a true feather edge; zero VOC content; eg. Feather Finish by Ardex Americas.

.4 Primers: Waterproof type.

.5 Sealer: Enviro Solutions Barricade Floor Sealer #82.

.6 Wax: Swish Green and Clean Floor Finish Wax.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify surfaces are dry, true, even, and smooth.

.3 Verify surfaces are free of gaps, holes, depressions, paint, grease, and oil.

.4 Verify concrete slabs have cured for minimum 28 days.

.5 Verify concrete slabs have pH level between 5 and 11, when tested to ASTM F3441.

.6 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER $\leq$ 3.17 kg per 93 m^2 for 24 hours.

.7 Determine absorptive nature of substrate by conducting porosity tests to ASTM F3191.

.8 Ensure concrete slabs meet minimum requirements of flooring and adhesive manufacturers. Do not proceed with placement of adhesive and installation of resilient flooring until slab surfaces and conditions comply with manufacturers' requirements, as indicated in each manufacturer's installation instructions and good work practices. Prior to commencing flooring installation, adhesive and resilient flooring manufacturers must each submit a written acceptance to Owner, Contractor, Consultant, and installation Subcontractor, verifying existing conditions at Place of the Work are acceptable.

3.2 PREPARATION

.1 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test. Conform to ASTM F710.

.2 Prepare cementitious underlayment patching compounds and slab surfaces to ASTM F2678.

.3 Clean substrate to remove deleterious matter that would impair subsequent installation.

.4 Prime substrates to ensure proper adhesion of Products.

3.3 INSTALLATION

.1 Install Products with joints and seams parallel to building lines, laid in a brick ashlar pattern.

.2 Spread only enough adhesive to permit installation of Products before initial set.

.3 Set Products in place, and press with heavy roller to attain full adhesion.

.4 Provide perimeter tile of similar size within any given area.

.5 Provide accent tiles, feature strips, and inserts where indicated on Drawings.

.6 Lay flooring continuously from wall to wall in each area, including beneath casework.

.7 Terminate flooring at centre line of door openings where adjacent floor finish is dissimilar.

.8 Scribe flooring to walls, columns, floor outlets, and other appurtenances to produce tight joints.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean installed Products.

.3 Seal Products using minimum two coats sealer.

.4 Wax Products using minimum two coats wax.

3.5 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect completed installation with suitable and durable material, or by keeping traffic off floor.

.3 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 21 00 - Thermal Insulation.

.2 Section 09 21 16 - Gypsum Board Assemblies.

.3 Section 09 51 23 - Acoustical Tile Ceilings.

1.2 REFERENCES

.1 ASTM C167-25: Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

.2 ASTM C423-23e1: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.3 ASTM E90-23: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.5 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.6 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

.7 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.8 ULC-S702.2-15: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products away from construction activity and sources of ignition.

.3 Protect Products from damage during handling, installation and at point of installation.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of acoustical insulation having Product considered acceptable for use:
.1 CertainTeed Canada, Inc.
.2 Knauf Insulation.
.3 Owens-Corning Canada Inc.
.4 Rockwool.

.2 Manufacturers of flame-resistant acoustical insulation having Product considered acceptable for use:
.1 Johns Manville.
.2 Owens-Corning Canada Inc.
.3 Rockwool.

.3 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 MATERIALS

.1 Acoustical Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre acoustical batts, non-rigid, friction fit type, manufactured from glass, rock, or slag fibers; and as follows:
.1 Noise Reduction Coefficient (ASTM C423): NRC $\geq$ 1.10 @ 76 mm thick.
.2 Facing: Unfaced.
.3 Density (ASTM C167): $\geq$ 40 kg/m^3.
.4 Combustibility (CAN/ULC-S114): Noncombustible.
.5 Surface Burning Characteristics (CAN/ULC-S102)
.1 Flame Spread Index = 0.
.2 Smoke Developed Index = 0.
.6 Thickness: As indicated on Drawings.
.7 Manufacturer and Product Name: eg. Safe'n'Sound by Rockwool.

.2 Flame-Resistant Acoustical Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre acoustical batts, non-rigid, friction fit type, manufactured from only rock or slag fibers; acceptable for use in fire-rated partitions; and as follows:
.1 Noise Reduction Coefficient (ASTM C423): NRC $\geq$ 1.10 @ 100 mm thick.
.2 Facing: Unfaced.
.3 Density (ASTM C167): $\geq$ 40 kg/m^3.
.4 Combustibility (CAN/ULC-S114): Noncombustible.
.5 Surface Burning Characteristics (CAN/ULC-S102)
.1 Flame Spread Index = 0.
.2 Smoke Developed Index = 0.
.6 Smoulder Resistance (CAN/ULC-S129): 0.04 wt percent.
.7 Thickness: As indicated on Drawings.
.8 Manufacturer and Product Name: eg. AFB Acoustical Fire Batt Insulation by Rockwool.

.3 Mechanical Fasteners: Stainless steel screw type fastener, complete with 75 mm OD moulded plastic disc washer.

.4 Adhesive: Mastic type, synthetic rubber base, fungi resistant, gun or trowel application.

3 Execution

3.1 INSTALLATION

.1 Install Products to ULC-S702.2 and ASTM E90, without gaps and voids.

.2 Fit acoustic insulation tight within spaces, around cut openings, behind and around facility service components within or behind partitions, and tight to items passing through partitions.

3.2 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect acoustic insulation at the end of each Working Day.

.3 Protect acoustic insulation in areas where welding will be carried out.

.4 Replace acoustic insulation damaged by others.

.5 Protect acoustic insulation requiring a thermal barrier in accordance with authorities having jurisdiction.

END OF SECTION

1 General

1.1 PRODUCTS FURNISHED OR INSTALLED UNDER OTHER SECTIONS

.1 Carefully examine the scope of the Work as indicated on the Drawings, and include all finishing, whether specifically mentioned or not, except as specifically excluded below:
- .1 Section 04 22 00 - Concrete Unit Masonry: Integral colour of decorative concrete masonry units and concrete brick.
- .2 Section 05 12 23 - Structural Steel for Buildings: Shop priming.
- .3 Section 05 21 00 - Steel Joist Framing: Shop priming.
- .4 Section 05 50 00 - Metal Fabrications: Shop priming.
- .5 Section 06 24 00 - High Pressure Decorative Laminate: Integral colour.
- .6 Section 06 41 00 - Architectural Wood Casework: Shop finishing.
- .7 Section 07 41 13 - Metal Roof Panels: Shop finishing.
- .8 Section 07 42 93.13 - Extruded Aluminum Soffit Panels: Shop finishing.
- .9 Section 07 42 93.23 - Linear Metal Soffits: Shop finishing.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim: Shop finishing.
- .11 Section 07 72 46 - Roof Walkways: Galvanized coating.
- .12 Section 07 81 00 - Applied Fireproofing: Integral colour.
- .13 Section 07 84 00 - Firestopping: Integral colour.
- .14 Section 07 91 00 - Preformed Joint Seals: Integral colour.
- .15 Section 07 92 00 - Joint Sealants: Integral colour.
- .16 Section 07 95 13 - Expansion Joint Cover Assemblies: Shop finishing.
- .17 Section 08 12 13 - Hollow Metal Frames: Galvannealed coating.
- .18 Section 08 13 13 - Hollow Metal Doors: Galvannealed coating.
- .19 Section 08 14 00 - Wood Doors: Laminate-clad door faces.
- .20 Section 08 31 00 - Access Doors and Panels: Shop priming.
- .21 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Anodized coating.
- .22 Section 08 44 13 - Glazed Aluminum Curtain Wall: Anodized coating.
- .23 Section 08 51 13 - Aluminum Windows: Anodized coating.
- .24 Section 08 71 00 - Finishing Hardware: Shop finishing.
- .25 Section 09 51 23 - Acoustical Tile Ceilings: Shop finishing.
- .26 Section 09 96 46 - Intumescent Painting.
- .27 Section 10 11 00 - Visual Display Surfaces: Shop finishing.
- .28 Section 10 14 00 - Signage: Shop finishing.
- .29 Section 10 14 53 - Traffic Signage: Shop finishing.
- .30 Section 10 28 13 - Toilet Accessories: Shop finishing.
- .31 Section 10 56 13 - Metal Storage Shelving: Shop finishing.
- .32 Section 12 24 13.16 - Manual Roller Window Shades: Shop finishing.
- .33 Section 32 17 23 - Pavement Markings.
- .34 Do not paint glass surfaces.
- .35 Do not paint plastic components.
- .36 Do not paint plated, polished or anodized metal components.
- .37 Do not paint stainless steel components.

1.2 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 12 23 - Structural Steel for Buildings.

.4 Section 05 21 00 - Steel Joist Framing.

.5 Section 05 50 00 - Metal Fabrications.

.6 Section 06 10 00 - Rough Carpentry.

.7 Section 06 20 00 - Finish Carpentry.

.8 Section 06 41 00 - Architectural Wood Casework.

.9 Section 07 72 46 - Roof Walkways.

.10 Section 08 12 13 - Hollow Metal Frames.

.11 Section 08 13 13 - Hollow Metal Doors.

.12 Section 08 14 00 - Wood Doors.

.13 Section 08 31 00 - Access Doors and Panels.

.14 Section 09 21 16 - Gypsum Board Assemblies.

.15 Section 20 05 53 - Identification of Mechanical Services.

1.3 REFERENCES

.1 MPI Architectural Painting Specification Manual.

.2 MPI Maintenance Repainting Manual.

.3 SSPC Painting Manual, Volume 2 - Systems and Specifications.

1.4 SCHEDULING

.1 Schedule painting operations to prevent disruption to the Work.

.2 Schedule painting and coating operations in occupied facilities to prevent disruption of occupants at existing facility. Conduct painting and coating after facility working hours and on weekends in accordance with Owner's operating requirements.

.3 Schedule work such that finished surfaces have dried before occupants are affected.

.4 Schedule site finishing of doors and frames prior to door, glass, and hardware installation.

.5 Obtain written authorization from Owner for changes in work schedule.

1.5 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturers' standard data sheets for each finishing Product being used, indicating relevant MPI finish system, volatile organic compound (VOC) content, and volume solids (VOL SOL) content.

1.6 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: A full range of colour selector samples for each type of paint or stain required.

.3 Verification Samples: If requested by Consultant, prepare 1 000 x 1 000 mm size sample panels. Apply finish material to actual substrate or acceptable alternate if required to be portable.

1.7 EXTRA STOCK MATERIALS

.1 Supply additional 4 L of each Product, colour and sheen used.

.2 Supply extra stock materials in unopened, new containers, clearly labelled as to manufacturer, Product, colour, and sheen.

1.8 QUALIFICATIONS

.1 Applicators: A firm specializing in commercial painting and finishing of buildings in accordance with MPI Architectural Painting Specification Manual and MPI Maintenance Repainting Manual, having minimum 10 years documented experience.

1.9 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-ups: Three 3 000 x 3 000 mm size mock-ups of different paint schedule code systems, selected by Consultant, in locations acceptable to Consultant; demonstrating quality of work, colour, and hiding power of Products.

.3 Obtain Consultant's acceptance in writing before proceeding with coating applications.

.4 Accepted mock-ups will be used as the standard for acceptance of the Work.

.5 Remove and replace installed Product that does not conform to accepted mock-up.

.6 Accepted mock-ups may remain as part of the Work. Protect from damage.

.7 Repaint over mock-ups that do not form part of the Work.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Deliver Products in original containers with unbroken seals and labelled to indicate name of manufacturer, brand, colour and quality of contents.

.3 Store thinners, loose soaked rags and similar combustible materials in closed containers. Remove from Place of the Work or store in assigned area.

.4 Provide adequate safe-guards against spontaneous combustion of finishing materials.

.5 Arrange for properly enclosed and heated space, satisfactory to Consultant, to be used as paint shop. Store paint materials at minimum 10 degrees C.

1.11 AMBIENT CONDITIONS

.1 Conform to MPI Architectural Painting Specification Manual.

.2 Apply water-based paints only when temperature of surfaces to be finished and surrounding air temperatures are between 10 degrees C and 30 degrees C.

.3 Apply solvent-thinned paints only when temperature of surfaces to be finished and surrounding air temperatures are between 6 degrees C and 32 degrees C.

.4 Do not apply finishes in snow, rain, fog or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 2 degrees C above dew point; or to damp or wet surfaces.

2 Products

2.1 MANUFACTURERS

.1 Manufacturer: Use only Products from manufacturers listed in MPI Architectural Painting Specification Manual for each specified paint and finish system.

.2 Single-Source Responsibility: Provide primers and undercoats produced by same manufacturer as finish coats.

2.2 DESCRIPTION

.1 Gloss Ratings: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following gloss level categories, as defined in MPI Architectural Painting Specification Manual:
- .1 Gloss Level G1: Matte or Flat finish.
- .2 Gloss Level G2: Velvet finish.
- .3 Gloss Level G3: Eggshell finish.
- .4 Gloss Level G4: Satin finish.
- .5 Gloss Level G5: Semi-Gloss finish.
- .6 Gloss Level G6: Gloss finish.
- .7 Gloss Level G7: High-Gloss finish.

.2 Colours: A maximum of 5 exterior colours and 20 interior colours may be required. There may be more than two colours used in each room or space.

2.3 PERFORMANCE CRITERIA

.1 Volatile Organic Compound Content (VOC): Use paints and coatings having a volatile organic compound (VOC) content as follows:
- .1 Gloss Level G1: < 50 g/L.
- .2 Gloss Levels G2-G7: < 150 g/L.

.2 Volume Solids Content (VOL SOL): Use only paints and coatings having a volume solids (VOL SOL) content as follows:
- .1 Alkyd Paints and Coatings: $\geq$ 45 percent.
- .2 Latex Paints and Coatings: $\geq$ 40 percent.

2.4 MATERIALS

.1 Paints and Coatings: Use only Products meeting specified performance criteria and listed in most current Approved Products List included in MPI Architectural Painting Specification Manual, for each specified paint and finish system.

.2 Paint Accessory Materials: Linseed oil, shellac, turpentine and other materials of commercial quality.

2.5 MIXING

.1 Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage, that can and will be dispersed readily and uniformly by paddle to a complete homogeneous mixture.

.2 Carefully mix and prepare paint materials according to manufacturer's directions.

.3 Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

.4 Stir material before application to produce a mixture of uniform density. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

.5 Use only thinners approved by paint manufacturer, and only within recommended limits.

.6 Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of same material are applied. Tint undercoats to match colour of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Measure moisture content of surfaces using an electronic moisture metre. Do not apply finishes unless moisture content of surfaces are below recommended maximum.

3.2 PREPARATION

.1 Prepare surfaces to MPI Architectural Painting Specification Manual.

.2 Prepare existing, previously finished surfaces designated for re-finishing to MPI Maintenance Repainting Manual.

.3 Mask out surrounding surfaces not to receive paint, to protect from overspray or overbrushing.

.4 Remove hardware and accessories, plates, machined surfaces, lighting fixtures, and similar items already installed but not intended to be painted.

.5 Remove mildew, efflorescence, and foreign material from surfaces using appropriate methods.

.6 Correct minor defects and deficiencies in surfaces which affect work of this Section.

.7 Clean and prepare surfaces to be painted according to manufacturers' instructions for each particular substrate condition and finish system.

.8 Provide barrier coats over incompatible primers.

.9 Clean ungalvanized ferrous metal surfaces designated to receive site finish. Use solvent or mechanical cleaning methods to SSPC Painting Manual, Volume 2 - Systems and Specifications.

.10 Clean galvanized surfaces with non-petroleum-based solvents. Surface to be free of oil and surface contaminants. Remove pretreatment from galvanized steel metal fabricated from coil stock by mechanical methods.

3.3 APPLICATION

.1 Apply Products to MPI Architectural Painting Specification Manual.

.2 Protect exterior surfaces and areas, including landscaping, walks, drives, and adjacent building surfaces (including glass aluminum surfaces etc.) and equipment, and any labels and signage from painting operations and damage by drop cloths shields, masking templates, or other suitable protective means.

.3 Protect interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means. Make Good damage caused by failure to provide protection.

.4 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work areas as required.

.5 Use methods best suited for substrate and type of material being applied.

.6 Do not use compressed air or aerosol methods of application without prior written approval of Consultant.

.7 Spread finishes evenly and flow on smoothly without runs or sags.

.8 Apply Products no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.

.9 Apply Products under adequate illumination.

.10 Sand lightly between coats to achieve required finish.

.11 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

.12 Back prime interior wood work with enamel primer sealer paint.

.13 Back prime exterior wood work with exterior primer paint.

.14 Pigmented (Opaque) Finishes: Completely cover substrate to a smooth, opaque surface of uniform finish, colour, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be accepted.

.15 Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, colour irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.

.16 Match approved samples for colour, texture and coverage. Remove, refinish or repaint work not complying with specified requirements.

.17 Finish wood door stiles, top rails, bottom rails and glass stops to match laminate-clad door faces.

3.4 FACILITY SERVICES

.1 Unless otherwise specified or noted, paint "unfinished" conduits, piping, hangers, ductwork, and other facility service equipment with colour and texture to match adjacent surfaces, in the following areas:
- .1 Where exposed-to-view in exterior and interior areas.
- .2 In high humidity interior areas.
- .3 In mechanical and electrical rooms.

.2 Remove finished louvres, grilles, covers, and access panels on facility service components from location, and paint separately. Finish paint primed equipment to colour selected by Consultant.

.3 Paint inside of air ducts, convection and baseboard heating cabinets where visible behind louvers, grilles, and diffusers for a minimum of 460 mm or beyond sight line, whichever is greater, with one coat primer and one coat of matt black (non-reflecting) paint.

.4 Paint the inside of light valances gloss white.

.5 Paint red disconnect switches for fire alarm system and exit light systems.

.6 Paint red or band fire protection piping and sprinkler lines as specified in Section 20 05 53. Keep sprinkler heads free of paint.

.7 Paint yellow or band natural gas piping as specified in Section 20 05 53.

.8 Backprime and paint face and edges of plywood service panels a semi-gloss, gray colour before installation of telephone and electrical equipment. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.9 Paint exterior steel electrical light standards.

.10 Do not paint outdoor transformers and substation equipment.

.11 Colour code facility service equipment, piping, conduit, and exposed ductwork. Colour band and identify with flow arrows, names, and numbering as specified in Section 20 05 53.

.12 In unfinished areas, leave exposed conduits, piping, hangers, ductwork, and other facility service equipment in original finish, and touch up scratches and marks.

.13 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by equipment manufacturer.

.14 Do not paint over nameplates.

3.5 FIELD QUALITY CONTROL

.1 Inspect surfaces, preparation, and paint applications.

.2 Painted and coated surfaces shall be inspected by a paint inspection agency, acceptable to Consultant and local MPI Accredited Quality Assurance Association. Contractor to notify paint inspection agency minimum 7 days prior to commencement of painting and coating operations, and submit one copy of relevant Specifications, Drawings, and finish schedule.

.3 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the inspector:
- .1 Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in painting coatings.
- .2 Evidence of poor coverage at fastener heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
- .3 Damage due to touching before paint is sufficiently dry or other contributory cause.
- .4 Damage due to application on moist surfaces or caused by inadequate protection from weather.
- .5 Damage or contamination of paint due to blown contaminants (dust, spray paint, etc).

.4 Painted surfaces will be rejected if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
- .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1 000 mm.
- .2 Visible defects are evident on horizontal surfaces when viewed at normal veiwing angles from distance of not less than 1 000 mm.
- .3 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
- .4 When the final coat on any surface exhibits a lack of uniformity of colour, sheen, texture and hiding across full surface area.

.5 Make Good rejected surfaces. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags, or damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.6 ADJUSTING

.1 Following completion of painting and finishing operations, reinstall removed items.

.2 Remove protective covers and masking from protected surfaces.

.3 Repaint damaged surfaces to satisfaction of Consultant.

3.7 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove paint where spilled, splashed, splattered, or sprayed using means and materials that are not detrimental to affected surfaces.

.3 Keep work area free from unnecessary accumulation of tools, Construction Equipment, surplus materials, and debris.

.4 Remove combustible rubbish materials and empty paint cans each day. Safely dispose of in accordance with authorities having jurisdiction.

.5 Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.

.6 Leave the Work clean and free from dirt and debris.

3.8 WASTE MANAGEMENT

.1 Paint, stain and wood preservative finishes and related materials (thinner, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from authorities having jurisdiction.

.2 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and deliver to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or in into the ground the following procedures shall be strictly adhered to:
- .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. Do not clean equipment using free draining water.
- .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- .5 Empty paint cans are to be dry prior to disposal or recycling.
- .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Set aside and protect surplus and uncontaminated finish materials not required by Owner and deliver or arrange collection of verifiable re-use or re-manufacturing.

3.9 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect other surfaces from paint or damage.

.3 Maintain protection until Ready-for-Takeover.

.4 Make Good damage before Ready-for-Takeover.

3.10 FINISH SCHEDULE

.1 Provide the following paint or finish systems for the various substrates indicated, in accordance with MPI Architectural Painting Specification Manual.

.2 Refinishing Existing, Previously Finished Surfaces:

.1 Refer to MPI Maintenance Repainting Manual Section for refinishing existing finishes.
.2 Use finish coat of respective new surface finish system for minor repair of existing finishes.
.3 Use system primer where existing finishes are damaged down to bare surface.

.3 Exterior Painting and Finishing Schedule
.1 Concrete Vertical Surfaces
.1 Opaque Painted Finish: EXT. 3.1C - W.B. LIGHT INDUSTRIAL COATING (over w.b. alkali resistant primer), Premium Grade; Gloss Level G3.
.2 Semi-Transparent Stained Finish: EXT. 3.1J - CONCRETE STAIN, Premium Grade, manufacturer's standard gloss level for MPI Product #58.
.2 Structural Steel
.1 Corrosion-Resistant Opaque Painted Finish: EXT. 5.1B - W.B. LIGHT INDUSTRIAL COATING (over inorganic zinc), Premium Grade; Gloss Level G5.
.3 Metal Fabrications
.1 Opaque Painted Finish: EXT. 5.1D - ALKYD (over alkyd metal primer), Premium Grade; Gloss Level G5.
.4 Galvanized and Galvannealed Metal
.1 Opaque Painted Finish: EXT. 5.3B - ALKYD (over cementitious primer), Premium Grade; Gloss Level G6.
.5 Aluminum (Not Anodized)
.1 Opaque Painted Finish: EXT. 5.4H - LATEX (over q.d. metal primer), Premium Grade, Gloss Level G6.
.6 Dimension Lumber and Panels
.1 Opaque Painted Finish: EXT 6.2A - LATEX (over alkyd/oil primer), Premium Grade; Gloss Level G5.
.2 Opaque Stained Finish: EXT. 6.2B - SOLID COLOR STAIN, W.B. (over alkyd/oil primer), Premium Grade; Gloss Level G1.
.3 Semi-Transparent Stained Finish: EXT. 6.2E - VARNISH, S.B. (over s.b. stain), Premium Grade; Gloss Level G5.
.7 Dressed Lumber and Panels
.1 Opaque Painted Finish: EXT. 6.3A - LATEX (over alkyd/oil primer), Premium Grade; Gloss Level G5.
.2 Semi-Transparent Stained Finish: EXT. 6.3E - VARNISH, S.B. (over s.b. stain), Premium Grade; Gloss Level G5.
.3 Opaque Stained Finish: EXT. 6.3K - SOLID COLOR STAIN, W.B. (over alkyd/oil primer), Premium Grade; Gloss Level G1.

.4 Interior Painting and Finishing Schedule
.1 Concrete Surfaces (except floors)
.1 Epoxy Finish: INT. 3.1F - EPOXY ("Tile-Like") (for smooth concrete), Premium Grade; Gloss Level G6.
.2 Opaque Painted Finish: INT. 3.1M - INSTITUTIONAL LOW ODOR / VOC, Premium Grade; Gloss Level G4.
.2 Concrete Floors
.1 Epoxy Finish: INT. 3.2C - EPOXY, Premium Grade; Gloss Level G5.
.3 Concrete Masonry Units
.1 Opaque Painted Finish: INT. 4.2E - INSTITUTIONAL LOW ODOR / VOC (over latex block filler), Premium Grade; Gloss Level G4.
.2 Epoxy Finish: INT. 4.2J - EPOXY-MODIFIED LATEX (over latex block filler) FOR DRY ENVIRONMENTS, Premium Grade; Gloss Level G6.
.4 Structural Steel, Steel Joists, Steel Deck, and Metal Fabrications
.1 Opaque Painted Finish - Overhead Applications: INT. 5.1C - W.B. DRY FALL (over q. d. alkyd primer), Budget Grade; Gloss Level G5.
.2 Opaque Painted Finish: INT. 5.1E - ALKYD (over q.d. alkyd primer), Premium Grade; Gloss Level G5.

.3 Epoxy Finish: INT. 5.1K - EPOXY-MODIFIED LATEX (over w.b. rust-inhibitive primer), Premium Grade; Gloss Level G6.

.5 Galvanized and Galvannealed Metal
.1 Opaque Painted Finish: INT. 5.3N - INSTITUTIONAL LOW ODOR / VOC (over w. b. galvanized primer), Premium Grade; Gloss Level G5.

.6 Dimension Lumber and Panels
.1 Opaque Painted Finish: INT. 6.2L - INSTITUTIONAL LOW ODOR / VOC (over latex primer), Premium Grade; Gloss Level G5.

.7 Dressed Lumber, Panels, and Veneers
.1 Semi-Transparent Stained Finish: INT. 6.3EE - POLYURETHANE VARNISH (over w.b. stain), Premium Grade; Gloss Level G4.
.2 Semi-Transparent Stained Fire Retardant Finish: INT. 6.3RR - FIRE RETARDANT, PIGMENTED, W.B., Gloss Level G4.
.3 Opaque Painted Finish: INT. 6.3V - INSTITUTIONAL LOW ODOR / VOC (over latex primer), Premium Grade; Gloss Level G5.

.8 Gypsum Board
.1 Epoxy Finish: INT. 9.2F - EPOXY-MODIFIED LATEX (over latex primer/sealer), Premium Grade; Gloss Level G6.
.2 Opaque Painted Finish: INT. 9.2M - INSTITUTIONAL LOW ODOR / VOC (over latex primer/sealer), Premium Grade; Gloss Levels as follows:
.1 Ceiling Applications: G1
.2 Other Applications: G3.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 12 23 - Structural Steel for Buildings.

.2 Section 05 21 00 - Steel Joist Framing.

.3 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM E84-26a: Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 ASTM E2924-14(2025): Standard Practice for Intumescent Coatings.

.3 ASTM E3432-25: Standard Practice for On-Site Inspection of Installed Intumescent Fire Resistive Material.

.4 SSPC-PA 2-2015: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

.5 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets for each type of intumescent material, including information on physical properties, relevant ULC tested assemblies, installation instructions, and general requirements.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: 300 x 300 mm size sample of each type of intumescent coating, applied to a rigid backing, in colour and finish indicated.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines, including procedures for stain removal, repairing surface, and general cleaning; sufficient quantity for inclusion in operation and maintenance manual.

1.6 QUALIFICATIONS

.1 Applicator: Person or firm experienced in applying intumescent coatings, and having minimum 10 years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Store Products in a dry, enclosed area protected from exposure to moisture.

.3 Maintain temperatures between 16 degrees C and 32 degrees C.

1.8 AMBIENT CONDITIONS

.1 Refer to Section 01 61 00.

.2 Do not install coatings when ambient temperature is below 4 degrees C or above 43 degrees C.

.3 Maintain temperature range 7 days before, during, and 48 hours after installation of wall coatings.

.4 Ensure adequate ventilation is maintained during and after coating application. Comply with WHMIS requirements and manufacturer's instructions.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Products considered acceptable for use:
.1 3M Company Canada.
.2 Carboline Company.
.3 Isolatek International.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Intumescent Coating: Multi-component seamless intumescent coating system, consisting of a primer, intermediate, finish and tinted top coats, applied to sufficient thicknesses to achieve required fire resistance ratings and W/D factors.

2.3 REGULATORY REQUIREMENTS

.1 Conform to applicable regulatory requirements for surface burning characteristics as tested to CAN/ULC-S102 or ASTM E84.

2.4 MATERIALS

.1 Metal Primers: As listed in ULC tested assemblies.

.2 Intermediate Coats: As listed in ULC tested assemblies.

.3 Finish Coat: As listed in ULC tested assemblies.

.4 Tinted Top Coat: Two-component urethane, Semi-Gloss finish, colours as selected by Consultant.

2.5 MIXING

.1 Thoroughly mix ingredients in proper quantities needed for immediate use.

.2 Provide uniformity of mix and colouration.

.3 Discard mixed material 45 minutes after initial mixing at air temperature of 25 degrees C.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify ferrous metal surfaces have been prepared using SSPC SP-6, Commercial Blast Cleaning method.

3.2 PREPARATION

.1 Clean substrate surface free of foreign matter.

.2 Spray apply metal primers to manufacturer recommended dry film thicknesses.

.3 Allow primer to cure.

3.3 APPLICATION

.1 Apply intumescent coatings to ASTM E2924 and SSPC Steel Structures Painting Manual, Volume 2.

.2 Spray apply intermediate coating to primed substrate in multiple coats, to a dry film thickness sufficient to achieve required fire resistance rating and W/D factor of steel member being protected. Refer to UL Directory under relevant UL design. Allow each coat to cure prior to applying subsequent coats.

.3 Apply finish coats and tinted top coats to manufacturer's recommended dry film thicknesses.

.4 Spray apply finish coating over cured intermediate coating.

.5 Apply tinted top coating over cured finish coating.

.6 Terminate in straight lines, at masking tape line.

.7 Thoroughly air cure applied Products.

.8 Prevent contamination during application and prior to completion of curing process. Close area of application for minimum 24 hours after application.

.9 Ensure cured intumescent coatings have a smooth, flat, and even surface, without visually noticeable runs, sags, waves, and other imperfections.

3.4 FIELD QUALITY CONTROL

.1 Arrange for manufacturer's representative to be present at start of installation.

.2 Arrange for field inspection to be performed by independent inspector as specified in Section 01 40 00.

.3 Inspect cured intumescent coatings to ASTM E3432.

.4 Verify dry film thicknesses with positector or similar dry film thickness testing device to SSPC-PA 2.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove temporary protective coverings and clean intumescent coatings prior to final inspection.

3.6 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect intumescent coatings from damage and wear during construction with temporary protective coverings.

.3 Make Good damage prior to Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 06 20 00 - Finish Carpentry.

.3 Section 06 41 00 - Architectural Wood Casework.

.4 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AA Designation System for Aluminum Finishes.

.2 ANSI A208.1-2009: Particleboard.

.3 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.5 PEI 1002: Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

.6 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.7 CAN/ULC-S706.1-2020: Standard for Wood Fibre Insulating Boards for Buildings.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, layouts, component dimensions and thicknesses, details of connections and fastening, trim, hardware, and shop-applied finishes.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Samples: A composite sample of markerboard and tackboard; minimum 1 000 x 1 000 mm size; illustrating quality of each material, trim pieces, and method of joining adjacent panels.

1.5 CLOSE-OUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

.3 Apply removable maintenance instruction labels to each markerboard.

1.6 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: Warrant markerboards for a period of 10 years against defects other than those due to normal usage and wear, including fading, crazing, chipping, peeling, and surface becoming slick, glassy, or otherwise unsuitable for use.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ASI Visual Display Products, Inc.
.2 Claridge.
.3 Delta Products, Ltd.
.4 Global School Products Inc.
.5 Martack Specialties Ltd.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Use matching components sourced from a single manufacturer's series of Products.

2.3 REGULATORY REQUIREMENTS

.1 Test Products for fire performance to CAN/ULC-S102.

2.4 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper.

.2 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS), Types A, B, and C.

.3 Cork: Natural cork, Tan colour.

.4 Fibreboard: To CAN/ULC-S706.1, Type I; impregnated, sound absorbing type.

.5 Particleboard: To ANSI A208.1, Grade M-2.

2.5 COMPONENTS

.1 Markerboard: Sandwich type construction, as follows:
.1 Face Panel: 0.76 mm thick electroplated steel; Vit-Rite porcelain enamel writing surface, acid-resistant, washable surface; White colour.
.2 Core: 11 mm impregnated sound absorbing fibreboard.
.3 Back-up Balancing Sheet: 0.4 mm thick galvannealed steel.

.2 Tackboard: 13 mm thick; factory laminated; as follows:
.1 Tackable Surface: 6 mm thick cork.
.2 Back-up Panel: 6 mm thick particleboard.

.3 Aluminum Trim: 1.5 mm thick extruded aluminum profiles; eg. Series 9800 by ASI Visual Display Products, Inc., comprised of:
.1 Perimeter and divider trim,
.2 Concealed mechanical joining system, with integral slotted PVC insert laminated into ends of panels, and 2.0 mm thick galvanized steel spline.
.3 Marker trays with contour fitting end castings; flat and non-protruding types as noted on Drawings.

.4 Horizontal Sliding Trim: 1.5 mm thick extruded aluminum, eg. Series 9800 by ASI Visual Display Products, Inc., comprised of:
.1 Continuous one-piece head with integral map rail and fully enclosed single or double track section as required by Drawings.
.2 Two 4-wheel moulded nylon rollers per panel.

.3 Tubular jamb sections rigidly attached to top and bottom sections complete with shock absorbing and noise-reducing rubber bumpers.
.4 Single tubular sill section, and support angle with single or double rigid vinyl guide for sliding panels.

2.6 FABRICATION

.1 Markerboards: Factory laminate core to face panel and back-up balancing sheet under heat and pressure.

.2 Tackboards: Factory laminate tackable surface to back-up panel under mechanical pressure, using a waterproof adhesive.

.3 Sliding Tackboards:
.1 Provide white painted back surface for horizontal sliding tackboard units.
.2 Fabricate sliding tackboards with adequate steel reinforcing to ensure they will remain warp-free.

2.7 FINISHES

.1 Porcelain Enamel Panels: To PEI 1002; gloss factor of 6-8 measured by 45 degree glossometer.

.2 Aluminum: To AA-A41; clear etched and anodized 0.051 mm satin finish, free from extruding draw marks and surface scratches.

.3 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify millwork units designated to incorporate visual display surfaces are installed.

3.2 INSTALLATION

.1 Rigidly install Products straight, square, level, and plumb.

.2 Securely attach aluminum trims to ensure fastenings are concealed.

.3 Adhere tackboards to wall surface with approved adhesive applied in egg-size blobs at approximately 200 mm OC. Press tackboards firmly into adhesive, ensuring proper adhesion.

.4 Join markerboards together using concealed mechanical joining system. Ensure flush butt joints with hairline appearance.

3.3 ADJUSTING

.1 Leave visual display boards in a state suitable for immediate use by Owner.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean down, remove dirt, and leave elements in a first class condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 21 00 - Clay Unit Masonry.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 05 50 00 - Metal Fabrications.

.4 Section 08 13 13 - Hollow Metal Doors.

.5 Section 08 14 00 - Wood Doors.

.6 Section 09 21 16 - Gypsum Board Assemblies.

.7 Section 10 14 53 - Traffic Signage.

.8 Section 26 05 01 - Electrical Work General Instructions.

.9 Section 32 16 13.21 - Cast-in-Place Concrete Piers.

1.2 REFERENCES

.1 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.2 AAMA 2605-26: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.3 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.6 ASTM A276/A276M-25: Standard Specification for Stainless Steel Bars and Shapes.

.7 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.8 ASTM A563/A563M-24: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.9 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.10 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.11 ASTM B85/B85M-18e1: Standard Specification for Aluminum-Alloy Die Castings.

.12 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.13 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.14 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.15 ASTM D3363-20: Standard Test Method for Film Hardness by Pencil Test.

.16 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

.17 ASTM F844-19: Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

.18 CSA/ASC B651:23: Accessible Design for the Built Environment.

.19 CSA G40.20-13 (R2023): General Requirements for Rolled or Welded Structural Quality Steel.

.20 CSA G40.21-13 (R2023): Structural Quality Steel.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, thicknesses, design style, fonts and font sizes, finishes, methods of attachment, and special details.

.3 Shop Drawings for exterior pylon sign are to be stamped, signed, and dated by fabricator's design engineer. Coordinate design of concrete pier foundations with Section 32 16 13.21.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: One full size sample of each sign type, illustrating size, thickness, method of attachment, font style and size, and finishes.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard care, maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.6 QUALIFICATIONS

.1 Manufacturer: A firm specializing in manufacturing building signage, having minimum 5 years documented experience.

.2 Fabricator's Design Engineer: A professional structural engineer experienced in designing exterior pylon signs and concrete foundations, licensed to practice at Place of the Work.

2 Products

2.1 DESCRIPTION

.1 Exterior Building Signage: Individual die cut or die cast metal letters, numbers and symbols; shop finished; securely attached to building face; design as indicated on Drawings.

.2 Exterior Pylon Sign: Two-sided, illuminated sign box complete with acrylic panel faces and electronic message displays; shop finished; mounted on metal pylons secured to cast-in-place concrete pier foundations as specified in Section 32 16 13.21; design as indicated on Drawings.

.3 Braille and Tactile Characters: To CSA/ASC B651; raised bead type, and incorporating international symbols of access.

2.2 MATERIALS

.1 Hollow Structural Sections (HSS): To CSA G40.20, and CSA G40.21, Grade 350W, Class H.

.2 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 316.

.3 Stainless Steel Bar and Shapes: To ASTM A276/A276M, Type 316.

.4 Galvanized Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel; galvanized.

.5 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet.

.6 Extruded Aluminum: To ASTM B221M, 6061 alloy, T6 temper.

.7 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.

.8 Cast Aluminum: To ASTM B85/B85M, 6063 alloy, T5 temper.

.9 Acrylic Panels: Plastic compound, White translucent colour; 6 mm thick unless noted otherwise.

.10 Fasteners:
- .1 Exterior Applications: To ASTM A307, Grade A; carbon and alloy steel, galvanized where noted; concealed types.
- .2 Interior Applications: Countersunk screw-type with tamperproof heads, complete with plastic wall plugs when required for securement to wall surfaces; suitable sizes for intended application. Do not use through-fastening types.

.11 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.

.12 Washers:
- .1 Hardened Type: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; hardened steel; circular, bevelled, and clipped types as required.
- .2 Unhardened Type: To ASTM F844, punched from cold-rolled steel, plain (flat) type; diameter to suit bolt size; galvanized.

.13 Adhesive: As recommended by sign manufacturer.

2.3 MANUFACTURED UNITS

.1 Text Door Sign Plates: Surface engraved type; 2.0 mm thick dual-layered acrylic with 30 degree bevelled edges; as follows:
- .1 Length: As required to fit text, minimum 300 mm.
- .2 Height: 57.2 mm.
- .3 Text: 25 mm high Helvetica upper and lower case letters.
- .4 Fastening: Pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges.
- .5 Colours: As selected by Consultant.
- .6 Text: As determined by Owner.

.2 Pictogram Door Sign Plates: 3.2 mm thick plexiglass, square edged, hot stamped or silk screened image on rear face, 150 mm high; pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges; sizes, colours, and graphic symbols as selected by Owner.

.3 Banner Brackets: Gravity cast AS 380 aluminum alloy; direct bolting type and tension-adjustable, powder coated to custom colour as selected by Consultant; eg. Titan Econo.

.4 Fabric Banners: Flame-retardant fabric, by D. Garden Collection, sizes and graphics as selected by Consultant and indicated on Drawings.

2.4 FABRICATION

.1 Fabricate sign plates with letters and numbers centered within the sign plate's length and height.

.2 Provide countersunk holes for screw fasteners.

2.5 FINISHES

.1 Stainless Steel: To AISI No. 6 - Matte.

.2 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

.3 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

.4 Monochromatic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc., colour as selected by Consultant.

.5 Metallic Paint Coating on Aluminum: To AAMA 2605; four-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, complete with metal flakes incorporated in colour coat; factory-applied to 0.05 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc., colour as selected by Consultant.

.6 Powder Coated Finish on Metal Components: To AAMA 2605; electrostatically sprayed polymer powder, factory-applied to 0.075 mm dry film thickness, with 4H Hardness rating to ASTM D3363; colour as selected by Consultant.

.7 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.8 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.9 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

3 Execution

3.1 INSTALLATION

.1 Install Products straight, plumb, and level.

.2 Secure Products in a manner to prevent distortion or displacement.

.3 Finished work shall be free of defects, warping, open seams, and rattles.

.4 Provide double-sided foam tape adhesive on rear face of sign plates prior to securing with mechanical fasteners.

.5 Provide routing or mortising for items required to be mortised, rebated, or otherwise housed within material.

.6 Replace Products that are bent, scratched, or damaged.

.7 Provide fasteners to full required complement, properly tightened.

.8 Exposed fasteners shall be neatly executed and shall match adjacent surfaces.

.9 Install braille and tactile character signage adjacent to sign plates.

.10 Do not fasten signage through acoustically-rated or fire-rated doors.

.11 Provide banners and banner hardware as indicated on Drawings.

.12 Coordinate connections to power supply with Section 26 05 01.

3.2 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect installed Products with temporary removable film.

.3 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.4 ASTM A563/A563M-24: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.5 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.6 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

1.2 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating sign design and layout, materials, sizes, thicknesses, methods of attachment, and special details.

1.3 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard installation and maintenance instructions; sufficient quantity for inclusion in operation and maintenance manual.

2 Products

2.1 DESCRIPTION

.1 Traffic and Emergency Signage: Galvanized sheet steel with reflective baked enamel finish; quantities and designs as indicated on Drawings.

2.2 MATERIALS

.1 Galvanized Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet, galvanized.

.2 Bolts: To ASTM A307, Grade A; carbon and alloy steel, galvanized.

.3 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.

.4 Washers: To ASTM F436/F436M, Type 3; hardened steel; circular, bevelled and clipped types as required.

.5 Adhesive: As recommended by sign manufacturer.

2.3 MANUFACTURED UNITS

.1 Sign Posts: Galvanized steel, square-shaped stakes; complete with regularly spaced drilled holes for attachment of signage; suitable length to accommodate 1 000 mm buried depth plus sign mounting height as required by authority having jurisdiction; eg. Telespar Sign Post by Unistrut Service Company.

2.4 FINISHES

.1 Reflective Coating on Metal Components: Clean and degrease metal surface; apply one coat of zinc oxide primer sprayed and baked; two coats of semi-gloss reflective enamel sprayed and baked; symbols and colours as required by authorities having jurisdiction.

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

3 Execution

3.1 INSTALLATION

.1 Install Products in accordance with authorities having jurisdiction.

.2 Provide routing or mortising as required.

.3 Bury support stakes minimum 1 000 mm below finished grade.

.4 Replace Products that are bent, scratched, or otherwise damaged.

.5 Properly install and tighten fasteners to full required complement.

3.2 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect surfaces with removable protective coverings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 08 80 00 - Glazing.

.4 Section 09 21 16 - Gypsum Board Assemblies.

.5 Section 09 30 00 - Tiling.

.6 Section 10 14 00 - Signage.

.7 Section 26 08 50 - Hand Dryers.

1.2 REFERENCES

.1 ASTM A123/A123M-24: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.4 ASTM A269/A269M-22: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.5 ASTM A276/A276M-25: Standard Specification for Stainless Steel Bars and Shapes.

.6 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.7 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.8 ASTM F446-19(2023): Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, sizes, finishes, details of function, and attachment methods.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Selection Samples: Duplicate 300 x 300 mm size, illustrating colour and finish.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and standard care, maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

.3 Keys: Two keys for each lockable accessory, master keyed.

2 Products

2.1 OWNER-SUPPLIED PRODUCTS

.1 Refer to Section 01 61 00.

.2 Owner-supplied Products: Paper towel dispensers, toilet tissue dispensers, and soap dispensers.

2.2 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ASI Group Canada.
.2 Bobrick Washroom Equipment, Inc.
.3 Bradley.
.4 Frost Products Limited.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet, thicknesses as specified below.

.2 Stainless Steel Plate, Strip and Sheet: To ASTM A240/A240M, Type 304; sizes and thicknesses as specified below.

.3 Stainless Steel Tubing: To ASTM A269/A269M, Grade TP316; thicknesses, diameters and sizes as specified below.

.4 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304; sizes and profiles as indicated.

.5 Mirrored Glass: Type GL-5 as specified in Section 08 80 00.

.6 Adhesive: Two-component epoxy type, waterproof.

.7 Fasteners, Screws, and Bolts: Galvanized steel, tamper-proof, security type; sizes to suit applications.

.8 Expansion Shields: Fibre, lead or rubber as recommended by accessory manufacturer for component and substrate.

2.4 MANUFACTURED UNITS

.1 Grab Bars: To ASTM F446; 38 mm OD, 1.2 mm thick stainless steel tubing; peened non-slip finish; round or oval concealed flange attachments, straight and L-shaped configurations in sizes indicated on Drawings.

.2 Sanitary Napkin Disposal: Surface mounted design, 203 mm wide, 337 mm high, 115 mm deep; complete with 0.76 mm thick welded stainless steel construction, with self-closing lid and pivoting bottom with friction catch, and permanent die embossed bilingual lettering; eg. Code 622 by Frost Products Ltd.

.3 Sanitary Napkin/Tampon Vendor: Dual purpose dispenser, surface mounted design; stainless steel construction; 1.2 mm thick stainless steel door with full length stainless steel piano hinge and secured with two tumbler keyed locks; removable coin box with tumbler lock keyed different from door; $1.00 coin vending operation; eg. Code 608-3 by Frost Products Ltd.

.4 Toilet Backrest: 32 mm OD stainless steel tubing having minimum 1.6 mm thick walls; with 16 mm thick, 255 x 102 mm size solid plastic laminate panel; concealed mounting with flange attachments, spaced at 305 mm OC; 200 mm extension from wall face; eg. Code 1028 by Frost Products Ltd.

.5 Flat Framed Mirror: 610 x 915 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; vandal-resistant three-way mounting; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941-2436 by Frost Products Ltd.

.6 Fixed-Tilt Framed Mirror: 610 x 915 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; fixed tilt; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941FT by Frost Products Ltd.

.7 Stainless Steel Shelf: 460 mm long, 140 mm deep, 102 mm high; 0.76 mm thick stainless steel with rounded corners, surface mounted; eg. Code 950-18 by Frost Products Ltd.

.8 Garment Hooks: Stainless steel double-hook, with concealed fasteners and mounting bracket; eg. Code 1139-SS by Frost Products Ltd.

.9 Custodial Utility Shelf: 1.2 mm thick stainless steel, 914 x 203 mm size, surface mounted; complete with 3 mop/broom holders, two pail hooks and one 8 mm OD chrome plated drying rod; eg. Code 1115 by Frost Products Ltd.

2.5 FABRICATION

.1 Weld and grind smooth, joints of fabricated components.

.2 Use mechanical fasteners only where approved.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Do not apply manufacturer's or brand names on face of units.

2.6 FINISHES

.1 Shop Primed Coating on Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

.5 Stainless Steel: To AISI No. 4 - Brushed.

.6 Baked Enamel Coating on Steel Components: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

3 Execution

3.1 PREPARATION

.1 Provide templates and rough-in measurements as required.

3.2 INSTALLATION

.1 Install Products and Owner-supplied Products rigidly in place using tamper-proof fasteners, as follows:
- .1 Stud Walls: Install steel back plate to stud prior to application of wall board. Provide plate with threaded studs or plugs.
- .2 Hollow Masonry Units: Use toggle bolts drilled into cell or wall cavity.
- .3 Solid Masonry or Concrete: Use bolt with lead expansion sleeve set into drilled hole.
- .4 Toilet Compartments: Use male-female through bolts.

.2 Install grab bars using built-in anchors.

.3 Set square items plumb.

.4 Install mirrors on concealed wall hangers. Secure in place with theft-proof locking screws.

3.3 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect Product surfaces with temporary, removable protective film.

.3 Maintain protection until Ready-for-Takeover.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

1.2 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, shelving layouts, dimensions, component sizes, anchorage, and installation details.

1.3 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 78 00.

.2 Manufacturer's Instructions: Manufacturer's standard assembly and installation instructions, complete with parts listings; sufficient quantity for inclusion in operation and maintenance manual.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 North American Steel Equipment Co. Ltd.
.2 Redirack.
.3 Sturdymet.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Storage Shelves: Modular, bolt-less design; 2 540 mm high assembly; complete with metal adjustable shelves, side and back braces, and gussets; with baked enamel finish; eg. Series 200 Steel Shelving by North American Steel Equipment Co. Ltd.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M; Commercial Steel (CS) Types A, B, and C; cold-rolled steel, free from imperfections; thicknesses as specified below.

2.4 COMPONENTS

.1 Metal Shelves (MS-1): 1.1 mm thick sheet steel with U-shaped front edge; 457 x 915 mm; with a shelf capacity of 254 kg uniformly distributed load.

.2 Metal Shelves (MS-2): 1.1 mm thick sheet steel with U-shaped front edge; 610 x 915 mm; with a shelf capacity of 218 kg uniformly distributed load.

.3 Posts: 1.7 mm thick steel, factory punched on 50 mm OC vertical increments.

.4 Side and Back Braces: Steel X-braces; for bolted connection.

.5 Gussets: As required from both sides of shelving units.

.6 Shelf Clips: Compression type, as recommended by shelf system manufacturer.

2.5 FINISHES

.1 Baked Enamel Coating on Metal Components: Electrostatically sprayed and baked-on alkyd enamel finish; Grey colour.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify site dimensions prior to fabrication.

3.2 INSTALLATION

.1 Install Products true to dimensions, straight, square, plumb, and level, to a rigid structure.

.2 Conform to accepted Shop Drawings.

.3 Determine shelving height by clearance required for major obstruction at ceiling unless otherwise instructed by Consultant.

.4 Accurately fit members with hairline joints, properly secured.

.5 Construct shelving units free from distortion and defects detrimental to appearances and performance.

3.3 ADJUSTING

.1 Touch-up damaged surfaces with one coat of spray touch-up paint matching factory-applied finish.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA 611-26: Specification for Anodized Architectural Aluminum.

.2 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.4 Canada Consumer Product Safety Act, SOR/2019-97: Corded Window Coverings Regulations.

.5 NFPA 701-2004: Methods of Fire Tests for Flame Propogation of Textiles and Films.

.6 CAN/ULC-S109-14 (R2019): Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.

.7 ANSI/WCMA A100.1-2018: American National Standard for Safety of Corded Window Covering Products.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 30 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, components and accessories, component sizes, available fabrics and finishes, and installation instructions.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating wall opening dimensions, shade sizes, operator details, top rail, anchorage details, joint locations, hardware and accessory details, conditions between adjacent units, corner conditions, and required clearances.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 30 00.

.2 Verification Samples: Duplicate samples of the following:
.1 Shade Fabric: 200 x 200 mm size samples of each specified fabric.
.2 Visually-Exposed Components: 300 mm long samples of each visually-exposed component, illustrating material, colour, surface texture and sheen.
.3 Prefinished Metal: 50 x 100 mm size samples, illustrating specified finish.

1.6 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control submittals as specified in Section 01 30 00.

.2 Fire Test Reports: Manufacturer's standard fire test reports, prepared by independent testing agency deemed acceptable by authorities having jurisdiction, indicating fire hazard classification of shade fabric meets regulatory requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.8 QUALIFICATIONS

.1 Supplier: A manufacturer-certified firm, approved to supply specified Products and to honour warranty claims.

.2 Installer: A manufacturer-certified firm, trained and experienced in installing specified Products.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 61 00.

.2 Protect Products with suitable heavy weight wrapping before delivery to Place of the Work.

.3 Store Products at Place of the Work in a designated area, allowing for natural ventilation over finished surfaces.

1.10 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 10 years, covering complete replacement cost of defective Product, including removal and disposal of defective assembly, and installation of replacement Product. Covered defects to include the following:
.1 Fading of shade fabric colour,
.2 Shrinkage of shade fabric,
.3 Loss of flame-retardant properties of shade fabric,
.4 Punctures, rips or tears in shade fabric, and
.5 Mechanical failure of operating mechanisms.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Altex Inc.

.2 Substitution Procedures: Refer to General Conditions of the Contract, as amended.

2.2 DESCRIPTION

.1 Roller Window Shades (RWS-1): Manual wand-controlled operation, single sprocket roller shade, rectangular-shaped, with infinite positioning; each unit consisting of two end brackets, shade roller tube, cassette fascia, exposed hembar and sun control fabric; factory anodized finish; sizes as indicated on Drawings.

2.3 DESIGN CRITERIA

.1 Basis of Design: Newton High-Speed Lite-Lift with Fascia by Altex Inc.

.2 Design manual roller window shades to operate without any exposed cords or chains, in accordance with Canada Consumer Product Safety Act SOR/2019-97 and ANSI/WCMA A100.1.

.3 Design system to allow lowering shade by pulling on hembar without damaging clutch or spring.

.4 Design system with embedded upper limit stop device to ensure constant upper position and avoid shade being over lifted.

.5 Design system to be operable with one hand, from any height while sitting.

.6 Design system to be operated using two wands per roller, as follows:
.1 Front Wand: To raise shade.
.2 Rear Wand: To lower shade.

2.4 PERFORMANCE CRITERIA

.1 Fire Classification of Fabrics: Flame-retardant and fire-resistant to CAN/ULC-S109 and NFPA 701.

.2 Required Lifting Force: Minimum 1.134 kg and maximum 1.814 kg to raise or lower shade.

.3 Operating Speed: $\geq$ 1.0 m/s.

.4 Durability: $\geq$ 5 500 cycles.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper; unless specified otherwise.

.2 Sheet Aluminum: To ASTM B209/B209M, 5005 alloy, H32 temper.

.3 Plastic: ABS type.

.4 Sun Control Fabric (SCF): Vinyl-coated polyester yarn, consisting of 79 percent vinyl and 21 percent dernier polyester core yarn, with antimicrobial coating; three percent openness factor; tensioned prior to heat setting; colour as selected by Consultant.

.5 Bituminous Coating: Fibrous asphalt emulsion.

.6 Screw Fasteners: Non-corrosive type, size as recommended by shade manufacturer.

2.6 COMPONENTS

.1 End Bracket: 77 x 96 mm, two-piece moulded ABS construction; 64 mm OD nylon drive sprocket; finish to match fascia colour.

.2 Shade Roller Tube: 1.52 mm thick extruded aluminum with 3 internal 4.82 mm high continuous fins spaced 120 degrees apart.

.3 Cassette: Two-piece interlocking 1.9 mm thick extruded aluminum housing, rectangular profile.

.4 Fascia: 1.7 mm thick extruded aluminum complete with three continuous screw flute.

.5 Drive Assembly: Factory set for size and travel of shades, field adjustable; complete with built-in shock absorber.

.6 Wand: Extruded aluminum, with powder coated finish to match assembly.

.7 Hem Bar: 32 x 19 mm size, extruded aluminum, with upper groove to secure shading fabric; complete with high-impact nylon plugs inserted into each end.

2.7 FINISHES

.1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating (No. 17 - Clear).

3 Execution

3.1 PREPARATION

.1 Apply heavy coat of bituminous paint on aluminum surfaces placed in direct contact with concrete, mortar, plaster, or dissimilar metals.

.2 Supply fastenings and anchors required to be built in to adjacent work to other Sections.

3.2 INSTALLATION

.1 Install Products inside window openings, level, plumb, and square.

.2 Install Products parallel with window plane.

.3 Install Products rigidly coupled and adequately anchored.

.4 Maintain uniform clearances and accurate alignment levels.

.5 Conform to manufacturer’s Product data and accepted Shop Drawings.

.6 Conceal brackets and rollers with closure panels for full width of opening.

3.3 TOLERANCES

.1 Gap Variation Along Perimeter: $\leq$ 6 mm per 2 440 mm of shade height.

.2 Offset from Level: $\leq$ 3 mm.

.3 Conform to manufacturer's edge clearance requirements for shades exceeding 1:3 width-to-height ratio.

3.4 ADJUSTING

.1 Adjust Products to ensure smooth and trouble free operation without binding.

.2 Adjust shade and fabric to hang flat without buckling or distortion.

.3 Leave shades in raised position upon completion.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean exposed surfaces using non-abrasive materials and methods.

3.6 DEMONSTRATION

.1 Demonstrate proper operation and maintenance of roller shades to Owner.

END OF SECTION

PART I - GENERAL

1.1. DESCRIPTION

.1 This section specifies the supply and installation of all site furnishings including benches, waste receptacles, and all other site furnishings.

.2 Comply with all requirements for the General Requirements – Section 01 00 00.

1.2. SHOP DRAWINGS

.1 Submit detailed shop drawings. Incidate sizes, materials and fastening methods.

1.3. QUALITY ASSURANCE

.1 All installation of site furnishings will be carried out by experienced personnel under the direction of a skilled foreman and in strict accordance with all drawings, and manufacturer’s specification.

1.3. SUBMITTALS

.1 The contractor will make available a colour and finish sample of all site furnishings for approval by the Owner or Landscape Architect.

1.4. PRODUCT DELIVERY, STORAGE & HANDLING

.1 Protect all materials from harmful exposure during transportation to the site.

.2 Upon delivery, store all materials off the ground and protect from adverse conditions to prevent deterioration, damage, or impairment of structural or other essential properties.

.3 All damaged or deteriorated materials will be rejected and must be removed from the site immediately.

1.5. SITE EXAMINATION

.1 The contractor shall report to the Landscape Architect, in writing, of any conditions or defects encountered on the site during or before construction, upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until such conditions or defects have been investigated and corrected.

.3 Where required, layout all furniture locations on the site and give timely notice to the Landscape Architect to allow for inspections before commencing work.

PART II – PRODUCTS

2.1. MATERIALS

.1 All furnishings are to be as specified on drawings. Confirm colours with the Landscape Architect prior to ordering.

PART III - EXECUTION

3.1. INSTALLATION

.1 All site furnishings to be installed as per the manufacturer's specifications and details.

.2 Layout as per drawings and subject to the approval of the Owner or Landscape Architect.

END OF SECTION

PROJECT NAME: Simcoe Muskoka Catholic District School Board
Notre Dame Catholic School – Addition and Renovation

RDZ PROJECT NUMBER: 25092

Following Supplementary Mechanical Bid Form is submitted by:

…….....

(Bidding Company)

…….....

(Street Address or P. O. Box No.)

…….....

(City, Province and Postal Code)

Dated …… And which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Mechanical Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Unless otherwise noted, submit Supplementary Mechanical Bid Form **within Twenty-Four (24) hours of Bid closing**, via e-mail addressed to:

RDZ Engineers Ltd.
Attention : Michael Hughes
e-mail : mhughes@rdzeng.ca
cc'd: rmoncarz@snyderarchitects.ca

Supplementary Bid Form Signature:

…….....

(Signature of Authorized Representative)

…….....

(Print Name)

…….....

(Title)

LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of Consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of Consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
23 21 00	Pumps	
23 33 05	Silencers	
23 34 00	HVAC Fans	
23 36 00	VAV Terminal Boxes	
23 57 00	Heat Exchangers	
23 70 00	Semi-Custom Rooftop Units	
23 73 13	Custom Indoor Air Handling Units	
23 82 00	Radiant Ceiling Panels	
23 82 40	Motorized Heaters	
25 20 01	Control Valves	
25 20 01	Building Automation System	

END OF DOCUMENT

1. General

1.1 REFERENCES

.1 *Issued for Construction documents are issued for Contractors' convenience for reference only and are a consolidation of issued drawings, specifications, and addenda. Consultant makes no representation of their completeness. Exact construction requirements to be based on official Bid issued drawings, specifications, and issued separate addenda. Contact Consultant for any clarifications.*

1.2 APPLICATION

.1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.3 DEFINITIONS

.1 The following are definitions of words found in Mechanical Divisions of the Specification and on associated drawings:
- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, remove obsolete materials and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Consultant.
- .8 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
- .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .10 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .11 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.2 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.3 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.4 DOCUMENTS

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Specification is arranged in accordance with CSI/CSC 50 Division MasterFormat.

.3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.4 Read Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant’s report.

.5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

.6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.

.7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

.8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa in Specification.

.10 Starter/motor control center (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission and confirm exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.

.12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in “General Conditions”, however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.

1.5 IMPERIAL AND METRIC MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.6 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.

.2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.7 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
- .1 Associated Air Balance Council (AABC);
- .2 Air-Conditioning, Heating and Refrigeration Institute (AHRI);
- .3 American Iron and Steel Institute (AISI);
- .4 Air Movement and Control Association (AMCA);
- .5 American National Standards Institute (ANSI);
- .6 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
- .7 American Society of Mechanical Engineers (ASME);
- .8 American Society of Testing and Materials (ASTM);
- .9 American Water Works Association (AWWA);
- .10 Building Industry Consulting Services, International (BICSI);
- .11 National Standards of Canada (CAN);
- .12 Canadian Gas Association (CGA);
- .13 Canadian General Standards Board (CGSB);
- .14 Canadian Standards Association (CSA);
- .15 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
- .16 Electronic Industries Association (EIA);

.17 Electrical Safety Authority (ESA);
.18 Factory Mutual Systems (FM);
.19 Institute of Electrical and Electronic Engineers (IEEE);
.20 Illuminating Engineering Society (IES);
.21 International Standards Organization (ISO);
.22 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
.23 National Building Code of Canada (NBC);
.24 National Environmental Balancing Bureau (NEBB);
.25 National Electrical Manufacturers Association (NEMA);
.26 National Fire Protection Association (NFPA);
.27 NSF International (NSF);
.28 Ontario Building Code (OBC);
.29 Ontario Electrical Safety Code (OESC);
.30 Occupational Health and Safety Act (OHSA);
.31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
.32 Thermal Insulation Association of Canada (TIAC);
.33 Technical Standards and Safety Authority (TSSA);
.34 Underwriters' Laboratories of Canada (ULC);
.35 Workplace Hazardous Materials Information System (WHMIS);
.36 Material Safety Data Sheets by product manufacturers;
.37 local utility inspection permits;
.38 Codes, standards, and regulations of local governing authorities having jurisdiction;
.39 additional codes and standards listed in Trade Sections;
.40 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay associated costs associated with these submittals.

.6 Unless otherwise specified, equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on site supervision of an experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined as stated in Ontario College of Trades and Apprenticeship Act.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by Consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.

.11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.12 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.

.13 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.8 PERMITS, CERTIFICATES AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 For heating plant work involving gas fired equipment, apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the work will take place, including TSSA and ESA. Have the work inspected and certified by PV [Boilers and Pressure Vessels Reg], OE [Operating Engineers Reg.] and FS [Fuel Safety Reg.] branches of TSSA. At the end of the work, the new plant shall be fully TSSA certified by all branches noted herein.

.3 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.

.4 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities.

.5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities to certify that completed Work is in accordance with regulations of regulatory authorities and is acceptable to them.

1.9 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's Consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned Consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Liability insurance requirements are as follows:
- .1 coverage is to be a minimum of $1,000,000.00 inclusive of any one occurrence;
- .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
- .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
- .4 retained Consultants are to ascertain that Sub-Consultants employed by them carry insurance in the form and limits specified above;
- .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner’s Consultant, and Municipal Authorities as required prior to commencement of aforementioned Consultant’s services.

1.10 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces".

1.11 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
.1 large ducts (main runs);
.2 cable tray and bus duct;
.3 conduit 100 mm (4") dia. and larger;
.4 smaller branch ductwork;
.5 conduit less than 100 mm (4") dia.

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.

.4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of the work for coordination with General Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, disks of engineering drawings for this use. Prints and/or disks of Contractors' interference drawings are to be distributed among other Trade Contractors and General Contractor. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination by this Division.

1.12 COORDINATION OF THE WORK

.1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:
- .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
- .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
- .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
- .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.

.3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building and protected from elements.

.4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.13 EQUIPMENT AND MATERIALS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

.3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.

.4 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.

.5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Note that above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

.7 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.

.8 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.

.9 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.

.10 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the School Board. No proposed substitutions will be accepted.

.11 Indicate in Form of Supplementary Mechanical Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

1.14 SHOP DRAWINGS

.1 At start-up meeting, confirm with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.

.2 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
- .1 product literature cuts;
- .2 equipment data sheets;
- .3 equipment dimension drawings;
- .4 system block diagrams;
- .5 sequence of operation;
- .6 connection wiring schematic diagrams;
- .7 functionality with integrated systems.

.3 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.4 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.5 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted. Submit electronic copies of shop drawings unless otherwise directed by Consultant. Confirm exact requirements with Consultant.

.6 Consultant will review shop drawings and indicate review status by stamping shop drawing copies as follows:
- .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;

.2 "REVISE AND RESUBMIT" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.7 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAIL DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR, AND SUCH REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.8 Each system and each major component are to be separate shop drawing submissions. Shop drawings for common devices such as devices of each system are to be submitted together.

.9 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.10 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

.11 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

1.15 ENGINEERED SUBMITTALS

.1 Submittals for items required to be sealed by a professional engineer (engineered) are to be duly prepared, sealed, and signed under direct control and supervision of a qualified professional engineer licensed in jurisdiction of the work. Professional engineer is to conform to requirements specified in this Section in article entitled Requirements for Contractor Retained Engineers.

.2 Engineered submittals are to include, but not be limited to, following:

.1 complete CAD layout drawings indicating equipment, piping schematic, pipe routing and sizing, zones, devices, wiring schematics, and any other pertinent data;

.2 listing of design data used to determine system layout and sizing;

.3 complete copies of design calculations and listing of design data used in preparing calculations;

.4 list detailing standards, codes, regulations, etc. adhered to when designing system;

.5 items as noted in other Sections of the Specification.

.3 Professional engineer responsible for engineered submittals is to perform periodic field reviews, including review of associated mock-ups where applicable, at locations wherever work as described by engineered submittal is in progress, during fabrication and installation of such work, and submit a field review report after each visit. Submit field review reports to Consultant and authorities having jurisdiction as required.

.4 Field reviews are to be at intervals as necessary and appropriate to progress of work described by engineered submittal to allow engineer to be familiar with progress and quality of such work and to determine if work is proceeding in general conformity with Contract Documents including reviewed shop drawings and design calculations.

.5 Upon completion of work as described by engineered submittal, professional engineer responsible for preparation of engineered submittal and for performing periodic field reviews is to prepare and submit to Consultant and, if applicable, authorities having jurisdiction, a letter certifying that work has been supplied and installed in accordance with requirements of Contract Documents, authorities having jurisdiction and engineered submittal.

1.16 EQUIPMENT LOADS

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.

.2 When choice of specific equipment is made by Contractor, actual weight, location and method of support of equipment may differ from those initially given to Consultants and thus from those assumed for design. Consequently, it is necessary to back-check equipment loads, location, and supports.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with Consultant prior to construction.

1.17 OPENINGS

.1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval of Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

.3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless otherwise directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

1.18 SCAFFOLDING, RIGGING, AND HOISTING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to review by and coordination with Consultant.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Consultant.

1.19 TEMPORARY CRANES

.1 Submit following to Consultant for review:
- .1 Propose details showing existing structures and surfaces being used for lifting locations.
- .2 Copies of approvals of authorities for work.
- .3 Copies of approvals of property management of buildings affected by hoisting work, allowing for work.
- .4 Copies of required insurance for work.

1.20 CHANGES OR REVISIONS TO THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for approval, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 If overhead and profit percentages are not specified, but allowable under Contract as confirmed with consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be as per “Supplementary Conditions & Amendments to Standard Construction Document CCDC2 – 2020 Stipulated Price Contract” included in the Contracting Requirements of the Project Manual.

.4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to all quotations submitted:
- .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
- .2 material costs are not to exceed those published in local estimating price guides;
- .3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
- .4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
- .5 costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
- .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent’s involvement is necessary;
- .7 costs for rental tools and/or equipment are not to exceed local rental costs;
- .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
- .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.21 BREAKDOWN OF MECHANICAL WORK COST

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.22 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until Consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.23 PRELIMINARY TESTING

.1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.24 TEMPORARY SERVICES

.1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.

.2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.25 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.

.2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.

.3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.

.4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.26 CLEANING UP

.1 During construction, and on a daily basis, keep the site reasonably clear of rubbish and waste material resulting from mechanical work to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all of your rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of mechanical work.

.2 Clean equipment and devices installed as part of this project.

1.27 RECORD (AS-BUILT) DRAWINGS

.1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of $500.00 CDN plus HST, per drawing, up to first 5 drawings, and $100.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:
   .1 dimensioned location of inaccessible concealed work;
   .2 locations of control devices with identification for each;
   .3 location of piping system air vents;
   .4 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
   .5 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;

.6 location of concealed services terminated for future extension.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.

.4 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.

.5 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.28 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:

.1 on front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;
.2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
.3 equipment manufacturer's authorized contact person name, telephone number and company website;
.4 Table of Contents sheet, and corresponding index tab sheets;
.5 copy of each "Reviewed" or clean, updated "Reviewed As Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
.6 pressure test reports, and certificates issued by governing authorities;
.7 Operating data is to include:

.1 description of each system and its controls;
.2 control schematics for equipment/systems including building environmental controls;
.3 if applicable, BAS architecture and all required operating data;
.4 description of operation of each system at various loads together with reset schedules and seasonal variances;
.5 operation instruction for each system and each component;
.6 description of actions to be taken in event of emergencies and/or equipment failure;
.7 valve tag schedule, and flow diagrams to indicate valve locations.

.8 Maintenance data is to include:

.1 servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system;
.2 schedules of tasks, frequency, tools required, and estimated task time;
.3 complete parts lists with numbers.

.9 Performance data is to include:

.1 equipment and system start-up data sheets;
.2 equipment performance verification test results, and final commissioning report;
.3 final testing, adjusting and balancing reports.

.10 copies of warranties;
.11 items requested specifically in Section Articles.

.2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

.4 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with Consultant and enhanced with bookmarks and internal document links. Each PDF file name shall be the same as that indicated in the binder. The contents in each PDF file shall be searchable.

1.29 COMMISSIONING

.1 After successful start-up and prior to Substantial Performance of the Work, commission the mechanical work. Commissioning work is the process of Contractor demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.
.1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section entitled Testing, Adjusting and Balancing.
.2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.
.3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.
.4 Submit final commissioning data sheets, TAB reports as specified in Section entitled Testing, Adjusting and Balancing, project closeout documents, and other required submittals.

1.30 WARRANTY

.1 Unless otherwise specified, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of one (1) year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.7 Submit signed and dated copies of extended warranties to Consultant which clearly states herein specified requirements.

.8 Warranties and Guarantees shall be original copies, printed on company letterhead, or on a standard company warranty certificate, bearing the name of the company.

.9 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
.1 once during first month of building operation;
.2 once during third month of building operation;
.3 once between fourth and tenth month in a season opposite to first and third month visits.

.10 The following table indicates the warranty period that shall be provided for the following equipment:

EQUIPMENT	ITEMS	WARRANTY
CONTROLS		4 YEAR
HVAC EQUIPMENT	Boilers, pumps, heat exchangers, expansion tank, air separator, Air Handling Units, Fans, Motorized Heaters	As per equipment manufacturer's warranty

.11 The Board reserves the right to initiate a service contract for all equipment with one of the board approved certified service companies. This shall not affect any of the above extended warranties provided by the manufacturers.

1.31 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

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

1.32 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
  .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments;
  .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor, to Consultant.

1.33 PROJECT CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
  .1 Building and Fire Department Occupancy Permits or Final Inspection Report with notice of "Approval to Occupy";
  .2 Gas fired appliances inspection;
  .3 Plumbing Inspection;
  .4 Domestic Water Quality Test Report;
  .5 Fire Alarm verification (include legible technicians worksheets),
  .6 Operating and Maintenance Manuals;
  .7 as-built record drawings and associated data;
  .8 extended warranties for equipment as specified;
  .9 operating test certificates, i.e. Sprinkler dry test verification letter stamped and signed by sprinkler design Engineer;
  .10 final commissioning report and TAB report;
  .11 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
  .12 other data or products specified.

1.34 INSTRUCTIONS TO OWNER

.1 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.2 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
  .1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
  .2 Troubleshooting – diagnostic instructions, test and inspection procedures;
  .3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
  .4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
.6 The training sessions shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Consultant shall video tape the sessions. Refer to Section 20 05 40 for further requirements.

.4 Before instructing Owner's designated personnel, submit to Consultant for review a preliminary copy of training manual and a proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.5 Obtain in writing from Consultant a list of Owner's representatives to receive instructions. Submit to Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
.1 date instructions were given to Owner's staff;
.2 duration of instruction;
.3 names of persons instructed;
.4 other parties present (manufacturer's representative, consultants, etc.).

.6 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.7 Submit to Consultant, copy of electronic version of training materials used to train Owner's designated personnel. Include in operating and maintenance manuals submission.

1.35 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
.1 deficiencies noted during job inspections have been completed;
.2 field quality control procedures have been completed;
.3 systems have been tested and verified, balanced and adjusted, and are ready for operation;
.4 maintenance and operating data have been completed and submitted to, reviewed and accepted by Consultant;
.5 tags and nameplates are in place and equipment identifications have been completed;
.6 clean-up is complete;
.7 spare parts and replacement parts specified have been provided and acknowledged by Consultant;
.8 as-built and record drawings have been completed and submitted to, reviewed and accepted by Consultant;
.9 Owner's staff has been instructed in operation and maintenance of systems;
.10 commissioning procedures have been completed.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 a sample of each proposed type of access door, as well as a copy of architectural reflected ceiling plan drawings showing proposed ceiling access door locations;
.2 location drawings for all required sleeves and formed openings in poured concrete or precast concrete construction;
.3 a list of equipment identification nameplates indicating proposed wording and sizes;
.4 a list of pipe and duct identification colour coding and wording;
.5 a proposed valve tag chart and a list of proposed valve tag numbering and identification wording;
.6 samples of materials and any other items as specified in succeeding Sections of this Division of the Specification.

.3 Submit a spare belt set, tagged and identified, for each belt driven piece of equipment.

.4 Submit an affidavit stating that lead free solder was used for all soldered joints in copper potable water, drainage and vent piping.

2. Products

2.1 PIPE SLEEVES

.1 Galvanized Sheet Steel – Minimum #16 gauge galvanized steel with an integral flange at one end to secure sleeve to formwork construction.

.2 Polyethylene – Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Waterproof Galvanized Steel Pipe – Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at sleeve midpoint.

.4 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section entitled Firestopping and Smoke Seal Systems and work is to be done as part of mechanical work.

2.3 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Acceptable products are:
.1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;
.2 The Metraflex Co. "MetraSeal" type ES.

2.4 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.5 PIPING HANGERS AND SUPPORTS

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:
.1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
.2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.

.2 Hangers and supports for horizontal suspended piping as follows:
.1 adjustable steel clevis hanger – MSS Type 1;
.2 adjustable swivel ring band hanger – MSS Type 10;

.3 Supports for horizontal pipe on vertical surfaces as follows:
.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
.2 heavy-duty steel pipe clip – MSS Type 26;
.3 single steel pipe hook – Myatt Fig. 156;
.4 epoxy coated steel pipe stays are not permitted.

.4 Floor supports for vertical risers as follows:
.1 copper tubing riser clamp – MSS Type 8;
.2 heavy-duty steel riser clamp – MSS Type 8.

.5 Supports for vertical piping on vertical surfaces as follows:
.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
.2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
.3 extension split pipe clamp – MSS Type 12;
.4 epoxy coated steel pipe stays are not permitted.

.6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.

.7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:
.1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;

.8 Special hangers and supports for various applications as follows:
.1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between clamp and floor;
.2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;
.3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;

.4 for glass drain and vent piping – special padded hangers supplied by pipe supplier;
.5 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;
.6 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;
.7 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;
.8 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;
.9 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.

.9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case minimum 9.5 mm (3/8") diameter.

.10 Acceptable manufacturers are:
.1 E. Myatt & Co. Inc.;
.2 Anvil International Inc.;
.3 Empire Industries Inc.;
.4 Hunt Manufacturing Ltd.;
.5 Unistrut Canada Ltd.;
.6 Nibco Inc. "Tolco";
.7 Taylor Pipe Supports.

2.6 ROOF MOUNTED PIPING SUPPORTS

.1 Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.

.2 Design system using high density / high impact polypropylene bases with carbon black, anti-oxidants for UV protection, and steel framing for support is 1-5/8 inch (41 mm) B22TH or 1-7/8 inch (48 mm) BTS22TH.

.3 Bases:
.1 Injection molded high density / high impact polypropylene with UV-inhibitors and anti-oxidants, conforming to the following:
.2 Moisture Content: Negligible.
.3 Shrinkage/Swelling Due to Moisture: Negligible.
.4 Density: 55.8 lb/cu ft (894 kg/cu m).
.5 Insect Resistance: No known insect damage potential.
.6 Chemical Resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, and sulfuric acid: No visual or physical change apparent.
.7 Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D 1929.
.8 Sized as required by loading conditions and as indicated on the drawings.
.9 Shop fabricated with inserts for square tubing or threaded rods as required.
.10 Color: Integral black color as molded.
.11 Bases for Mechanical Attachment: Sealant chamber around penetration point, with injection port for sealing after fastening; beveled lip for sealant bead around entire diameter.
.12 Do not use bases containing carbonated plastics, press molded recycled rubber and plastics, steel, stainless steel, or any injection molded threaded receivers.

.4 Steel Framing:
.1 Channel Types: 1-5/8 inch (41.3 mm) B22TH or 1-7/8 inch (47.6 mm) BTS22H, as required for loading conditions.
.2 Thickness: 12 gage (2.7 mm).
.3 Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 inch (14.3 mm) holes at 1-7/8 inch (47.6 mm) centers on three sides.
.4 Finish: Hot dip galvanize in accordance with ASTM A 123 after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.
.5 Do not use tubing or tube steel.

.5 Stainless Steel Framing:
.1 Channel Types: 1-5/8 inch (41.3 mm) or 1-7/8 inch (47.6 mm), as required for loading conditions.
.2 Thickness: 12 gage (2.7 mm).
.3 Form: Roll-formed 3-sided or tubular shape.
.4 Finish: Mill finish.
.5 Do not use tubing or tube steel.

.6 Pipe Supports and Hangers: Conform to MSS SP-58 and MSS SP-69 and as follows:
.1 Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.
.2 Sizes 2-1/2 inch (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
.3 Sizes 3 inch (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

.7 Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.
.1 Carbon Steel: Hot-dip galvanized in accordance with ASTM A 153/A 153M.
.2 Stainless Steel: Mill finish.
.3 For Mechanical Fastening to Deck: On wood and steel decks, use bolts with toggle wings; on concrete decks use threaded rods and adhesive anchors, with rod embedded at least 1-3/4 inches (44 mm) into concrete.

.8 Acceptable manufacturers are:
.1 Portable Pipe Hangers (Canada), Inc. (PHP Systems/Design);
.2 Taylor Pipe Supports (EcoFoot);
.3 Mifab, Inc.

2.7 ACCESS DOORS

.1 Access doors to be provided under work of Division 08 by General Trades Contractor.

.2 Coordinate with Mechanical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services, where possible, be accessible from common access door. Coordinate work to ensure same common location access doors are not supplied by more than one Division.

.3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.

.4 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain fire separation integrity.

.5 Identify on reflected ceiling plans and wall elevation drawings, coordinated locations of proposed access door locations and submit to Consultant for review.

2.8 PRESSURE GAUGES AND THERMOMETERS

.1 Pressure gauges as follows:
- .1 adjustable, glycerine filled, 100 mm or 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;
- .2 type 304 stainless steel case with relief valve and polished stainless steel bayonet;
- .3 stainless steel rotary movement with stainless steel bushings and socket;
- .4 clear acrylic window;
- .5 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;
- .6 black pointer.

.2 Pressure gauge accessories and additional requirements as follows:
- .1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;
- .2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;
- .3 pressure gauges in fire protection piping must be ULC listed and labelled;

.3 Thermometers as follows:
- .1 round, 125 mm (5") diameter, adjustable (90°) angle bimetal dial type thermometers, each accurate to within 1% of full scale;
- .2 hermetically sealed stainless steel case with stainless steel ring;
- .3 dampened bimetal coil;
- .4 calibration adjustment screw;
- .5 white aluminum dual scale dial with black and blue markings and a range such that working temperature of system is approximate mid-point of the scale;
- .6 black aluminum pointer;
- .7 double strength glass window;
- .8 12 mm (½") NPT connection with 6.4 mm (¼") diameter stainless steel stem;
- .9 suitable thermowell.

.4 Acceptable manufacturers are:
- .1 H.O. Trerice Co.;
- .2 Weiss Instruments;
- .3 Ashcroft.

2.9 EQUIPMENT BELT DRIVES

.1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:
- .1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;
- .2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch (± 10% range) for motors under 10 HP, fixed pitch type with split tapered bushing and keyway for motors 10 HP and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;
- .3 motor slide rail adjustment plates are to allow for centre line adjustment.

.2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

2.10 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OHSA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1-½") diameter tachometer openings at each shaft location.

.2 For flexible couplings – removable "U" shaped galvanized steel guards to OHSA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.

.3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OHSA Standards.

2.11 ELECTRIC MOTORS

.1 Unless otherwise specified, motors are to conform to NEMA Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.

.2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.

.3 Efficiency of 1-phase motors to 1 HP is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 HP and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

.4 Unless otherwise specified, 1-phase motors smaller than ½ HP are to be 115 volt, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.

.5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 volt continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.

.6 Unless otherwise specified, motors ½ HP and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminium rotor windings.

.7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.

.8 Motor(s) for 2-speed cooling tower(s) are to be as specified above but 2-speed single winding type.

.9 Motor(s) for 2-speed fan(s) are to be as above but 2-speed double winding type.

.10 Unless otherwise indicated, motors 30 HP and larger are to be complete with a heat sensing PTC thermistor in the end turn of stator winding for each phase and connected in series inside motor with 2 marked leads brought out to motor conduit box.

.11 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.

.12 Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.

.13 Acceptable manufacturers are:
- .1 TECO-Westinghouse Motors (Canada) Inc.;
- .2 Canadian General Electric;
- .3 Baldor Electric Co.;
- .4 U.S. Electrical Motors;
- .5 Weg Electric Corp.;
- .6 Marathon Electric;
- .7 Toshiba Corp.;
- .8 Leeson Canada.

2.12 MOTOR STARTERS AND ACCESSORIES

.1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.

.2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.

.3 Unless otherwise specified, starters for 3-phase motors less than 50 HP are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.4 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.5 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.

.6 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:
- .1 enclosures located in sprinklered areas – Type 2;
- .2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;
- .3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;
- .4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;
- .5 enclosures except as noted above – Type 1;
- .6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.

.7 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.

.8 Acceptable manufacturers are:
.1 Rockwell Automation Inc. - Allen-Bradley;
.2 Eaton Corp. – Cutler-Hammer;
.3 Eaton Corp. – Moeller Electric;
.4 Siemens Canada;
.5 Schneider Electric.

2.13 SPRINKLER PROOFING

.1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
.1 factory constructed by respective equipment manufacturers;
.2 constructed from non-combustible materials (sheet steel);
.3 enamel painted to match equipment;
.4 surfaces and edges filled/sanded smooth prior to painting;
.5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
.6 structural support finish painted to match shield.

.2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.

.3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.

.4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.

.5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.

.6 Obtain CSA approval where required by local governing authorities.

2.14 MECHANICAL WORK IDENTIFICATION MATERIALS

.1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:
.1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;
.2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;
.3 supply stainless steel screws for securing nameplates in place;
.4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12

200 mm (8")

CHILL. WATER

NORMALLY OPEN

.3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

.1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;

.2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

.4 Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN
heating water drain	yellow	HTG. WTR. DRAIN
refrigerant suction	yellow	REFRIG. SUCTION
refrigerant liquid	yellow	REFRIG. LIQUID

.5 Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
yellow	black
green	white
red	white

.6 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

2.15 FLEXIBLE CONNECTORS

.1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application. Acceptable manufacturers are:
.1 Hyspan Precision Products Inc.;
.2 Senior Flexonics Ltd.;
.3 The Metraflex Co.

3. Execution

3.1 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 Unless otherwise noted, locate and arrange horizontal ducts above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.2 Unless otherwise noted, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas.

.3 Install pipes and ducts parallel to building lines and to each other.

.4 Neatly group and arrange all exposed work.

.5 Do not make duct joints in wall or slabs.

.6 Locate all dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where dampers and similar ductwork accessories occur in vertical ductwork in shafts or partitions, locate the accessories at the floor level.

.7 Ensure that equipment and material manufacturer's installation recommendations and instructions are followed unless otherwise noted herein or on the drawings, and unless such instructions and recommendations contradict governing codes and regulations.

.8 Carefully clean all ducts and fittings prior to installation. Temporarily cap or plug ends of ducts and equipment which are open and exposed during construction.

.9 Install piping and ductwork which shall be insulated such that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the duct except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.

.10 Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of your work will constitute acceptance of such surfaces as being satisfactory.

.11 Ensure that exposed ferrous metal products, except ductwork and piping, have at least one (1) factory prime coat of alkyd metal primer, or paint such ferrous metal products with one (1) prime coat of alkyd metal primer on the job. Clean and wire brush ferrous metal products prior to application of prime coat.

.12 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.

.13 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.

.14 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work. Quality of repair to finish shall be equal to finish provided by equipment manufacturer.

.15 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m [40']) piping runs to permit removal of sections of piping.

.16 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.2 DUCT, DAMPER AND SIMILAR MATERIAL OPENINGS

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.

.2 Ensure that openings for fire dampers to 14" (350 mm) high are sized to suit the damper arrangement with the folding blade out of the air stream.

3.3 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise noted, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two (2) pipe threads shall remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove all scale and oxide from the bevels and leave same smooth and clean. Ensure that personnel doing welding work are CWB certified welders and qualified for the particular pressure application worked on, and that all tests required by governing authorities are carried out, including X-ray tests where required for certain applications.

.5 Use Bonney Forge Ltd. or equal welding tees or welding outlet fittings for piping branches off mains, welded or socket type for pipes with welded fittings and threaded type for pipes with screwed fittings.

.6 Make all flanged joints with Cranite Ltd. or equivalent gasket materials to suit the application, and suitable bolts and nuts. Bolts shall not be longer than the length necessary to screw the nut up flush to the end of the bolt.

.7 Bolts used for flanged connections in all piping with a working pressure of 100 psi (690 kPa) and greater shall be ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H.

.8 Provide suitable washers between each bolt head and the flange and between each nut and the flange.

.9 A random check of bolted flanged connections will be made by the Consultant to verify that flanged connections are properly mated with no shear force acting on bolts. Supply all labour to disconnect and reconnect the selected flanged joints as directed by the Consultant. If improperly mated joints are found, remove and reinstall the affected piping at your expense so that the flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.10 Unless otherwise specified, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.11 Install type “MJ” mechanical joint fittings and couplings in accordance with the manufacturer's recommendations.

.12 Solvent weld PVC piping in accordance with manufacturer's recommendations and ASTM 2855. Solvent welds must be two (2) part, consisting of a priming and cementing stage. Primer and cement used must be compatible with the pipe material and approved by the pipe manufacturer. Use IPS Weld-on 719 cementing compound for cementing 8" (200 mm) diameter and larger piping. Ensure solvent (or cement) is evenly distributed around the joint and joined pipe and sockets are properly aligned prior to solvent or cement taking set.

.13 Install PVC piping with gasketted joints in accordance with manufacturer's latest published specifications, instructions and recommendations with respect to pipe, coupling and fittings preparation and installation, and support anchoring and guiding of the piping system. Apply pipe and fitting manufacture supplied lubricant to gasket prior to mating components.

3.4 INSTALLATION OF PIPE SLEEVES

.1 Pipe sleeves in poured concrete slabs, unless otherwise noted, shall be minimum No. 24 USS gauge (0.635 mm thick) flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.

.2 Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel pipe.

.3 Sleeves in waterproof slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the detail. Provide waterproof sleeves in the following locations:
.1 in mechanical room floor slabs, except where on grade;
.2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;
.3 in all floors equipped with waterproof membranes;
.4 in the roof.

.4 Size sleeves, unless otherwise noted, to leave 1/2" (12 mm) clearance around the pipes, or where pipe is insulated, a 1/2" (12 mm) clearance around the pipe insulation.

.5 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

.1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;
.2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;
.3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

.1 Thunderline Corp. (Power Plant Supply Co.) “Link Seal” model S-316 or Metraflex Co. “Metraseal” Type ES.

.6 For fire-rated construction, refer to section entitled Firestopping and Smoke Seal Systems.

.7 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.

.8 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 4" (100 mm) above the finished surface.

.9 "Gang" type sleeving will be permitted only with the approval of the Consultant.

.10 Where sleeves are provided for future piping, cap and seal both ends of the sleeved opening to the approval of the Consultant.

3.5 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

.5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder’s identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.

.6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.

.7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.

.9 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.

.10 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer’s latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.

.11 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer’s recommendations, ASTM D2855, and CSA requirements.

.12 Install PVC piping with gasketed joints in accordance with manufacturer’s current published specifications, instructions and recommendations, and CSA requirements.

3.6 INSTALLATION OF WATERPROOF MECHANICAL SEALS

.1 Provide watertight link type mechanical seals in exterior wall openings.

.2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.

.3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.

3.7 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.

.2 Begin to prepare such drawings immediately upon notification of acceptance of tender and award of contract.

3.8 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitably secured over all exposed piping passing through walls, floors, ceilings, partitions, furrings, and similar construction in finished areas.

.2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

3.9 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fasteners, anchors, braces and supports required to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner, capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where hangers are suspended from concrete slabs, install inserts before concrete is placed using inserts designed for the specific purpose.

.4 Where built-in inserts are inaccessible due to subsequent installation of ducts, pipes or other installations, use anchors appropriate to the load requirements, including safety factor.

.5 Where fastener installations are suspect, conduct on-site tests of installed fasteners, employing an independent testing laboratory acceptable to the Consultant, using properly engineered and calibrated force measuring meters.

.6 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure that the load is properly secured to the structure that is to support the products.

.7 Provide reinforcing or connecting supports where required to distribute the loading to the structural components.

.8 Do not use wood plugs and hammer impact fasteners. Anchors in floor topping fills are not acceptable. Secure anchors in floors to the structure.

.9 Where a performance requirement is specified, submit engineering calculations and written verification signed by a registered professional engineer that the installation has been inspected and is structurally sound and in accordance with design requirements.

.10 Fastenings which cause spalling or cracking of the structure or products to which anchorage is made are not acceptable.

.11 Obtain the Consultant's consent before using explosive actuation fastening devices. If consent is obtained, comply with CSA A166.

.12 Space anchors within limits of load bearing or shear capacity and ensure they provide positive permanent anchorage.

3.10 INSTALLATION OF PIPE HANGERS AND SUPPORTS

.1 Provide required pipe hangers and supports.

.2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.

.3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.

.4 Support requirements for underground piping are as follows:
- .1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;
- .2 support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs, all as per drawing detail;
- .3 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.

.5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.

.6 Space hangers and supports in accordance with following:
- .1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;
- .2 plastic pipe – conform to pipe manufacturer's recommended support spacing;
- .3 glass pipe – conform to pipe manufacturer's recommended support spacing and support requirements;
- .4 copper and steel pipe – hang at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

.7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.

.8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

.9 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.

.10 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:
- .1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;
- .2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;
- .3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;
- .4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;
- .5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.

.11 Support piping on the roof as follows:
- .1 supply manufactured roof supports as per Part 2 of this Section to accommodate piping.
- .2 The use of wood for supporting piping is not permitted.
- .3 Provide supports spaced so deflection of piping does not exceed 1/240 of span.
- .4 Piping support spacing is to be as per manufacturer's recommendations or as indicated in schedule below, but in no case greater than 3 m (10') on centre.
- .5 Supports are to be provided upstream and downstream of all corners, valves, and branch tee-offs.
- .6 Contractor is responsible for piping supports meeting the requirements of all local codes and standards (ex. TSSA, Natural Gas Utility requirements, etc.).
- .7 Set framing posts into bases and assemble framing structure as indicated.
- .8 Use galvanized fasteners for galvanized framing and stainless steel fasteners for stainless steel framing.
- .9 Piping supports are to be provided as follows:
  - .1 For Gas Lines 2-1/2 inches (64 mm) in Diameter or Less, up to 10 inches (254 mm) above roof: Portable Pipe Hanger Model number: SS8.
  - .2 For Gas Lines 3-1/2 inches (89 mm) in Diameter or less, up to 16 inches (406 mm) above roof: Portable Pipe Hanger Model number PP10.
  - .3 For Gas Lines 4 to 6 inches (100-150 mm) in Diameter, up to 12 inches (305
  - .4 mm) above roof: Portable Pipe Hanger Model number RB18.
  - .5 For single Gas Lines 3 to 8 inches (80-200 mm) in Diameter: Portable Pipe Hanger Model number PS 1-2.
  - .6 Option for Multiple Lines: Portable Pipe Hanger Model number PSE custom.

.10 Support roof mounted piping at spacing according to the following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
Less than 25 mm (1")	1.2 m (4')	Continuous Support
25 mm (1")	2.4 m (8')	2 m (6')
32 mm (1-1/4) and Greater	3.0 m (10')	2 m (6')

.11 For copper tubing less than 25mm (1"), provide heavy gauge galvanized metal pan (or equivalent) running between supports (pan shall be constructed to support pedestrian loads). The refrigerant piping shall be mounted on the pan for continuous support c/w galvanized pipe clamp fasteners.

.12 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

.13 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.

.14 Do not support piping from steel deck without written consent from Consultant.

3.11 SUPPLY OF ACCESS DOORS

.1 Supply access doors to give access to all valves, cleanouts, strainers, duct access doors, and other similar mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.

.2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.

.3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.

.4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.

.5 Group piping and ductwork to ensure the minimum number of access doors is required.

.6 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.12 INSTALLATION OF VALVES

.1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:
- .1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
- .2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;
- .3 unless otherwise specified, provide a check valve in discharge piping of each pump;
- .4 valve sizes are to be same as connecting pipe size;
- .5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;
- .6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.13 INSTALLATION OF PRESSURE GAUGES AND THERMOMETERS

.1 Provide pressure gauges with cocks in the following locations:
- .1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;
- .2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;
- .3 in expansion tank(s);
- .4 in separate domestic hot water storage tank(s);
- .5 at top most outlet in each standpipe fire protection system riser;
- .6 in piping at each side of a pressure reducing valve;
- .7 in potable water service piping downstream of meter;
- .8 wherever shown and/or specified on the Drawings or in the Specification.

.2 Provide thermometers in following locations:
- .1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;
- .2 wherever else shown and/or specified.

.3 Conform to following installation requirements:
.1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;
.2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;
.3 locate, mount and adjust instruments so they are easily readable;
.4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

.4 Locate and mount all instruments so they are easily readable.

3.14 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Provide OHSA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.

.2 Install belt guards to allow movement of motors for adjusting belt tension.

.3 Provide a means to permit lubrication and use of test instruments with guards in place.

.4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.

.5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.15 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

.1 Unless otherwise noted, supply a motor starter for each item of motorized equipment which you provide.

.2 Where three (3) phase starters are indicated and scheduled in motor control centre enclosures, supply the control centres complete with starters and bolt the assemblies to concrete housekeeping pads where shown.

.3 Where package type equipment with integral starters, or equipment with starters integral in loose control panels supplied with the equipment (either by Mechanical Divisions or as part of the work of other Divisions) is fed from a motor control centre, provide a disconnect switch in the motor control centre in lieu of a starter. Refer to the starter schedule(s) for requirements.

.4 Unless otherwise noted or shown on the drawings, single phase starters will be mounted adjacent to the equipment they serve and connected complete as part of the electrical work. Hand the starters to the electrical trade at the site at the proper time.

.5 Motor starter interlocking will be done as part of the electrical work in accordance with requirements specified in Mechanical Divisions, and as outlined on the starter schedule(s). Equip each starter to be interlocked with all required contacts and control connection accessories.

.6 Provide an identification nameplate on each motor starter or disconnect located in a motor control centre or on a motor starter panel, on each individually mounted starter which you supply, and on each disconnect which is provided by Electrical Division for motorized equipment which you supply.

3.16 IDENTIFICATION PAINTING

.1 Identify exposed piping and ductwork in locations as follows:
.1 at every end of every duct run;

.2 adjacent to each valve, strainer, damper and similar accessory;
.3 at each piece of connecting equipment;
.4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;
.5 at 20' (6 m) intervals on pipe and duct runs exceeding 20' (6 m) in length;
.6 on each side of special fittings and branch connections;
.7 at least once in each room, and at least once on pipe and duct runs less than 20' (6 m) in length.

.2 Identify concealed ductwork in locations as follows:
.1 at points where pipe or ducts enter and leave rooms, shafts and similar areas;
.2 at maximum 20' (6 m) intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
.3 at each access door location;
.4 at each piece of connected equipment, automatic valve, etc.

.3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

.4 Paint new natural gas piping with primer and 2 coats of yellow paint in accordance with Code requirements and requirements of Painting Section in Division 09. Identify piping at intervals as specified above.

.5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.

.6 Identification for ductwork shall consist of neatly stencilled, painted 1" (25 mm) high lettering to indicate the system the duct is associated with and the duct service, i.e., "SYSTEM ACS-1-SUPPLY", and stencilled directional arrows to indicate air flow. On insulated ductwork with a paintable finish apply the identification directly to the duct insulation. On uninsulated ducts apply the lettering to a rectangular painted white background. Identification paint colour shall be black.

.7 Equipment identification wording shall be minimum 1" (25 mm) high stencilled lettering and shall indicate the use of the particular pieces of equipment. Abbreviations will not be permitted.

.8 Note that use of Brady Ltd. or equal plasticcoated cloth material colour coded markers with lettering, arrows, and waterproof adhesive backing will be permitted in lieu of painting and stencilling if the surface the marker is to be applied to is dry and sealed with clear lacquer, and clear lacquer is applied over the marker after installation.

.9 Tag valves and prepare a valve tag chart in accordance with following requirements:
.1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;
.2 prepare a computer printed valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);
.1 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;
.2 frame and glaze one copy of chart and, unless otherwise directed, affix to a wall in each main Mechanical and/or Equipment Room;

.3 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;
.4 hand an identified CD of valve tag chart to Owner at same time O & M Manuals are submitted.

.10 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:

.1	HVAC piping valves and equipment:	yellow
.2	fire protection valves and equipment:	red
.3	plumbing valves and equipment:	green
.4	HVAC ductwork dampers and equipment:	blue
.5	control system hardware and equipment:	orange

3.17 FINISH PAINTING OF MECHANICAL WORK

.1 Finish paint exposed mechanical work as specified and/or scheduled in accordance with requirements of painting Section in Division 09.

.2 Touch-up paint damaged factory applied finishes on mechanical work products.

3.18 PIPE LEAKAGE TESTING

.1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.

.2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 Gravity Drainage and Vent Piping
.1 Test piping in accordance with local governing building code.
.2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.

.5 Domestic Water Piping
.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.6 Heat Transfer (HVAC) System Piping
.1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.

.1 0 kPa to 105 kPa (0 psi to 15 psi) low pressure piping – 690 kPa (100 psi);
.2 110 kPa to 690 kPa (16 psi to 100 psi) medium pressure piping – 1035 kPa (150 psi);
.3 greater than 690 kPa (100 psi) high pressure piping – 1380 kPa (200 psi).

.7 Natural Gas Piping
.1 Test piping in accordance with requirements of CAN/CSA B149.1 and any additional requirements of local governing authorities.

.2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.
.3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.8 Following requirements apply to all testing:
.1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;
.2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;
.3 when testing is carried out below highest level of the particular system, increase test pressure by the hygrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;
.4 include for temporary piping connections required to properly complete tests;
.5 piping under test pressure is to have zero pressure drop for length of test period;
.6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;
.7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;
.8 tests are be done in reasonably sized sections so as to minimize number of tests required;
.9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.19 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

.1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:
.1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;
.2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;
.3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;
.4 provision of receptacles for plug-in equipment;
.5 provision of disconnect switches for motors in excess of 10 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;
.6 motor starter interlocking in excess of 24 volts;
.7 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts;
.8 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;
.9 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;
.10 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.

.2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

3.20 MECHANICAL PLANT PERFORMANCE AND ACCEPTANCE TESTS

.1 After individual pieces of equipment have been tested and accepted, but prior to operating tests specified hereinafter, forward to the Consultant a letter stating that the entire mechanical plant is complete in all respects, has been checked and tested, and is ready for start-up. When the letter has been received, the Consultant will visit the site for purpose of witnessing a performance and acceptance test of the entire plant.

.2 Include for all required labour for the performance test and any adjustments required due to the results of the test, and ensure that competent and qualified equipment manufacturer's representatives are present during the test.

.3 When the entire mechanical plant is ready for acceptance, but before acceptance of same, subject the entire plant to a continuous run for the length of time required for the purpose of demonstrating that all apparatus, materials, and systems are in perfect working order, that all controls and operating services are properly adjusted, that all units are heating and/or cooling properly, and that the systems provide uniform temperatures inside the building regardless of outside temperatures or conditions. Make the tests under the direction of the Consultant, and if the plant is not in proper operating condition, the Owner reserves the right, if all defects are not properly rectified, to employ other parties to make the necessary alterations and put the systems in proper working order, at your expense.

.4 Note that the testing specified above must be complete prior to issue of a Certificate of Substantial Performance.

3.21 EQUIPMENT BASES AND SUPPORTS

.1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:
- .1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;
- .2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;
- .3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

.2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:
- .1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;
- .2 flange bolt steel stands to concrete housekeeping pads;
- .3 seismically restrained stands and supports in accordance with applicable requirements.

3.22 CONCRETE WORK FOR MECHANICAL SERVICES

.1 Concrete work required for mechanical equipment bases/pads will be provided as part of concrete work of Division 03.

.2 Exactly locate bases/pads at site and be present during concrete pour to ensure anchor bolts, inserts, plates and similar hardware are not damaged or dislodged

3.23 EXCAVATION AND BACKFILL WORK

.1 Excavation, backfill and related work such as dewatering required for mechanical work will be performed as part of excavation and backfill work, except for final hand grading work which is to be done as part of mechanical work. Mark out location and routing of excavation required for work as well as required depth. Ensure that bedding is graded to provide proper drainage for ducts as directed by Consultant.

.2 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm local utilities have performed locates and marking out. Ensure inverts and locations are correct, prior to commencement of work. Where discrepancies are found, immediately inform Consultant, and await a direction.

.3 Accurately mark-out location and routing of excavation required, as well as required depth.

.4 Ensure underground piping subject to freezing and located outside building has a minimum of 1.37 m (4-½') of cover.

.5 Ensure underground piping subject to freezing and located inside building in unheated areas has a minimum of 450 mm (18") of cover.

.6 Ensure pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.

.7 Ensure piping is inspected, leakage tested and approved prior to backfilling. Supervise initial backfilling operation to ensure buried work is not disturbed.

.8 Ensure work is inspected by Consultant before covering and backfilling. Failure to do so prior to backfilling will require re-excavating of work and re-backfill at no additional cost to Owner.

3.24 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:
- .1 pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal;
- .2 pack and seal openings in fire rated walls and slabs as specified in Section entitled Firestopping and Smoke Seal Systems;
- .3 pack openings in exterior wall above grade with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;
- .4 seal exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

3.25 CLEANING MECHANICAL WORK

.1 Refer to cleaning requirements specified in Division 01.

.2 Clean mechanical work prior to application for Substantial Performance of the Work.

.3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.26 CONNECTIONS TO OTHER EQUIPMENT

.1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.27 INSTALLATION OF FLEXIBLE CONNECTORS

.1 Provide flexible connectors in piping connections to seismically restrained equipment, and wherever else shown.

.2 Provide flexible connectors in piping connections to vibration isolated equipment.

3.28 FAN NOISE LEVELS

.1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

3.29 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

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

3.30 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
   .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant;
   .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

END OF SECTION

1 GENERAL

1.01 APPLICATION

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

1.02 SUBMITTALS

.1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.

.2 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

2 PRODUCTS

2.01 GENERAL

.1 Vibration isolation products are to be in accordance with drawing schedule and details, and as specified below.

.2 Springs are to be stable, colour coded, selected to operate at no greater than ⅔ solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.

.3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.

.4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.

.5 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

2.02 ISOLATION PADS

.1 Sandwich type pads, 20 mm (¾") nominal thickness, selected for 3.2 mm (1/8") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum #10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type NSN;

.2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics) "SHEAR-FLEX PLATES";

.3 Kinetics Noise Control Vibron Products Group Type NGS/NGD;

.4 Mason Industries Inc. Type SW/S/SW with HG Bolt Insertion Washers;

.5 J. P. America Inc. Type JSJ.

2.03 RUBBER FLOOR ISOLATORS

.1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type R;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type RSM;

.3 Kinetics Noise Control Vibron Products Group Type RQ;

.4 Mason Industries Inc. Type BR;

.5 J. P. America Inc. Type TRM.

2.04 SPRING FLOOR ISOLATORS

.1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SFS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type AMSR;

.3 Kinetics Noise Control Vibron Products Group Type FLSS;

.4 Mason Industries Inc. Type SSLFH;

.5 J. P. America Inc. Type TSO-C-SC.

2.05 OPEN SPRING MOUNTS

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type FS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type A;

.3 Kinetics Noise Control Vibron Products Group Type FDS;

.4 Mason Industries Inc. Type SLFH;

.5 J. P. America Inc. Type TSO.

2.06 CLOSED SPRING MOUNTS

.1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CM;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Types B and C;

.3 Kinetics Noise Control Vibron Products Group Type FLS;

.4 Mason Industries Inc. Type C;

.5 J. P. America Inc. Type TSC.

2.07 TOTALLY RETAINED SPRING MOUNTS

.1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CSR;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type MS;

.3 Kinetics Noise Control Vibron Products Group Type SM;

.4 Mason Industries Inc. Type SLRSO;

.5 J. P. America Inc. Type TSR.

2.08 SPRING HANGERS

.1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SHR-SN;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Series HRSA;

.3 Kinetics Noise Control Vibron Products Group. Type SRH;

.4 Mason Industries Inc. Type 30N;

.5 J. P. America Inc. Type TSH.

2.09 NEOPRENE HANGER ISOLATORS

.1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type NH;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type HR;

.3 Kinetics Noise Control Vibron Products Group Type RH;

.4 Mason Industries Inc. Type HD or WHD;

.5 J. P. America Inc. Type TRH.

3 EXECUTION

3.01 INSTALLATION OF VIBRATION ISOLATION MATERIALS

.1 Provide vibration isolation products for mechanical work in accordance with drawing schedule and details, and requirements specified herein and/or on drawings.

.2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:

.1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;

.2 steel bases are to clear the sub-base by 25 mm (1");

.6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:

.1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;

.2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;

.3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;

.7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").

.8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.

.9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.

.10 Isolate designated piping risers at floor support points in accordance with drawing detail.

.11 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Consultant.

.12 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

.1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.

.2 "exposed" – means exposed to normal view during normal conditions and operations.

.3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.

.4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the mechanical insulation work is specified in other Sections of the Specification:
.1 plumbing and drainage piping and equipment;
.2 hydronic piping and/or equipment;

1.4 SUBMITTALS

.1 Submit a product data sheet for each insulation system product.

1.5 SAMPLES

.1 Submit to the Consultant for review, a sample of each type of insulation, in applied form. Mount the samples on a rigid plywood board. Identify each sample with the manufacturer's name and insulation type, and the proposed use of the insulation. The sample board shall be provided in shop drawing form. Accompanying the sample board shall be complete, up to date literature from the manufacturer for each product. It shall be understood that any and all insulation supplied and/or installed on the project shall be in accordance with the reviewed sample board.

1.6 QUALITY ASSURANCE

.1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.

.2 Do not apply insulation unless leakage tests have been satisfactorily completed.

.3 Ensure surfaces to be insulated are clean and dry.

.4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.

.5 Company with sub-contract for mechanical insulation work is to be a member in good standing of Thermal Insulation Association of Canada.

.6 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

1.7 VAPOUR BARRIER JACKET

.1 Insulation specified with a vapour jacket, shall be supplied with the vapour barrier jacket factory installed. Installation of a vapour barrier jacket outside of the insulation manufacturer's factory is not acceptable and will be considered deficient work. Contractor and manufacturer shall certify in writing that vapour barrier jacketed insulation supplied and installed on the work is in accordance with this stipulation.

2. Products

2.1 FIRE HAZARD RATINGS

.1 All insulation system materials must meet requirements of NFPA 90A and insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.2 THERMAL PERFORMANCE

.1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.3 PIPE INSULATION MATERIALS

.1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.

.2 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with ULC S115 and ULC-S101 firestopping. Acceptable products are:
.1 Roxul "Techton 1200";
.2 IIG (Johns Manville Inc.) MinWool-1200;
.3 Paroc 1200.

.3 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket. Acceptable products are:
.1 Johns Manville Inc. "Micro-Lok AP-T Plus";
.2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;
.3 Manson Insulation Inc. "ALLEY K APT";
.4 Owens Corning “Fiberglas” Pipe Insulation.

.4 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m^3 (1-½ lb/ft^3) density, with a factory applied vapour barrier facing. Acceptable products are:
.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.5 Pre-moulded weatherproof jacketed mineral fibre is to be Knauf Insulation "Redi-Klad 1000" sectional, sleeve type pipe insulation with a self-sealing weather-proof jacket and a 100 mm (4") butt joint sealing strip with each section.

2.4 BARRIER-FREE LAVATORY PIPING INSULATION KITS

.1 Removable, flexible, reusable, white moulded plastic insulation kits for barrier-free lavatory drain piping and potable water supplies exposed under lavatory.

.2 Acceptable products are:
.1 Truebo "Lav-Guard 2" E-Z Series;
.2 Zeston "SNAP-TRAP";
.3 McGuire Manufacturing Co. Inc. "ProWrap".

2.5 PIPE INSULATION REQUIREMENTS – FLEXIBLE FOAM ELASTOMERIC

.1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants and finish to produce a water-tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:

2.6 EQUIPMENT INSULATION MATERIALS

.1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:
.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.2 Semi-rigid mineral fibre board is to be roll form, moulded insulation to ASTM C1393, with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper. Acceptable products are:
.1 Knauf Fiber Glass Pipe and Tank Insulation;
.2 Manson Insulation Inc. "AK FLEX";
.3 Johns Manville Inc. Pipe and Tank Insulation "Micro-Flex";
.4 Multi-Glass Insulation Ltd. "MULTI-FLEX MF";
.5 Owens Corning Pipe and Tank Insulation;
.6 Glass-Cell Fabricators Ltd. "R-Flex".

2.7 REMOVABLE/REUSABLE INSULATION COVERS

.1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.

.2 Custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m^3 (6 lb/ft³) density ceramic fibre insulation sewn between minimum 542.5 g/m^2 (1.8 oz/ft²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place. Acceptable manufacturers are:
.1 Crossby Dewar Inc.;
.2 Insufab Systems Inc.;
.3 ADL Insulflex Inc.;
.4 Firwin Corp.;
.5 GlassCell Isofab Inc.

2.8 DUCTWORK SYSTEM INSULATION MATERIALS

.1 Rigid mineral fibre board is to be pre-formed board type insulation to ASTM C612, 48 kg/m^3 (3 lb/ft^3) density, with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:
.1 Knauf Fiber Glass Insulation Board with FSK facing;
.2 Manson Insulation Inc. "AK BOARD FSK";
.3 Johns Manville Inc. Type 814 "Spin-Glas";
.4 Owens Corning 703.

.2 Semi-rigid mineral fibre board is to be roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing. Acceptable products are:
.1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";
.2 Glass-Cell Fabricators Ltd. "R-FLEX";
.3 Owens Corning Pipe and Tank Insulation;
.4 Johns Manville Inc. Pipe and Tank Insulation.

.3 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m^3 (1½ lb/ft^3) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing. Acceptable products are:
.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.4 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A. Acceptable products are:
.1 Armacell "AP/Armaflex SA";
.2 IK Insulation Group "K-Flex Duct Wrap", S2S.

2.9 INSULATING COATINGS

.1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:
.1 anti-condensation coating, "No Sweat-FX";
.2 thermal insulating coating, "ThermaLite".

2.10 INSULATION FASTENINGS

.1 Wire – minimum #15 gauge galvanized annealed wire.

.2 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.

.3 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.

.4 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.

.5 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.

.6 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.

.7 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.

.8 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.

.9 Screws – No. 10 stainless steel sheet metal screws.

2.11 INSULATION JACKETS AND FINISHES

.1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz.).

.2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories. Acceptable products are:
.1 Proto Corp. "LoSMOKE";
.2 The Sure-Fit System "SMOKE-LESS 25/50";
.3 Johns Manville Inc. "Zeston" 300.

.3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.

.4 Flexible foam elastomeric insulation protective coating equal to Armacell "WB Armaflex" weatherproof, water-based latex enamel finish.

3. Execution

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise noted, do not insulate the following:
.1 factory insulated equipment and piping;
.2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;
.3 branch domestic water piping located under counters to serve counter mounted plumbing fixtures and fittings;
.4 exposed chrome plated domestic water angle supplies from concealed piping to plumbing fixtures and fittings;
.5 heated liquid system pump casings, valves, strainers and similar accessories;
.6 heating system expansion tanks;
.7 manufactured expansion joints and flexible connections;
.8 acoustically lined ductwork and/or equipment;
.9 factory insulated flexible branch ductwork;
.10 piping unions, except for unions in "cold" category piping.

.2 Install insulation directly over pipes and not over hangers and supports.

.3 Do not apply insulation until leakage tests have been satisfactorily completed.

.4 Ensure that all surfaces to be insulated are clean and dry.

.5 No material including tapes, adhesives, etc. used as part of an insulation assembly shall be rated greater than 25/50 Article 2.1 entitled “FIRE HAZARD RATING OF INSULATION” shall be used within a “plenum” as defined in OBC.

.6 Install work generally in accordance with TIAC "NATIONAL INSULATION STANDARDS MANUAL" except conform with manufacturer's published instructions and recommendations and the requirements specified herein this Section of the Specification.

.7 Ensure that the ambient temperature is minimum 55°F (13°C) for at least one (1) day prior to the application of insulation, and for the duration of insulation work.

.8 Install piping insulation continuous through pipe openings and sleeves.

.9 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.10 Provide proper covering shields, sized to suit the insulated pipe, between the pipe hanger or support and the insulation for all piping not supported by roller hangers or supports.

.11 Where roller hangers and supports are used, steel protection saddles will be supplied and installed as part of the piping work. Pack the saddle voids with fibreglass insulation.

.12 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal.

.13 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.14 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.

.15 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.16 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

.17 The final appearance and finish of exposed mechanical work depends to a large degree on the quality of the insulation application, therefore, first class workmanship will be insisted upon.

.18 For all piping system components and for equipment or sections of equipment which require insulation but also access to permit maintenance or adjustment, design and install the insulation to permit easy removal and replacement.

.19 For items such as “circuit balancing valves” which are supplied with insulating accessories, specified in other Sections of the Specification, incorporate the packing into the pipe insulation, but do not contravene fire hazard ratings of CAN/ULC-S102.

3.2 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

3.3 PIPE INSULATION REQUIREMENTS - MINERAL FIBRE

.1 Except where other types of insulation are specified for portions of piping in succeeding articles in this Section, insulate the following pipe with rigid fibreglass pipe insulation of the thickness noted:
- .1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;
- .2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;
- .3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;
- .4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;
- .5 storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal underground mains – 25 mm (1") thick;
- .6 tempered domestic water piping, supply and return, less than 40 mm (1-½") dia. – 25 mm (1") thick;
- .7 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;
- .8 drainage piping from refrigerated drinking fountains to nearest 75 mm (3") dia. or larger drain pipe – 25 mm (1") thick;
- .9 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;
- .10 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;
- .11 refrigerant suction piping (between compressor and evaporator coil) inside building – 25 mm (1") thick;
- .12 refrigerant hot gas piping (between compressor and condenser) inside building – 25 mm (1") thick;
- .13 refrigerant hot gas by-pass piping (between compressor discharge and evaporator coil) inside building – 25 mm (1") thick;

.2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.

.3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.

.4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.

.5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.

.6 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.

3.4 PIPE INSULATION REQUIREMENTS – FLEXIBLE FOAM ELASTOMERIC

.1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants and finish to produce a water-tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:
.1 refrigerant suction and hot gas piping outside building – 25 mm (1") thick.

3.5 PIPE INSULATION REQUIREMENTS – FIRE RATED INSULATION

.1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

3.6 INSTALLATION OF BARRIER FREE LAVATORY INSULATION KITS

.1 Provide manufactured insulation kits to cover exposed drainage and water piping under barrier free lavatories.

3.7 EQUIPMENT INSULATION REQUIREMENTS – SEMI-RIGID MINERAL FIBRE

.1 Insulate following equipment with semi-rigid mineral fibre board insulation of thickness indicated:

.1 heating main air separator – 40 mm (1-½") thick;

.2 Install insulation as required to fit shape and contour of equipment. Secure insulation in place with adhesive, and with aluminum straps on 450 mm (18") centres. Apply a 6 mm (¼") thick skim coat of insulating cement, then, when insulating cement has dried, apply a 6 mm (¼") thick coat of cement trowelled smooth.

.3 For "cold" equipment, prime insulation with suitable sealer and apply a jacket of glass thread reinforced foil and kraft paper vapour barrier jacket material laminated in place with a full coverage of adhesive.

.4 Provide removable and replaceable insulated metal covers for equipment with removable heads to permit heads to be removed and replaced without damaging adjacent insulation work.

3.8 EQUIPMENT INSULATION REQUIREMENTS – REMOVABLE/REUSABLE TYPE

.1 Provide custom designed and manufactured removable and reusable insulation covers for following:
.1 plate type heat exchanger(s);

.2 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") dia.

3.9 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:

.1 outside air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;
.2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
.3 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
.4 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
.5 any other ductwork, casings, plenums or sections specified or detailed on drawings to be insulated – thickness as specified.

.2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.

.3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:
.1 at trapeze hanger locations, install insulation between duct and hanger;
.2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.

.4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.

.5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.

.6 Insulation application requirements common to all types of rigid ductwork are as follows:
.1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;
.2 installation of fastener pins and washers is to be concurrent with duct insulation application;
.3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;
.4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;

.5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.10 DUCTWORK INSULATION REQUIREMENTS – FLEXIBLE ELASTOMERIC

.1 Insulate exposed exterior ductwork (except fresh air intake ductwork) and associated plenums and/or casings outside building with minimum 40 mm (1-½") thick flexible elastomeric sheet insulation as required, applied in 2 minimum 20 mm (¾") thick layers with staggered tightly butted joints.

.2 Install with adhesive in strict accordance with manufacturer's instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.

3.11 APPLICATION OF INSULATING COATINGS

.1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:
.1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;
.2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.

.2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

3.12 INSULATION FINISH REQUIREMENTS

.1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.

.2 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.

.3 Install rigid aluminum jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with the jacket. Provide aluminum jacket for following insulation:
.1 Outdoor Refrigerant Piping.

END OF SECTION

1. General

1.1 SUBMITTALS

.1 Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:
  .1 construction and performance details;
  .2 wiring and control schematics;
  .3 dimensions of units;
  .4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;
  .5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

.2 Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;

.3 Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to Consultant.

.4 Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.

.5 Additionally, coordinate with Prime Contractor and Electrical Contractor to ensure shop drawings clearly identify proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

1.2 COORDINATION WITH ELECTRICAL DIVISIONS

.1 This Section specifies VFD requirements for motors. VFDs packaged with various system equipment are to comply with specifications of this Section.

.2 Each VFD to be approved by respective manufacturer of VFD and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.

.3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.

.4 Check motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.

.5 Additionally, review and confirm responsibilities with Consultant and Prime Contractor.

2. Products

2.1 VFD BASIC REQUIREMENTS

.1 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified product is Danfoss VLT HVAC series units that include compliance with following standards:
  .1 CSA C22.2 No.14 Industrial Control Equipment;
  .2 UL 508 - Industrial Control Equipment;
  .3 UL 508C – Power Conversion Equipment;
  .4 NEMA ICS 7 - Adjustable-Speed Drives.

.2 Basis for limiting harmonics is to be provided generally to IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, except intended for user's electrical distribution system with point of common coupling (where harmonic limits are assessed) to be set at input terminals of harmonic mitigating equipment.

.3 VFDs to include following basic requirements:
- .1 regardless of HP rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of HP rating;
- .2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);
- .3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;
- .4 carrier frequency control circuit that reduces carrier frequency based on actual VFD temperature allowing higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;
- .5 provisions that determines motor torque and flux every 25 microseconds (40,000 times per second);
- .6 completely assembled and tested by manufacturer in their facility;
- .7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.
- .8 bypass system completely factory wired and tested;
- .9 door interlocked padlockable disconnect switch to disconnect all input power from drive and all internally mounted options;
- .10 control panel keyboard and display with password protection against parameter changes.

2.2 VFD RATINGS

.1 VFDs to be rated to operate from 3 phase input voltage of 208 or 600 volts ± 10%, as scheduled, and frequency range from 48 to 63 Hz. In addition, a tolerated voltage window to allow system to operate from a line of +30% to -35% nominal voltage. System to incorporate circuitry that allows drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.

.2 VFDs to employ a full wave rectifier to prevent input line notching and operate at a minimum fundamental input power factor of 0.97 at all speeds and loads.

.3 VFDs efficiency to be 97% or better at full speed and load.

.4 Output voltage and current ratings to match adjustable frequency operating requirements of standard 3 phase, 60 Hz, NEMA design B inverter-duty motors in compliance with NEMA-MG1, Part 31 Standard. Overload current capacity for variable torque overload capacity to be 110% of rated current for 1 minute out of 10 minutes and 130% for 2 seconds. Output frequency to be adjustable between 0 and 500 Hz.

.5 Open loop static speed regulation to be 0.1% to 0.3% (10% of motor slip). Dynamic speed accuracy to be 4%-sec. or better open loop.

.6 When a suitable motor is used, drive provides breakaway torque equal to 200% of rated motor torque. Torque response time to be 5 ms or less.

.7 Enclosures:
- .1 in climate controlled areas – minimum NEMA 12 with drip shield;
- .2 in non-climate controlled areas – NEMA 3R.

2.3 CONTROLS AND ADJUSTMENT FUNCTIONS

.1 Include for following:
- .1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;
- .2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 mA of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID allowing sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc; independent, second PID loop to utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (ie. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;
- .3 programmable analogue inputs that accept current or voltage signals;
- .4 programmable analogue outputs (0-20 mA or 4-20 mA), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;
- .5 programmable digital inputs;
- .6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS;
- .7 run permissive circuit - for damper or valve control; dry contact closure to signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;
- .8 two independently adjustable accel and decel ramps with 1 to 1800 seconds adjustable time ramps;
- .9 fireman’s override input - upon receipt of a contact closure from fireman’s control station, VFD operates in one of two modes: operate at a programmed predetermined fixed speed or operate in a specific fireman’s override PID algorithm that automatically adjusts motor speed based on override set point and feedback; mode overrides all other inputs (analogue/digital, serial communication and keypad commands), except customer defined safety run interlock, and forces motor to run in one of the two modes; "Override Mode" to be displayed on control panel; upon removal of override signal, VFD resumes normal operation.

.2 Operator Control Panel:
- .1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;
- .2 keys (switches) for H-O-A, and manual speed control INCREASE/DECREASE;
- .3 menu navigation and parameter selection keys for custom programming;
- .4 HELP key for assistance with programming and troubleshooting;
- .5 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;
- .6 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:

.1 “HAND” position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;
.2 “OFF” position stops drive;
.3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.
.4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:

.1 Output Frequency;
.2 Motor Speed (RPM, %, or Engineering units);
.3 Motor Current;
.4 Drive Temperature;
.5 DC Bus Voltage;
.6 Output Voltage.

2.4 PROTECTIVE FUNCTIONS

.1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations. Three most recent fault messages and times are stored in drive’s fault history.

.2 VFDs include metal oxide varistors (MOV’s) for phase to phase and phase to ground line voltage transient protection.

.3 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.

.4 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.

.5 VFDs to provide electronic motor overload protection qualified per UL 508C.

.6 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.

.7 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.

.8 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.

.9 Overtemperature protection to provide a warning if power module temperature is less than 5C° (9F°) below overtemperature trip level.

.10 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive’s protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.

.11 VFDs through 56 kW (75HP) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.

.12 EMI / RFI filters to be provided as per standard EN 61800-3.

.13 dv/dt long lead filter (LRC) to protect power system network.

.14 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:
.1 Overcurrent;
.2 Overvoltage;
.3 Undervoltage;
.4 Analogue input signal reference loss;
.5 External fault.

.15 Additional built-in protection circuits include:
.1 Overcurrent trip limit;
.2 Undervoltage trip limit;
.3 Microprocessor fault;
.4 Keypad control panel loss;
.5 Serial communication loss;
.6 External fault interlock inputs;
.7 Adjustable output frequency and motor speed limits;
.8 Pass code parameter change protection;
.9 Keypad operator control lockout.

2.5 MANUAL BYPASS

.1 VFDs associated with pumping systems such as heating water circulating pumps shall be provided with a Three-Contactor By-Pass. The Three-Contactor By-Pass shall be wired such that the Central Building Control System will not interfere with the By-Pass operation.

2.6 COMMUNICATIONS

.1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.

.2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols to match existing building automation system.

.3 Serial communication to be used for drive setup, diagnostic analysis, monitoring and control with capabilities to include, but not be limited to:
.1 run-stop control;
.2 speed set adjustment;
.3 proportional/integral/derivative PID control adjustments;
.4 current limit;
.5 accel/decel time adjustments;
.6 ability to lock and unlock control panel keypad;
.7 capability of allowing BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature;
.8 monitoring relays output status, and digital input status and analogue output values;
.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;
.10 remote fault reset.

2.7 WARRANTY

.1 VFDs to be warranted free from defective labour and materials for period of sixty (60) months from date of Substantial Performance of the Work. Include for initial one (1) year Contract warranty and an additional four (4) year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.

2.8 SITE SERVICES, TRAINING AND MAINTENANCE MANUALS

.1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer's authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.

.2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.

.3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.

.4 Include for manufacturer's authorized technician to be in attendance to assist Commissioning Agent during commissioning process.

2.9 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are Danfoss-Graham (VLT HVAC Drive FC102 Series), ABB, Siemens Electric. All variable frequency drives shall be supplied by one (1) manufacturer.

3. Execution

3.1 INSTALLATION OF VARIABLE FREQUENCY DRIVES

.1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.

.2 VFDs supplied to be products of same manufacturer.

.3 Include manual bypass with each VFD as noted or specified.

.4 Wire length between VFD and motor to be less than 15 m (50') with properly sized conductors.

.5 Install VFDs in accordance with manufacturer's instructions. VFDs installation to include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.

.6 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.

.7 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.

.8 Properly support VFDs. Coordinate exact locations on site with Consultant.

.9 Where VFDs are required for custom made air handling units VFDs to be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by air handling unit manufacturer. "Line" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.10 Where VFDs are required for pumps, mount each VFD generally where shown but with exact location to ensure VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.11 Install harmonic mitigation filter equipment as follows:
- .1 in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;
- .2 provide each VFD as specified in per Part 2, with a harmonic filter sized in accordance with manufacturer's rating table to match rating of connected VFD;
- .3 mount harmonic filters sized up to 110 kW (150 HP) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;
- .4 ensure adequate ventilation and space for access is provided;
- .5 review exact locations with Consultant prior to installation;
- .6 coordinate with Electrical Division Contractor to ensure units are connected complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass; include required control wiring and connections.

.12 Ground and bond equipment as per local governing electrical code requirements and manufacturer's instructions.

.13 Provide engraved lamacoid nameplate identifying each piece of equipment. Review exact nomenclature with Consultant.

3.2 TESTING, START-UP AND VERIFICATION

.1 When installation of VFDs and filters are complete, arrange for respective equipment manufacturer/supplier to:
- .1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of equipment, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;
- .2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on equipment operating and maintenance procedures;
- .3 prepare and submit letter certifying equipment have been properly installed, tested and adjusted, and are in proper operating condition;
- .4 submit list of start-up and testing parameters for uploading for future use by Owner and start-up data entries to include motor nameplate power, speed, voltage, frequency and current.

.2 Perform following:
- .1 Inspect equipment and accessories for verification of proper operation and installation.
- .2 Inspect interface wiring to BAS for verification of proper operation and installation.
- .3 Verify wire terminations to VFDs and bypass and to operational circuitry.
- .4 Verify installation of VFD, bypass and motor being driven for proper operation and reliability.
- .5 Verify connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.
- .6 Measurement for verification of proper operation on each of following items:

.1 Motor voltage and frequency;
.2 Verification of proper motor operation;
.3 Control input for proper building automation system interface and control calibration.

.7 Calibration check for following set points (and adjustment as necessary):

.1 minimum speed;
.2 maximum speed;
.3 acceleration and deceleration rates.

.3 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.

.4 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by equipment manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review.

.5 Additionally, refer to applicable installation, testing, coordination and verification requirements in Electrical Divisions Sections.

.6 Coordinate procedures specified above to be performed by equipment manufacturer/supplier authorized technician with system commissioning work.

END OF SECTION

1 GENERAL

1.01 APPLICATION

.1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

2 PRODUCTS

Not Used

3 EXECUTION

3.01 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK

.1 Where indicated on drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.

.2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.

.3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify Consultant who will issue a Site Instruction. If, in the opinion of Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.

.4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.

.5 Unless otherwise specified, remove from site and dispose of existing materials which have been removed and are not to be relocated or reused.

3.02 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

.1 Co-ordinate shut-down and interruption to existing mechanical systems with school. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.

.2 Upon award of contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform Owner in writing 5 business days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

.5 Pipe freezing may be used to connect new piping to existing piping without draining existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" equipment supplied by Mag Tool Inc. or Rigid Tool Co. RIGID "SuperFreeze".

END OF SECTION

1. GENERAL

1.1 APPLICATION

.1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Divisions 00 or 01 to take precedence.

1.2 COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS

.1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.3 SUBMITTALS

.1 Submit to Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.

.2 Submit for review, a Commissioning Plan with schedule and commissioning procedures for commissioning for equipment/systems to be commissioned.

.3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

.4 Submit equipment and system manufacturer’s start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

.5 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.4 DEFINITIONS

.1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.

.2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.

.3 Start-Up and Adjusting: process of equipment manufacturer’s/supplier’s technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer’s/supplier’s start-up reports to confirm equipment has been properly installed and is operational as intended.

.4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

.5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

.6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.

.7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.

.8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.5 QUALITY ASSURANCE

.1 Commissioning work is to be in accordance with requirements of following:

.2 CSA Z320, Building Commissioning Standard and Check Sheets;

.3 ASHRAE Guideline 0, The Commissioning Process;

.4 ASHRAE Guideline 1.1, The HVAC Commissioning Process;

.5 Owner designated Commissioning Agent.

1.6 COMMISSIONING OBJECTIVES

.1 Objectives of commissioning process:
- .1 to support quality management by means of monitoring and checking installation;
- .2 to verify equipment/system performance by means of commissioning of completed installation;
- .3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.7 TESTING EQUIPMENT

.1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2. Products

NOT USED

3. Execution

3.1 COMMISSIONING

.1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent, if applicable.

.2 Prerequisites to successful completion of commissioning:
- .1 submittal of signed start-up and test reports;
- .2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;
- .3 permanent electrical and control connections of equipment;
- .4 successful completion and documentation of pre-functional performance testing;
- .5 submittal of letters to Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

3.2 DEFICIENCIES LISTED DURING COMMISSIONING

.1 Correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent immediately.

3.3 SYSTEMS TO BE COMMISSIONED

.1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.

.2 Commissioning of water systems (all piping extended from Municipal main) includes:
- .1 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;
- .2 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;
- .3 commissioning of plumbing fixtures.

.3 Commissioning of natural gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.1, and any supplemental requirements of governing authorities.

.4 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

.5 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.6 Commissioning of HVAC chemical treatment systems includes feed and monitoring equipment, and testing of system fluids to confirm proper concentration of chemical.

.7 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.

.8 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.

.9 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.

3.4 COMMISSIONING PROCESS

.1 Perform commissioning process in stages and include, but not be limited to, following:
- .1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.
- .2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.
- .3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.
- .4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.
- .5 Stage 5: Successful seasonal commissioning of building.

3.5 RESPONSIBILITIES OF CONTRACTOR

.1 During construction phase, Contractor is to:
- .1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;
- .2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Consultant, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;
- .3 promptly correct reported deficient work, and report when corrective work is complete;
- .4 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;
- .5 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;
- .6 complete Manufacturer's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Consultant, accompany Consultant for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;
- .7 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Consultant for review and a site check of results, and perform any corrective work required as a result of site checks by Consultant;

.8 in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant a minimum of 5 working days' notice;

.9 perform system and subsystem functional performance testing, and submit to Consultant, completed and signed functional performance testing and commissioning data sheets.

.2 During post construction phase, Contractor is to:

.1 optimize system operation in accordance with building occupant’s needs and comments;

.2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

.3 complete system checks and "fine tuning" with signed documentation as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.

.4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

.5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner’s operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

.1 “Agency” – means agency to perform testing, adjusting and balancing work.

.2 “TAB” – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.

.3 “hydronic systems” – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.

.4 “air systems” – includes outside air, supply air, return air, exhaust air, and relief air systems.

.5 “flow rate tolerance” – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.

.6 “report forms” – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.

.7 “terminal” – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

.8 “main” – means duct or pipe containing system’s major or entire fluid flow.

.9 “submain” – means duct or pipe containing part of the systems’ capacity and serving 2 or more branch mains.

.10 “branch main” – means duct or pipe servicing 2 or more terminals.

.11 **“**branch” – means duct or pipe serving a single terminal.

1.3 QUALITY ASSURANCE

.1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:
   .1 AABC - Associated Air Balance Council;
   .2 NEBB - National Environmental Balancing Bureau.

.2 Testing, adjusting and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with 1 of following publications:
   .1 National Standards for a Total System Balance published by Associated Air Balance Council;

.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;
.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

1.4 SUBMITTALS

.1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.

.2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

.3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

.4 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.

.5 Submit a draft report, as specified in Part 3 of this Section.

.6 Submit a final report, as specified in Part 3 of this Section.

.7 Submit a testing and balancing warranty as specified in Part 3 of this Section.

.8 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

2. Products

NOT USED

3. Execution

3.1 SCOPE OF WORK

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.

.2 Mechanical systems to be tested, adjusted and balanced include:
.1 TAB of domestic water systems (all piping extended from Municipal main) is to include:

.1 domestic hot water recirculation piping;
.2 tempered water piping flows.

.2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
.3 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine.

.4 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.

3.2 TESTING, ADJUSTING AND BALANCING WORK

.1 Conform to following requirements:
.1 as soon as possible after award of Contract, Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;
.2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations of readings, and required revision work such as relocation of balancing devices and locations for additional devices;
.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;
.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;
.5 testing, adjusting and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;
.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;
.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;
.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;
.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;
.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;
.11 for belt-driven equipment, Agency is to report to Commissioning Agent who in turn is to inform Contractor and Consultant of any situation where sheaves have to be replaced to suit testing and balancing, and replacements are to be done by Contractor at no cost;
.12 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;
.13 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;
.14 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of ±5% of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;
.15 Agency is to perform testing, adjusting and balancing to within ±5% of design values, and make and record measurements which are within ±2% of actual values;

.16 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;

.2 Prepare reports as indicated below.
.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
.2 Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on Project Documents.
.3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:

.1 General Information and Summary;
.2 Air Systems;
.3 Hydronic Systems;

.4 Agency is to provide following minimum information, forms and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;
.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;
.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;
.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.

.5 Do not begin testing, adjusting and balancing work until:
.1 building construction work is substantially complete;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then performance tested in the presence of and to the satisfaction of the Consultant;
.3 the mechanical systems have been prepared for testing and balancing work.

.6 All mechanical systems to be tested, adjusted and balanced must be maintained in full, normal operation during each day of testing, adjusting and balancing.

.7 Perform testing, adjusting and balancing to within plus or minus 5% of design values, and make and record measurements using instruments with minimum accuracy of within plus or minus 2% of required values.

.8 Wherever possible, lock all balancing devices in place at the proper setting, and permanently mark settings on all devices.

.9 Co-operate and work with the controls contractor in the verification of the operation of all systems.

3.3 TESTING, ADJUSTING AND BALANCING REPORT

.1 Prepare and submit to the Consultant, when the work is complete, bound, identified copies of a testing and balancing report as specified in the article entitled "SUBMITTALS" in PART 1 of this Section. Prepare the report using standard AABC, NEBB or equal forms to indicate all measurements required by the referenced balancing standard, including, but not limited to, the following:
.1 Cooling system c/w location of equipment (e.g. chiller, pumps), measurements at inlet and outlet of equipment;
.2 Air handling system c/w location of equipment and measurements at the inlet and outlet of exhaust fan.

.2 Include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "As-built" diagram indicating all equipment and accessories.

.3 Prepare report sheets using the units of measurement (SI or Imperial) as used on the project construction documents.

3.4 VERIFICATION OF TESTING, ADJUSTING AND BALANCING REPORT

.1 When the testing, adjusting and balancing report has been received, the Consultant will schedule a site visit or visits for the purpose of verifying balancing results contained in the report. In addition to spot checking equipment performance, a maximum of 30% of all terminal equipment will be checked.

.2 The testing and balancing agency shall accompany the Consultant during report verification, and shall supply all required tools and instruments to take measurements. Instruments used shall be the same instruments used in performing the testing and balancing work.

.3 If, during the verification procedures, testing and balancing results indicated in the report are found to differ substantially with the results of spot checks, the report will be rejected by the Consultant, and testing, adjusting and balancing procedures shall be repeated and a new report issued for review and verification.

.4 Testing, adjusting and balancing must be complete and accepted by the Consultant prior to application for a Certificate of Substantial Performance of the Work.

.5 Include a copy of the accepted testing and balancing report in each copy of the operating and maintenance instruction manuals.

3.5 WARRANTY

.1 When testing, adjusting and balancing work is complete and the balancing report has been accepted, submit to the Project Manager, in the name of the Owner, an AABC National Guaranty Certification or NEBB Certificate of Conformance Certification, as applicable, and in addition, submit to the Project Manager, in the name of the Owner, a written extended warranty covering one (1) full heating season and one (1) full cooling season, during which time any balancing problems which occur in the building, with the exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by your personnel and reported on to the Project Manager. If it is determined that the problems are a result of improper testing, adjusting and balancing, they shall be immediately corrected without additional cost to the Owner.

END OF SECTION

1 General

1.1 APPLICATION

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

1.2 SUBMITTALS

.1 At least 4 weeks prior to work commencing, submit a sample of each type of material requirements for firestop and smoke seal systems in applied form. Identify each system with manufacturer’s name and type, ULC designation, and proposed use. After samples are reviewed, work is to conform to reviewed samples.

.2 Submit a product data sheet and a WHIMIS sheet for each firestopping and smoke seal product.

.3 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.

.4 Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.3 QUALITY ASSURANCE

.1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and is to be reviewed by Consultant.

.2 Comply with firestopping and smoke seal product manufacturer’s recommendations regarding suitable environment conditions for product installation.

2 Products

2.1 FIRESTOPPING AND SMOKE SEAL SYSTEM MATERIALS

.1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with ULC S115 and ULC S101 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than fire resistance rating of surrounding fire rated construction.

.2 Firestopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and system number for each specific installation.

.3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer’s recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.

.4 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.

.5 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

.6 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.

.7 Supply products of a single manufacturer for use on work of this Division.

.8 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.

.9 Include for manufacturer’s authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer’s authorized representative and manufacturer’s representative.

.10 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".

.11 Acceptable manufacturers are:
- .1 Specified Technologies Inc.;
- .2 3M Canada Inc.;
- .3 Tremco;
- .4 A/D Fire Protection Systems;
- .5 Nelson;
- .6 Hilti Canada.

3 Execution

3.1 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Where work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.

.2 Install firestopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and firestopping materials.

.3 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".

.4 Comply with following requirements:
- .1 Examine substrates, openings, voids, adjoining construction and conditions under which firestop and smoke seal system is to be installed. Confirm compatibility of surfaces.
- .2 Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.

.3 Report any unsuitable or unsatisfactory conditions to Consultant in writing, prior to commencement of work. Commencement of work will mean acceptance of conditions and surfaces.
.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces. Remove stains on adjacent surfaces.
.5 Prime substrates in accordance with product manufacturer’s written instructions.
.6 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.
.7 Tool or trowel exposed surfaces to a neat, smooth, and consistent finish.
.8 Remove excess compound promptly as work progresses and upon completion.
.9 At fusible link damper locations, seal perimeter of angle iron framing on both sides of wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

.5 Notify Consultant when work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of work by local governing authority inspector prior to concealing or enclosing work. Make any corrections required.

.6 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to service penetrations and that installation has been performed in strict accordance with requirements of local governing building code, any applicable local municipal codes, ULC requirements, and manufacturer’s instructions.

.7 Manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer's representative. Test report to list each installation and respective ULC certification and number.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit product data sheets for all products specified in this Section.

1.02 QUALITY ASSURANCE

.1 Fire extinguishers are to be in accordance with following Codes and Standards:

.1 National Fire Code of Canada;

.2 NFPA 10, Standard for Portable Fire Extinguishers;

.3 CAN/ULC S508, Standard for the Rating and Testing of Fire Extinguishers.

2 PRODUCTS

2.01 GENERAL

.1 Fire extinguishers are to be pressurized (stored pressure) rechargeable type, in accordance with NFPA 10, and UL and/or ULC listed and labelled for the class of fires and hazard locations for which they are specified.

.2 Each extinguisher is to be complete with:

.1 manufacturer’s identification label indicating extinguisher model number, rating, and operating instructions;

.2 anodized aluminum or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock;

.3 discharge hose with nozzle or horn and hose securing clip;

.4 for wall mounting extinguishers, a wall mounting bracket.

.3 Fire extinguishers in fire hose cabinets will be supplied with the cabinet and are specified in Section entitled Fire Protection Standpipe System.

2.02 3A10B:C RATED DRY CHEMICAL EXTINGUISHERS

.1 Multi-purpose 3A10B:C dry chemical extinguishers are to be 100 mm (4") dia., 2.27 kg (5 lb.), each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.

2.03 FIRE EXTINGUISHER CABINETS

.1 Surface Mounted: Rectangular break-glass type enclosures sized to suit the extinguishers to be housed, constructed of #18 gauge corrosion resistant steel with a baked white enamel finish, front glass panel, break-glass mechanism, and keyed alike cylinder lock.

.2 Recessed: Rectangular cabinets sized to suit the extinguishers to be housed, with a #18 gauge corrosion resistant white enamelled steel tub, #14 gauge cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch.

3 EXECUTION

3.01 INSTALLATION OF FIRE EXTINGUISHERS

.1 Provide fire extinguishers of type(s) in accordance with requirements of NFPA 10.

.2 Unless otherwise shown or specified, wall mount extinguishers using wall brackets supplied with extinguishers.

.3 Do not install extinguishers until after wall finishing work is complete.

.4 Be responsible for maintaining fire extinguishers until Substantial Completion of the Work.

.5 If extinguishers are indicated adjacent to a door, locate extinguishers at the strike side of the door.

3.02 INSTALLATION OF FIRE EXTINGUISHER CABINETS

.1 Provide wall cabinets for fire extinguishers where required.

.2 Unless otherwise shown or specified, locate cabinets so centerline is approximately 1.2 m (4') above finished floor.

.3 Confirm exact locations prior to installation.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine.

.2 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.

.3 Prior application for Substantial Performance of the Work, submit a minimum of 3 identified keys for key operated hydrants.

.4 Submit signed test results and inspection and test log cards for each backflow preventer as specified in Part 3 of this Section.

.5 Submit anchor drawing(s) to detail fabrication and installation of water piping anchors. Drawing(s) are to be prepared and stamped by a professional structural engineer registered and licensed in jurisdiction of the work.

.6 As specified in Part 3 of this Section, submit a letter from anchor design engineer stating anchor installation has been examined at site and anchors are properly fabricated and installed.

1.02 QUALITY ASSURANCE

.1 Domestic water piping and valves are to comply with following codes, regulations and standards (as applicable):

.1 applicable local codes and regulations;

.2 ASTM F1960, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing;

.3 CAN/CSA B125.1, Plumbing Supply Fittings;

.4 CAN/CSA B125.3, Plumbing Fittings;

.5 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;

.6 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies;

.7 CAN/ULC S101, Fire Endurance Tests of Building Construction and Materials;

.8 NSF/ANSI 14, Plastics Piping System Components and Related Materials;

.9 NSF/ANSI 61, Drinking Water System Components – Health Effects;

.10 NSF/ANSI 372, Drinking Water System Components – Lead Content.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 PVC

.1 ULC listed, rigid, Class 150, DR18, 1035 kPa (150 psi) pressure rated bell and spigot pattern PVC pipe to CAN/CSA B137.3, and CSA certified fittings to CAN/CSA B137.2, and AWWA C900, complete with gasket joints, and Ford "Uni-Flange" or equal restraint collars as per Part 3 of this Section.

.2 Soft Copper

.1 Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.3 Stainless Steel

.1 Schedule 10S type 304 stainless steel, ASTM A312, factory or site roll grooved, complete with Victaulic or equal type 304 stainless steel roll grooved end fittings and, unless otherwise specified, Victaulic Style 489 or equal lightweight rigid type 304L stainless steel couplings and coupling gaskets equal to Victaulic Grade E or Grade M.

.4 Hard Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin/ 5% Antimony or "SILVABRITE 100" solder for other services.

.5 Semi-Rigid Polyethylene Tubing

.1 Versa Fittings and Mfg. Inc. 12 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

2.02 SHUT-OFF VALVES

.1 Ball Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A-LF;

.2 Milwaukee Valve Co. #UPBA485B;

.3 Kitz Corporation Code 859;

.4 Apollo Valves #77LF-200;

.5 Watts Industries (Canada) Inc. #LFFBVS-3C.

.2 Butterfly Valves - Flanged Joint

.1 Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for domestic water bubble-tight dead end service with valve in position and either side of connecting piping removed. Butterfly valves to and including 100 mm (4") dia. are to be equipped with lever handles. Butterfly valves larger than 100 mm (4") dia. are to be equipped with worm gear operators.

.2 Acceptable products are:

.1 DeZurik #632L Series;

.2 Kitz Corporation Code #6122EL/EG;

.3 Toyo Valve Co. #918BESL/EG;

.4 Bray Valve and Controls Canada Series 31;

.5 Apollo Valves #141 Series;

.6 Watts Industries (Canada) Inc. #BF-03.

2.03 CHECK VALVES

.1 Horizontal

.1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 237A-LF;

.2 Milwaukee Valve Co. #UP1509;

.3 Kitz Corporation Code 823;

.4 Apollo Valves #61LF Series.

.2 Vertical

.1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends.

2.04 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5046;

.2 Dahl Brothers Canada Ltd. Fig. No. 50. 430;

.3 Kitz Corporation Code 58CC;

.4 Apollo Valves #78-104-01;

.5 Watts Industries (Canada) Inc. #B6000.

2.05 DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Solder or flanged end type as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

.2 Acceptable products are:

.1 S.A. Armstrong Model CBV Series;

.2 Tour and Andersson Model TBV Series;

.3 Watts Industries (Canada) Inc. Model CSM Series.

2.06 LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Lawler 310-SC1 12 mm (½") dia. or 20 mm (¾") dia. as required, each CSA B125 certified, forged brass, tamper-proof thermostatic mixing valves, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized to suit number of lavatories in grouping, and complete with a stop and check valve and a lockable handle.

.2 Each mixing valve is to be complete with a stainless steel flush wall mounting cabinet with vandal-proof hinged door.

.3 Acceptable manufacturers are:

.1 Lawler Manufacturing Co. Inc.;

.2 Webstone;

.3 Symmons Industries Inc.

2.07 CHLORINE

.1 Sodium hypochlorite to AWWA B300.

2.08 EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Flush-Concealed

.1 Recessed, encased, self-draining hydrants, each complete with a copper casing, operating rod assembly to suit wall thickness, polished nickel bronze box with hinged locking cover, 20 mm (¾") dia. threaded hose connection outlet, vacuum breaker, and a loose tee handle operating key.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. #HY-725;

.2 Jay R. Smith #5519-98;

.3 Zurn #Z1320;

.4 Mifab #MHY-26.

.2 Semi-Recessed

.1 Self-draining hydrants, each complete with a copper casing, operating rod assembly to suit the wall thickness, 20 mm (¾") dia. threaded hose connection outlet, vacuum breaker, and a loose tee handle operating key.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. #HY-420;

.2 Jay R. Smith #5619-98;

.3 Zurn #Z1321;

.4 Mifab #MHY-16.

2.09 FLOOR DRAIN TRAP SEAL PRIMERS

.1 Primer Valve Type

.1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.

.2 Primer Valve Type with Manifold

.1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.

.3 Electronic Type

.1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:

.1 galvanized steel cabinet with door;

.2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;

.3 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1-½") centres with quantity to suit the number of items to be primed;

.4 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.10 SHOCK ABSORBERS

.1 Type 304 stainless steel piping shock absorbers, each complete with a nesting type bellows and a casing of sufficient displacement volume to dissipate kinetic energy generated in piping system, and each sized to suit connecting potable water pipe and equipment it is provided for.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. "SG" Series;

.2 Jay R. Smith 5000 Series "HYDROTROL";

.3 Zurn #Z1700 "SHOKTROL";

.4 Mifab "HAMMERGUARD" WHB Series.

2.11 WATER HAMMER ARRESTORS

.1 Piston type, sealed, all stainless steel construction, pressurized water hammer arrestors suitable for either vertical or horizontal installation, each complete with a pressurized compression chamber, welded nesting-type expansion bellows surrounded by non-toxic mineral oil, and a male treaded nipple connection.

.2 Acceptable products are:

.1 Jay R. Smith 5000 Series;

.2 Precision Plumbing Products "SS" Series.

2.12 BACKFLOW PREVENTERS

.1 Double Check Valve Assembly

.1 Minimum 1205 kPa (175 psi) rated lead-free dual check valve assembly backflow preventer to CAN/CSA B64 (including supplements), complete with tight-closing resilient seated shut-off valves, test cocks and strainer.

.2 Acceptable manufacturers are:

.1 Watts Industries Canada;

.2 Zurn/Wilkins;

.3 Apollo Valves (Conbraco Industries).

.2 Reduced Pressure Zone Assembly

.1 Lead-free reduced pressure zone assembly backflow preventer in accordance with CAN/CSA B64 (including supplements), each of bronze or epoxy coated cast iron bronze fitted construction depending on size, and complete with inlet strainer, inlet and outlet shut-off valves, an intermediate relief valve, ball valve type test cocks, and a proper air gap fitting.

.2 Acceptable products are:

.1 Watts Industries #LF009QT-S for 12 mm (½") size, #LF909QT-S for 20 mm to 50 mm (¾" to 2") size, and #LF909-NRS-S for 65 mm (2-½") and larger size;

.2 Zurn/Wilkins 975XL2 and 375 Series;

.3 "Apollo" Valves manufactured by Conbraco Industries Inc. Series 4ALF;

.4 Danfoss Flomatic Corp. Series RPZ.

2.13 PIPING EXPANSION COMPENSATORS AND GUIDES

.1 Pressurized type, selected to withstand system pressure and to suit calculated movement from -5°C (23°F) to maximum operating temperature plus 25% safety factor, complete with stainless steel bellows and shroud, copper tube sweat type female ends, anti-torque device, and proper and suitable alignment guides for both sides of each compensator.

.2 Acceptable products are:

.1 Senior Flexonics Series HB;

.2 Hyspan Precision Products Series 8500.

2.14 PIPE ANCHORS

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% axial thrust, and is to be designed and detailed by a professional structural engineer registered and licensed in jurisdiction of the work. Submit anchor design and fabrication shop drawings, stamped by design engineer.

2.15 AIR VENTS

.1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

3 EXECUTION

3.01 PIPING INSTALLATION REQUIREMENTS

.1 Provide required domestic water piping.

.2 Piping, unless otherwise specified, is as follows:

.1 for underground piping 100 mm (4") dia. and larger outside and/or inside the building – rigid PVC;

.2 for underground piping less than 100 mm (4") dia. inside building – Type "K" soft copper;

.3 for pipe 100 mm (4") dia. and larger inside building and above ground – Schedule 10 stainless steel;

.4 for 12 mm (½") dia. trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;

.5 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints

.3 Brace and secure underground water service pipe at bends, tees and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with Municipal standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint restraint devices with 2 coats of corrosion resistant black asphalt base coating prior to backfilling.

.4 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, pipe has a smooth and uniform invert. Keep pipe thoroughly clean so jointed compound will adhere. Inspect pipe for defects before being lowered into trench.

.5 Slope piping so it can be completely drained.

.6 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.02 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Refer to Part 3 of Section entitled Basic Mechanical Materials and Methods.

.2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.03 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the bottom of domestic water piping risers, at other piping low points, and wherever else shown.

.2 Locate drain valves so they are easily accessible.

3.04 INSTALLATION OF DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Provide balancing valves in domestic hot water recirculation piping where shown or required.

.2 Locate each valve so it is easily accessible.

3.05 INSTALLATION OF LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Provide thermostatic water tempering valves for hot water supply to public washroom lavatory supply fittings. Conceal valves and piping.

.2 For wall mounted Lavatories, provide a flush wall mount panel for each valve. Confirm exact location prior to roughing-in.

.3 Install in accordance with manufacturer's instructions and set mixing valves to deliver 32°C (90°F) tempered water.

3.06 INSTALLATION OF EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Provide non-freeze wall hydrants.

.2 Install hydrants level and plumb such that hose outlets are approximately 600 mm (2') above grade level. Confirm exact locations prior to roughing-in.

.3 Provide a shut-off valve inside building to each exterior non-freeze wall hydrant.

3.07 INSTALLATION OF TRAP SEAL PRIMERS

.1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.

.2 Water closet flush valves may be used for priming washroom floor drain traps if flush tube is properly tapped and primer tubing exposed in washroom is chrome plated.

.3 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.

.4 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.

.5 Ensure trap primer piping is secured to floor drain primer tappings and not terminated through the tapping in the throat of the drain.

3.08 INSTALLATION OF SHOCK ABSORBERS

.1 Provide accessible shock absorbers in domestic water piping.

.2 Ensure size of each shock absorber is properly selected to suit size of domestic water pipe and equipment pipe is connected to.

3.09 INSTALLATION OF WATER HAMMER ARRESTORS

.1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:

.1 in headers at groups of plumbing fixtures;

.2 at top of risers;

.3 at ends of long horizontal runs of piping;

.4 in piping connecting solenoid valves or equipment with integral solenoid valves;

.5 wherever else shown or required by Code.

.2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with manufacturer's instructions and details.

3.10 INSTALLATION OF BACKFLOW PREVENTERS

.1 Provide a double check valve assembly backflow preventer on incoming DCW service. Provide a reduced pressure zone assembly backflow preventer in each direct domestic water connection to equipment other than plumbing fixtures and fittings.

.2 Locate each backflow preventer on floor or wall between 765 mm and maximum 1.5 m (30" and 60") above floor such that it is easily accessible for maintenance and testing. Equip each backflow preventer with an air gap fitting and pipe the reduced pressure zone water outlet to drain.

.3 Test operation of each backflow preventer in accordance with requirements of CAN/CSA B64 by personnel certified for such testing by governing authorities, and submit signed test results and a properly and clearly identified and marked inspection and test record card for each backflow preventer.

3.11 INSTALLATION OF EXPANSION COMPENSATORS, GUIDES AND ANCHORS

.1 Provide expansion compensators in domestic water piping.

.2 Ensure pipe ends are properly aligned. Provide alignment guides on each side of expansion compensators, properly secured to building structure.

.3 Provide anchors to secure domestic water piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.4 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a letter from design engineer confirming each anchor is properly installed.

3.12 INSTALLATION OF AIR VENTS

.1 Provide accessible air vents in domestic water piping to prevent air binding.

.2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.

.3 Locate exact vent locations on as-built record drawings.

3.13 FLUSHING AND DISINFECTING PIPING

.1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

.2 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.3 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.

.4 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

.2 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

.3 Submit letters from product manufacturers/suppliers to certify correct installation of products as specified in Part 3 of this Section.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 PVC Sewer

.1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.

.2 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

.2 Copper - Solder Joint

.1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.3 Cast Iron

.1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.4 Copper - Victaulic Coupling Joint

.1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought

.5 Galvanized Steel - Victaulic Coupling Joint

.1 Schedule 40 mild steel, galvanized, ASTM A53, factory or site rolled grooved, complete with Victaulic galvanized ductile iron grooved end fittings and, unless otherwise specified, Victaulic Style 77 hot dip galvanized mechanical joint couplings with Grade M gaskets.

.6 PVC Weeper Piping

.1 150 mm (6") dia. corrugated perforated PVC pipe with an integral geodesic sock, supplied in coils.

2.02 SHUT-OFF AND CHECK VALVES

.1 Shut-off Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;

.2 Milwaukee Valve Co. #BA-155 or #BA -125;

.3 Kitz Corporation Code 58 or Code 59;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valves # 77-100 or # 77-200;

.6 Watts Industries (Canada) Inc. #FBVS-3C.

.2 Check Valves

.1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;

.2 Milwaukee Valve Co. #1510 or #510;

.3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.03 VENT STACK COVERS

.1 Equal to Lexcor Model "Flash-Tite" seamless, spun aluminum, insulated vent stack covers with caps and a factory applied asphalt primer coating on top and bottom of flange.

.2 Each vent stack cover is to be complete with a vandal-proof cap.

2.04 CLEANOUTS

.1 Horizontal Piping

.1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

.3 Urinal(s)

.1 Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandal-proof stainless steel securing screw.

.2 Acceptable products are:

.1 Watts Industries (Canada) Ltd. #CO-590-RD;

.2 Jay R. Smith #SQ4-1819;

.3 Zurn #ZSS-1666-1;

.4 Mifab #C1440-RD.

2.05 FLOOR CLEANOUT TERMINATIONS

.1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.

.2 Acceptable products are:

.1 Watts Industries (Canada) Ltd. # CO-200-R-1;

.2 Jay R. Smith #4020-F-C Series;

.3 Zurn # ZN-1602-SP Series;

.4 Mifab # C1100-XR-1 or #C1000-R-3.

.3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.06 FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

.1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.

.2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.

.3 Acceptable manufacturers are:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

2.07 ROOF DRAINS

.1 Unless otherwise specified or indicated, roof drains are to be cast iron body drains with aluminium domes, in accordance with the drawing symbol list. Cast iron components are to be factory finished with latex based paint coating.

.2 Acceptable manufacturers are:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

2.08 TRENCH DRAINS

.1 Modular, pre-sloped, polyester fibreglass construction interlocking sections of drainage channel with overlapping joints, drain pipe connection outlets as required, end caps and covers to suit the application, integral anchor tabs for grate anchoring and trench levelling, heavy-duty coated steel angle top frames, and heavy-duty coated cast iron slotted grate supplied in 600 mm (24") long sections.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. “Dead Level” Series;

.2 Jay. R. Smith #9810 Series;

.3 Zurn "Flow-Thru" System;

.4 ACO Systems Ltd. "ACOdrain".

2.09 BACKWATER VALVES

.1 Backwater valve shall be modified to be of normally open design.

.2 Acceptable products are:

.1 Mainline

3 EXECUTION

3.01 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

.1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:

.1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;

.2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;

.3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

.4 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections – Type "DWV" copper with Victaulic "Copper Connection" fittings and couplings, or Schedule 40 galvanized steel with Victaulic fittings and couplings.

.2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').

.3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.

.4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').

.5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.

.6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.02 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.

.2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.03 SUPPLY OF VENT STACK COVERS

.1 Supply a properly sized vent stack cover for each vent stack penetrating roof.

.2 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.

3.04 INSTALLATION OF CLEANOUTS

.1 Provide cleanouts in drainage piping in locations as follows:

.1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;

.2 at or as close as practicable to the foot of each drainage stack;

.3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;

.4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;

.5 in the wall at each new urinal or bank of urinals in a washroom;

.6 wherever else shown on drawings.

.2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.

.3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.05 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.

.2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

.4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

3.06 INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

.1 Provide floor drains, funnel floor drains and hub drains.

.2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.

.3 Equip each drain with a trap.

.4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.

.5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.

.6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

3.07 INSTALLATION OF ROOF DRAINS

.1 Supply roof drains and place roof drain bodies in position for flashing into roof construction as part of roofing work. Connect with piping and provide accessories.

.2 Protect roof drains from damage and entrance of debris until roofing work is complete, and refinish any areas where cast iron factory finish has been damaged or removed, including rusted areas.

3.08 INSTALLATION OF TRENCH DRAINS

.1 Provide pre-sloped sections of drainage channel and install so top frames are level and plumb in relation to floor finishes. Provide accessories, traps, etc., as required.

.2 Be present during concrete pour to ensure trench drainage is not dislodged or damaged and remains straight and true. Immediately report any problems.

.3 Install grating and secure in place.

.4 Temporarily cover trench drainage openings during construction procedures. Clean trenches when work is complete.

3.09 INSTALLATION OF BACKWATER VALVES

.1 Provide backwater valves in drainage piping and connect with piping.

.2 Set backwater valve assembly such that cover is flush with finished floor. Provide an extension piece if required due to depth of piping.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings.

2 PRODUCTS

2.01 GENERAL RE: PLUMBING FIXTURES AND FITTINGS

.1 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CSA B125.3, Plumbing Fittings.

.2 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.

.3 Unless otherwise specified, vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.

.4 Unless otherwise specified, fittings and piping exposed to view are to be chrome plated and polished.

.5 Fittings located in areas other than private washrooms are to be vandal-proof.

.6 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.

.7 Floor flanges for floor mounted water closets are to be cast iron or brass, secured to floor to prevent movement and complete with a wax seal and brass or stainless steel bolts, nuts, and washers. Plastic floor flanges will not be acceptable.

.8 Proper seal to mate with fixture carrier flange and produce a water-tight installation.

.9 Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum #17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit fixture type and drain connection.

.10 Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit fixture type and drain connection.

.11 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.

.12 Water piping as specified, complete with ball type shut-off valves as specified with water piping, or Dahl Bros. Canada Ltd. ¼ turn Mini Ball Valves.

.13 All above grade drainage piping associated with waterclosets and showers are to be Class 4000 cast iron.

2.02 PLUMBING FIXTURES AND FITTINGS

.1 Plumbing fixtures and fittings are to be in accordance with the following:

.1 WC-1 TOILET – FLOOR MOUNTED TOILET – BARRIER FREE

.1 American Standard 215AA105.020 Toilet - CADET® PRO™, Tank type Toilet, Floor mounted with floor outlet, High Efficiency HET 4.8 LPF (1.28 GPF), Vitreous china, White finish, EverClean® antimicrobial surface, Elongated bowl, Right Height® rim at 419 mm (16-1/2"), Minimum 305 mm (12") rough-in from wall to the center of waste outlet, Siphon jet flush action, Manual, Polished chrome right-hand trip lever (7381231-201.0020A), Tank not lined, Without tank cover locking device, Gravity-assisted flush, Cadet® flushing system, 76 mm (3") flush valve, metal shank fill valve, Tank coupling components, 229 x 203 mm (9" x 8") water surface area, Fully-glazed 54 mm (2-1/8") trapway, PowerWash™ rim scrubs bowl with pressurized water every flush, Includes EZ-Install Tools, Trade exclusive tank, Toilet seat not included, Colour-matched bolt caps, 441 mm (17-3/8") wide, 765 mm (30-1/8") from finished wall, 772 mm (30-3/8") high, ASME A112.19.2 compliant, CSA B45.1 compliant, EPA WaterSense® compliant.

.2 Centoco 820STSFE-001 Seat - FAST-N-LOCK, Heavy-duty Open front Toilet seat With cover, For elongated bowl, White, Polypropylene plastic, Color-matched plastic check hinges with one solid metal hinge pin and bolt, FAST-N-LOCK mounting system.

McGuire LFBV172 Supply - CONVERTIBLE™ Commercial Toilet Supply kit, consisting of (1) stop valve, (1) riser, (1) flange, Lead Free Brass body, Chrome-plated finish, 138 - 862 kPa (20 - 125 PSI) operating pressure, Convertible loose key/triangle handle, Quarter turn ball valve, Angle stop, C.P. wrought steel deep bell wall flange (standard), C.P. prefabricated 127 mm (5") copper sweat tube extension nipple, 305 mm (12") C.P. toilet flexible copper riser tube (standard), 13 mm (1/2") Sweat inlet x 10 mm (3/8") O.D. outlet, AB 100 compliant, ASME A112.18.1 compliant, ASME A112.18.2-2 (risers), CSA B125.2 compliant (risers), Certified to NSF/ANSI 372, Certified to NSF/ANSI 61, UPC compliant.

.2 L-1 LAVATORY – WALL HUNG - BARRIER FREE

.1 American Standard 0954004EC.020 Basin - MURRO, Wall-hung Lavatory, Vitreous china, EverClean® antimicrobial surface, White finish, Single hole centerset, Rear overflow, Faucet ledge with recessed self-draining deck, For concealed arm or wall support, Overall Dimensions: 545 mm (21-7/16") long, 540 mm (21-1/4") wide, 152 mm (6") high, Bowl Dimensions: 394 mm (15-1/2") long, 540 mm (21-1/4") wide, 127 mm (5") deep.

.2 American Standard 0059020EC.020 Vitreous china shroud/knee contact guard with EverClean.

.3 Chicago Faucets 420-T45E2805ABCP Faucet - Counter mounted, Manual, Single handle, Lavatory faucet, Polished chrome finish, 102 mm (4") centerset, Lead Free ANSI/NSF 61 and ANSI/NSF 372 compliant, ECAST® brass construction, Thermostatic ceramic cartridge with check valve and scald protection, 1.9 LPM (0.5 GPM) maximum flowrate, 1.3 LPM (0.35 GPM) minimum flowrate for proper functioning of thermostatic protection, Vandal-resistant pressure compensating Econo-Flo™ non-aerated outlet, Fixed Cast brass spout, 118 mm (4-5/8") spout reach, 143 mm (5-5/8") high, Vandal-resistant lever handle, 13 mm (1/2") NPSM supply inlet for 10 mm (3/8") or 13 mm (1/2") flexible riser.

.4 Lawler TMM-1070-87500 Mixing Valve - The point of use mechanical mixing valve with thermostatic limit stop, MECHANICAL MIXING VALVE, Lead free brass body construction, The temperature adjusting dial is located on the cold inlet. Turning the dial clockwise will lower the outlet temperature, turning the dial counter-clockwise will raise it. The valve cannot be adjusted above its shut-off temperature of 120F, 1.8 LPM (0.5 GPM) tempered flowrate @ 5 PSI pressure drop, Compression Fitting, 84 mm (3-5/16") high, ASSE 1070 approved ASSE lead free Certified for ASSE 1070 applications, 3/8" MNPT (9.5 mm) inlet, 3/8" MNPT (9.5 mm) outlet, lintegral rubber duck-bill backflow checks, High temperature limit stop, 125 PSI max supply pressure, Automatically shuts down flow of water when temperature reaches 120 °F, 5 PSI Minimum Operating pressure, 140 °F max, 118 °F ±3 °F, Protects against scalding and chilling, 8 LPM (2.1 GPM) flowrate @ 45 PSI

.5 McGuire 155A Fixture Drain - Straight drain, Cast brass, Chrome-plated finish, Open grid PO plug, 7/32" (5.5 mm) Ø holes size, 17 gauge 32 mm (1-1/4") Ø tailpiece diameter, 17 gauge 17152 mm (6") long, Brass locknut, Heavy rubber basin washer Fiber friction washer, ASME A112.18.2 CSA B125.2, CSA compliant

.6 McGuire LFBV170 Supply - Lead Free, 127 mm (5") length, Convertible quarter-turn supply , Chrome-plated finish, 13 mm (1/2") copper sweat x 10 mm (3/8") outer Ø brass ball valve, 304 mm (12") copper flexible risers, Convertible loose key handle, Lavatory, One deep bell flange

.7 McGuire 8872C P-Trap - Heavy cast brass, Adjustable p-trap, 292 mm (11-1/2") distance, With cleanout plug, Steel shallow flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant

.8 Jay R. Smith Manufacturing Co. 0723-E - Carrier - Single wall-mounted lavatory supports with concealed arms, for high back lavatories to attach to backing plate secured in wall.

.3 MS-1 FLOOR MOUNTED, MOP SERVICE SINKS

.1 Stern Williams SB-902-T-35-T-40-BP Sink - Single compartment sink, Mop service sinks, Without faucet ledge, Precast terrazzo Pearl grey marble chips and white Portland cement, 76 mm (3") pipe size, cast integrally and provides for a caulked lead connection not less than 25 mm (1") deep to a 76 mm (3") pipe, flat stainless steel strainer, Two side tiling flanges, with stainless steel cap. Bowl Dimension: 546 mm (21-1/2") long, 546 mm (21-1/2") wide, 254 mm (10") deep, Overall Dimension: 610 mm (24") long, 610 mm (24") wide, 305 mm (12") high.

.2 Stern Williams T-35 Hose and wall hook. Hose 36" long, with 3/4" chrome couplings. Wall bracket of stainless steel.

.3 Stern Williams T-40 Stainless Steel Mop Hanger of stainless steel with #4 finish. 24" long, with 3 rubber spring loaded grips.

.4 Stern Williams BP Splash Catcher Panels of 20 ga. type 304 stainless steel.

.5 Chicago Faucets 897-RCF Faucet - Wall-hung, Manual, Two handles, Mop sink faucet, Rough chrome plated finish, 194 - 213 mm (7-5/8" to 8-3/8") adjustable centerset, Round wall escutcheons, Brass construction, Less supply, Adjustable supply arms, 1/4 turn ceramic cartridge, No flow restrictor, Threaded hose end, Spout with pail hook, 146 mm (5-3/4") spout reach, 273 mm (10-3/4") high, Top brace, 60 mm (2-3/8") lever handle with indexed buttons, Less drain, Atmospheric vacuum breaker is not intended for continuous pressure applications.

.4 EW-1 EYEWASH, WALL MOUNTED

.1 Guardian G1750-G3600LF-T Emergency Equipment - Wall mounted, constructed from Stainless steel, Thermostatic mixing valve blends hot and cold water, 283 mm (11-1/8") Ø bowl size, Corrosion resistant powder coated finish finish, Two FS-Plus spray heads with flip top dust cover each, 13 mm (1/2") Ø I.P.S. chrome-plated brass stay open ball valve, 13 mm (1/2") Ø NPT female inlet supply inlet, Chrome-plated brass tailpiece and trap with 38 mm (1-1/2") I.P.S. connection, 32 mm (1-1/4") Ø NPT female outlet, Codes and Compliances:, ANSI compliant.

.2 Lawler 911E/F-Unit 84908 Mixing Valve - Emergency mixing valve, Thermostatic High-low master water mixing valve, 229 x 205 x 127 mm (9" x 8" x 5") , Rough bronze finish, Temperature adjustment shall be vandal-resistant, 7.5 LPM (2 GPM) tempered flowrate @ 5 PSI pressure drop, 11 LPM (3 GPM) tempered flowrate @10 PSI pressure drop, 18 LPM (5 GPM) tempered flowrate @ 20 PSI pressure drop, 26 LPM (7 GPM) tempered flowrate @ 20 PSI pressure drop, In the event that the liquid motor fails, the control mechanism closes off the hot water port with the reverse seat and fully opens the internal variable bypass to allow cold water flow, The control mechanism shall employ a liquid-filled thermostatic motor to drive the valve without additional power requirements. The control mechanism shall employ a stainless steel sliding piston control device with reverse seat closure and both fixed and variable cold water bypass, Listed to ASSE 1071, 32 mm (1-1/4") NPT inlet, 32 mm (1-1/4") NPT outlet, In the event of interruption of the hot water supply, the control mechanism shall allow cold flow through both the fixed and variable bypass., Outlet Thermometer, In the event of interruption of the cold water supply, the control mechanism closes off the hot water port, stopping all flow. Positive hot water shut-off, 85 F, 125 PSI max inlet pressure, 70-90 F, 120 F Recommended inlet temperature, 65 PSI recommended operating pressure, 38 LPM (10 GPM) tempered flowrate @ 40 PSI pressure drop.

2.03 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, following:

.1 Flush Valves:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.2 Plumbing Brass:

.1 Sloan;

.2 Acorn Engineering;

.3 American Standard;

.4 Delta Commercial;

.5 Chicago Faucet;

.6 Moen Commercial.

.3 Stainless Steel Sinks:

.1 Franke Commercial;

.2 Novanni Commercial;

.3 Aristaline;

.4 Arch Metal Ind.

.4 Mop Sinks:

.1 Stern Williams;

.2 Acorn Engineering;

.3 Zurn Industries.

.5 Emergency Eye Wash and Emergency Showers:

.1 Haws;

.2 Speakman;

.3 Bradley.

.4 Guardian

.6 Drain Fittings, Angle Supplies, and Traps:

.1 McGuire;

.2 American Standard;

.3 Delta Commercial;

.4 Zurn Industries.

.7 Fixture Carriers:

.1 Watts Industries;

.2 Jay R. Smith;

.3 Zurn Industries.

.8 Water Closets, Lavatories, and Urinal:

.1 American Standard;

.2 Zurn Industries;

.3 Kohler.

.9 Thermostatic Mixing Valves:

.1 Lawler;

.2 Delta Commercial;

.3 Symmons

.10 Shower and Associated Trim:

.1 American Standard;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commerical.

.11 Toilet Seats:

.1 Olsonite;

.2 Centoco;

.3 Bemis Commercial.

.12 Electronic “No Touch” Flush Valves:

.1 Sloan;

.2 Delta Commerical;

.3 Zurn Industries;

.4 Moen Commercial.

.13 Electronic “No Touch” Faucets:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.14 Drinking Fountains:

.1 Murdoch

.2 Elkay

.3 Haws

2.04 CAULKING

.1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by Consultant from sealant manufacturer’s standard colour range.

3 EXECUTION

3.01 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

.1 Provide required plumbing fixtures and fittings.

.2 Connect plumbing fixtures and fittings with piping. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

FIXTURE AND/OR FITTING	DRAIN SIZE MM (IN.)	VENT SIZE MM (IN.)	DHW SIZE MM (IN.)	DCW SIZE MM (IN.)	TEMP WATER SIZE MM (IN.)
Water Closets Flush Valve Type	100 (4)	38 (1-½)	----------	25 (1)	----------
Urinals	75 (3)	38 (1-½)	----------	25 (1)	----------
Lavatories	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	----------
Lavatories (Electronic Faucet)	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	12 (½)
Counter Sinks	38 (1-½)	32 (1-¼)	12 (½)	12 (½)	----------
Shower Valves and Heads	----------	----------	12 (½)	12 (½)	12 (½)
Shower Stalls	50 (2)	38 (1-½)	12 (½)	12 (½)	12 (½)
Prefab. Mop Sinks with Drain	75 (3)	38 (1-½)	20 (¾)	20 (¾)	----------
Emergency Eye Wash	38 (1-½)	32 (1-¼)	----------	----------	12 (½)
Emergency Shower	----------	----------	----------	----------	25 (1)

.3 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.

.4 When installation is complete, check, and test operation of each fixture and fitting. Adjust or repair as required.

.5 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).

.6 Supply templates for counter mounted fixtures and trim and hand to trades who will cut the counter. Ensure openings in counter are properly located.

.7 Locate control panels for electronic faucets under lavatories and recessed into wall. Coordinate panel installations with electrical trade who will provide 115 volt power wiring to panels. Install flexible conduit (supplied with box) and extend cord from faucet through the flexible conduit to control box. Connect hot and cold water piping to mixing valve in each box, and tempered water piping from each mixing valve to faucet. Set mixing valve maximum temperature limit stops to 43°C (110°F) after domestic water systems (hot and cold) are complete. Ensure each programmable controller is properly programmed and water off after deactivation is set for 3 seconds.

.8 For electronic flush valves, locate transformer in ceiling space above electronic units to be served. Coordinate locations with electrical trade who will provide 120 volt line supply to transformers. Provide low voltage wiring from transformers to each electronic flush valve terminal point. Electrical line supply and low voltage wiring is to be concealed and access to transformer must be provided for servicing.

.9 Confirm exact mixing valve and shower head locations prior to roughing-in.

.10 Install refrigerated drinking fountains in accordance with manufacturer's instructions. Plug into a wall receptacle provided as part of electrical work. Coordinate receptacle installation with electrical trade on site.

.11 For emergency showers, install so bottom of shower head is approximately 2 m (82") above floor, and approximately 400 mm (16") out from the wall. Wall mount mixing valve approximately 1.5 m (5') above floor and adjacent shower head. Set valve temperature limit stop to 35°C (95°F). Ensure valve is open and exposed piping is chrome plated or stainless steel. Drain connection to be high enough so testing with bucket is possible.

.12 Install eye wash fixtures in accordance with manufacturer's instructions. Ensure exposed piping is painted.

.13 Wall mount mixing valves for emergency fixtures approximately 1.5 m (5') above floor and secure in place. Check and confirm valve operation and temperature of tempered water supply. Provide cabinets. Identify each cabinet and hand 3 identified cabinet keys to Consultant prior to Substantial Performance of the Work.

.14 Set mop service basins on floor over drain piping and connect to roughed-in service. Install wall supply trim and any accessories specified.

3.02 CAULKING AT PLUMBING FIXTURES AND FITTINGS

.1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.

.2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer's instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to the caulking bead.

.3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.

.4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

3.03 DISHWASHER CONNECTIONS

.1 Provide roughed-in water and drain connections for Owner supplied dishwasher consisting of:

.1 15 mm (½") dia. domestic hot water connection with a Dahl "Mini-Ball" valve with hose end and water hammer arrestor;

.2 40 mm (1-½") dia. DWV copper drain connection with “P” trap and cleanout plug.

3.04 CLOTHES WASHER CONNECTIONS

.1 Provide roughed-in water and drain connections for Owner supplied clothes washer consisting of:

.1 15 mm (½") dia. piping connection for both hot and cold water, each terminated in a Dahl "Mini-Ball" Valve with hose end and water hammer arrestor;

.2 40 mm (1-½") dia. standing waste with a height to suit the washer drain and complete with a “P” trap.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data for all products specified in Part 2 of this Section except for pipe, fittings, and unions. Indicate performance criteria, conformance to appropriate reference standards, and limitations.

.2 For each gas pressure regulating station, submit:

.1 selection sheet for each PRV, indicating connected equipment, heating loads, design allowance, meter model, body size, spring range and orifice size;

.2 selection sheet for each relief valve(s) serving a PRV.

1.02 QUALITY ASSURANCE

.1 Gas system work is to be in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 Gas system work is to be performed only by licensed gas pipe fitters (holding Gas Technician 1 Certificate) authorized under TSSA Act.

.3 Apply for, on TSSA forms, approval of gas system design by TSSA prior to work beginning at site and prior to ordering any equipment. Submit completed TSSA Form and copies of shop drawings/product data sheets as required to TSSA and obtain an approval certificate. Pay costs for TSSA review and approval process. If TSSA requires revisions to the system and revisions result in an extra cost, a Notice of Change will be issued by Consultant for the revision.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Uncoated Black Steel - Screwed Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with malleable cast iron screwed fittings to ANSI B2.1, and screwed joints.

.2 Uncoated Black Steel - Welded Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, mill or site bevelled, complete with factory made forged steel butt welding fittings and welded joints.

.3 Copper - Uncoated

.1 Type "G" seamless copper tubing to ASTM B837, hard temper with wrought copper capillary brazed joint type fittings to ASTM B.61, and brazed joints made with "Sil-Fos" or "Sil-Fos 5" brazing alloy, or, soft temper with flared brass fittings of a single 45º flare type, forged or with a machined long nut and copper to copper threaded connectors, and, where required, flared brass copper to NPS adapters.

.4 Flexible Stainless Steel

.1 Flexible, CSA certified, 860 kPa (125 psi) rated, gas-tight, convoluted stainless steel tubing factory jacketed with a bright yellow PVC coating which is continuously identified. Supply tubing in coils and complete with factory attached stainless steel end fittings, and adapter unions, protective plates, and steel clamps.

.2 Acceptable products are:

.1 Tru-Flex Metal Hose LLC. "Pro-Flex";

.2 Titeflex Corp. "Gastite";

.3 Omega Flex Canada "TracPipe".

2.02 PIPING UNIONS

.1 Screwed Piping

.1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

.1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

.3 Copper to Steel

.1 Equal to Kamco Products "Copper Stopper".

2.03 SHUT-OFF VALVES

.1 Ball Type

.1 CSA certified, minimum 3100 kPa (450 psi) WOG rated, 1/4 turn, full port non-lubricated brass ball valves, each complete with a Teflon PTFE seat, chrome plated solid ball, removable lever handle, and screwed ends.

.2 Acceptable products are:

.1 Neo Valves Inc. #425;

.2 Kitz Corp. Code 58;

.3 Toyo Valve Co. Fig. 5044A.

.2 Plug or Ball Type

.1 CSA certified, plain face flanged, Class 125, 1380 kPa (200 psi) rated, 1/4 turn, cast iron lubricated plug valves, each wrench operated and complete with cylindrical plug with lubricant grooves, lubricant screw, and lubricant receptacle, or full port carbon steel ball valves with flanged ends.

.2 Acceptable products are:

.1 Neo Valves Inc. #1AS40114 plug valve;

.2 Newman Hattersley #171M plug valve;

.3 Kitz Corp. Code No. 150 SCTAM-FS-CGA ball valve.

.3 Shut off valves serving natural gas emergency generators are to be provided with valve position indicator and contact to initiate trouble alarm condition at the generator control panel.

2.04 PRESSURE REGULATORS

.1 CSA certified pressure regulators as follows:

.1 non-vented type: lever action, dead end lockup type, each complete with a vent limiter, self-aligning valve, die-cast aluminium housing, and synthetic rubber compound diaphragm;

.2 vented type: spring-loaded self-operated design, tight closing, selected for facility gas pressure and piping pressure loss, and connected equipment load at full firing rate plus 20% spare, and complete with:

.1 1035 kPa (150 psi) rated cast iron body finished with corrosive resistant epoxy enamel;

.2 aluminum diaphragm and spring case with Nitrile diaphragm, disc, and body o-ring;

.3 throttling type, high flow rate, tight shut-off relief valve selected to protect equipment downstream of regulator in coordination with regulator capacity.

.2 Acceptable manufacturers are:

.1 Maxitrol Co.;

.2 Fisher Controls;

.3 Leslie Controls Inc.;

.4 Lakeside Process Controls.

3 EXECUTION

3.01 NATURAL GAS SERVICE

.1 Make required arrangement with natural gas supply utility on behalf of Owner for installation of natural gas service piping with gas pressure regulator and meter assembly.

3.02 NATURAL GAS PIPING INSTALLATION REQUIREMENTS

.1 Provide required natural gas distribution piping and connect gas fired or operated equipment, and provide required vent piping to atmosphere, including vent piping from pressure regulators. Perform piping work in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 Piping is to be as follows:

.1 for aboveground piping, uncoated Schedule 40 black steel, hard temper or soft copper, or, if permitted, flexible stainless steel.

.3 Install flexible stainless steel pipe in strict accordance with pipe manufacturer's instructions.

.4 Slope gas piping in direction of flow to low points.

.5 Ensure supports for roof mounted piping are sized (height) to accommodate roof slope and required piping slope, and to permit installation of low point dirt pockets.

.6 Provide full pipe diameter 150 mm (6") long drip pockets at bottom of vertical risers, at piping low points, and wherever else shown and/or required.

.7 Identify natural gas piping aboveground with 2 coats of safety yellow enamel applied over primer, and SMS Ltd. or equal coil type vinyl identification makers with arrows.

.8 For underground gas piping, provide continuous 75 mm (3") wide yellow PVC warning tape with "CAUTION - GAS LINE BURIED BELOW" wording at 750 mm (30") intervals located above pipe approximately 250 mm (10") below grade.

.9 Rough-in required natural gas piping for kitchen and laundry equipment in accordance with drawing plans and schedules. Obtain accurately dimensioned rough-in drawings for equipment and confirm exact locations prior to roughing-in. When equipment has been installed, connect equipment from the roughed-in Work. Provide shut-off valves in piping connections to equipment.

.10 Include for mounting of a solenoid valve in the gas piping to kitchen cooking equipment.

3.03 INSTALLATION OF SHUT-OFF VALVES

.1 Provide CSA approved ball type or lubricated plug type shut-off valves to isolate equipment, and wherever else shown.

.2 Ensure valves are located for easy accessibility and maintenance.

3.04 INSTALLATION OF PRESSURE REGULATORS

.1 Provide pressure regulators in gas distribution piping where indicated and/or required.

.2 For indoor appliances, use lever acting design vent limiter type, sized as shown and mounted in a horizontal upright position in strict accordance with manufacturer's instructions. Note: these pressure regulators do not require vent piping.

.3 Use vented type pressure regulators for all other applications.

.4 Install regulating stations in accordance with requirements of CAN/CSA B149.1.

.5 Provide 6 mm (¼") diameter test ports upstream and downstream of each regulator assembly.

.6 Locate outdoor regulating stations a minimum of 300 mm (12") away from walkways, and 3 m (10') away from equipment air intakes and building openings. Provide required vent piping and terminate vents in a turn-down elbow fitting with bronze bug screen secured in place.

.7 Locate indoor regulating stations in locations accessible without use of ladders or lifts. Combine vents where permitted and increase vent pipe size accordingly. Extend vent piping up through roof 3 m (10') away from equipment air intakes and building openings and terminated in a turn-down elbow fitting with bronze bug screen secured in place.

.8 Indicate operating set-points, relief settings and vent arrangements for each regulating station on as-built record drawings.

END OF SECTION

1 GENERAL

1.01 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the work of this Section is specified in other Sections of the Specification:

.1 supply of piping or equipment mounted temperature control components;

.2 domestic water piping connections to equipment;

.3 drainage piping connections to equipment drain pans;

.4 provision of boilers;

.5 provision of cooling tower;

.6 provision of heat pumps;

.7 provision of site applied thermal insulation for piping and equipment;

.8 circulating system testing, adjusting and balancing.

1.02 SUBMITTALS

.1 Submit shop drawings for all products specified in this Section except piping and unions.

.2 Submit certified performance curves with all pump shop drawings.

.3 Submit with delivery of each unit a copy of factory inspection and test report, and include a copy of each report with O & M Manual project close-out data.

.4 Submit a site inspection and start-up report from manufacturer’s representative as specified in Part 3 of this Section.

.5 Prior to Substantial Performance of the Work, submit a spare seal flush line filter for each pump equipped with a seal flush line.

.6 Shop drawings for piping anchors must be prepared and stamped by a professional Structural Engineer registered in the jurisdiction of the work. Refer to requirements for Contractor retained engineers specified in Section entitled Mechanical Work General Instructions.

.7 Submit a letter from pipe anchor design engineer to stating engineer has visited site to examine installation of pipe anchors and pipe anchor installation is in accordance with reviewed anchor shop drawing.

1.03 QUALITY ASSURANCE

.1 Pump motors are to comply with requirements of Section entitled Basic Mechanical Materials and Methods.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Black Steel - Screwed Joint

.1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.2 Black Steel - Welded Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.

2.02 PIPING UNIONS

.1 Screwed Piping

.1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

.1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.03 CIRCUIT BALANCING VALVES

.1 Tour & Andersson Series 787 threaded and Series 788 flanged for precise flow measurement, balancing, and positive shut-off with no drip seat. Each valve to be wye pattern, globe style with self-sealing EPDM measurement points, EPDM seat, and wheel handles with locking tamper-proof setting.

.2 Circuit balancing valves shall be sized based on design water flow and manufacturer's performance data. Refer to the following circuit balancing valve schedule for sizes.

Size (in)	Nominal Flow			
	Min. (gpm)	Max. (gpm)	Min. (l/s)	Max. (l/s)
1/2	0.6	2.8	0.038	0.177
3/4	2.0	6.0	0.126	0.379
1	3.9	10.0	0.246	0.631
1-1/4	5.0	15.0	0.316	0.947
1-1/2	6.6	20.0	0.416	1.262
2	12.6	36.0	0.795	2.272
2-1/2	38.0	100.0	2.398	6.310
3	31.0	130.0	1.956	8.203
4	68.0	200.0	4.291	12.620

5	90.0	320.0	5.679	20.192
6	182.0	450.0	11.48	28.395

.3 Acceptable manufacturer is Tour & Anderson (TA Hydronics) only.

2.04 PRESSURE RELIEF VALVES

.1 Dresser Industries Canada Ltd., "CONSOLIDATED", ASME tested, rated and certified, cast iron, bronze fitted, 1725 kPa rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and factory set at 105% (percent) times the system pressure at the point in the system where the pressure relief valve is installed.

.2 Acceptable manufacturers are Dresser Industries Canada Ltd., Watts Industries, Kunkle, Spirax Sarco Canada Ltd., Singer Valve Co. Ltd., and Lonergan.

2.05 SHUT-OFF VALVES

.1 Ball Type

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5044A;

.2 Watts Industries (Canada) Inc. #FBV-3;

.3 Kitz Corp. Code 58;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valve #77-100.

.2 Butterfly Type

.1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.

.2 Acceptable products are:

.1 DeZurik of Canada Ltd., Figure No. 632;

.2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;

.3 Apollo Valve 143 Series;

.4 Watts Industries (Canada) Inc. #BF-03;

.5 Kitz Corp. 6112 Series;

.6 Toyo Valve Co. 918DESL/G2.

2.06 SWING CHECK VALVES

.1 Bronze - Screwed

.1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 236;

.2 Nibco #T-433;

.3 Kitz Corp. Code No. 22.

.2 Cast Iron - Screwed and Flanged

.1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 435A;

.2 Watts Industries (Canada) Inc. #F-511;

.3 Kitz Corp. Code No. 78.

2.07 VERTICAL LIFT CHECK VALVES

.1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231;

.2 Watts Industries (Canada) Inc. #600;

.3 Kitz Corp. Code No. 36.

2.08 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Acceptable products are:

.1 Gulf Valve Co. "WAFER CHECK";

.2 Watts Industries (Canada) Inc. Series ICV-125;

.3 The Metraflex Co. Style CVXX.

2.09 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Ltd. Fig. 5046;

.2 Watts Industries (Canada) Inc. #B-6000-CC;

.3 Kitz Corp. Code No. 68AC;

.4 Apollo Valves #78-104-01.

2.10 RADIATOR SHUT-OFF AND BALANCING VALVES

.1 Heavy pattern, straight, 1750 kPa (250 psi) rated at 120°C (250°F) bronze radiator valves, each complete with composition disc, spring loaded packing, and union. Equip inlet valves with a handle for shut-off. Equip outlet valves with a lockshield for shut-off and balancing.

.2 Acceptable products are:

.1 Dahl Brothers Canada Ltd. #11042 and #13013;

.2 Spirax Sarco Ltd. Type R.

2.11 AIR VENTS

.1 Manual Air Vents

.1 Equal to Conbraco 27 Series, 3.2 mm (⅛") diameter with a key handle.

.2 Automatic Air Vents:

.1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.

.2 Acceptable products are:

.1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);

.2 Armstrong International Inc. No. 1-AV.

2.12 STRAINERS

.1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.

.2 Acceptable products are:

.1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;

.3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";

.4 Armstrong International Inc. A1 Series;

.5 Watts Industries (Canada) Inc. #77SCI;

.6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

2.13 PIPING EXPANSION JOINTS

.1 Steel Piping Mains:

.1 Controlled flexing, flanged expansion joints, 2070 kPa (300 psi) rated, with corrugated stainless steel bellows with closely matched neck rings and reinforcing or control rings, and selected for operating pressure plus 25% safety factor.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series CSF "High-Corr";

.2 Victaulic Co. of Canada Ltd. Style 155 with Style 07 or 107 "Zero-Flex" couplings on each side of assembly and a full length steel "V" shaped support trough with hangers;

.3 The Metraflex Co. Model MC.

.2 Steel Branch/Runout Piping:

.1 Externally pressurized, 1380 kPa (200 psi) rated expansion joints with a stainless steel bellows and shroud, welding or threaded steel nipple ends for steel piping, and copper sweat nipple ends for copper piping.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series "H";

.2 The Metraflex Co. Model "HP".

2.14 PIPING ALIGNMENT GUIDES

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit pipe size and pipe insulation thickness.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series PGT;

.2 E. Myatt & Co. Ltd. Fig. 1267;

.3 Empire Tool & Mfg. Inc. Fig 256;

.4 The Metraflex Co. Style IV.

2.15 PIPE ANCHORS

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% of axial thrust, and, as specified in Part 1 of this Section, is to be designed and detailed by a Professional Structural Engineer.

2.16 FLEXIBLE PUMP CONNECTIONS

.1 Flexible metal hose assemblies, each complete with annular corrugated unbraided type 321 stainless steel inner core, braided type 321 stainless steel hose, and a collar and flange at each end, all suitable for twice the working pressure of the system.

.2 Acceptable products are:

.1 Senior Flexonics Inc. A1 and A6 Series;

.2 The Metraflex Co. Model SST and "METRA-MINI".

2.17 AIR SEPARATOR

.1 Vortex type vertical air separator with side tangential inlet and outlet connections, a top air outlet connection, and bottom drain connection. Separator is to be constructed of cast iron or fabricated steel for a pressure of 1105 kPa (160 psi) at 180°C (350°F) in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.

.2 Acceptable products are:

.1 S.A. Armstrong Ltd. Model "VA";

.2 ITT Bell & Gossett "Rolairtrol";

.3 Taco Canada Ltd. "4900 Series".

2.18 EXPANSION TANK

.1 Replaceable bladder type, factory pressurized expansion tank with permanent separation of air and water, in accordance with drawing schedule and complete with:

.1 steel pressure tank suitable for a working pressure of 870 kPa (125 psi) at 115°C (240°F), constructed and stamped in accordance with the ASME Code for Unfired Pressure Vessels and complete with a system connection, drain connection, air charging valve, and a red oxide primer finish;

.2 heavy-duty butyl rubber (EDPM) bladder;

.3 tapping for installation of a pressure gauge;

.2 Acceptable products are:

.1 Calefactio Solutions AL Series "Expanflex";

.2 S.A. Armstrong Ltd. Series "AX-V" Series "L";

.3 ITT Bell & Gossett Series "B" (ASME);

.4 Amtrol "L-Series";

.5 Taco (Canada) Ltd. "CA" Series.

2.19 CLOSE COUPLED VERTICAL IN-LINE PUMPS

.1 Vertical Inline Centrifugal pumps as per the drawing schedule, each non overloading under all operating conditions and factory tested at specified operating conditions.

.2 Close coupled, single stage, vertical in-line pump complete with:

.1 Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.

.2 All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided to allow servicing.

.3 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

.4 The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.

.5 The pump shall incorporate a dry shaft design to prevent the circulating fluid from contacting the shaft. The pump shaft shall be AISI 1045 carbon steel with field replaceable bronze SAE 660 shaft sleeve. In order to improve serviceability and reduce the cost of ownership the shaft sleeve must be slip on (press on not allowable) and must be easily replaced in the field.

.6 The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250ºF. The mechanical seal shall be an inside type seal . This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. The entire pump line shall use no more than three different sizes of seals.

.7 Outside mechanical seals are NOT acceptable.

.8 The pump shall be close coupled to a JM Frame, TEFC, inverter rated motor with class F insulation and shaft grounding ring.

2.20 SPLIT COUPLED VERTICAL IN-LINE PUMP

.1 Vertical Inline Centrifugal pumps as per the drawing schedule, each non overloading under all operating conditions and factory tested at specified operating conditions.

.2 Split coupled, single stage, vertical in line pumps shall be complete with:

.1 Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.

.2 All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided to allow servicing.

.3 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

.4 The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.

.5 The pump shall be manufactured with AISI 416 Stainless Steel shaft.

.6 The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250ºF. The mechanical seal shall be an inside type seal yet engineered and applied in a manner that is as or more accessible than a specialty outside seal. This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. The entire pump line shall use no more than three different sizes of seals. Outside mechanical seals are NOT acceptable.

.7 The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without removal of the motor. The motor mount must be designed to accept several different motor frame standards; CZ and HP. The motor shall be a TEFC, inverter rated motor with class F insulation and shaft grounding ring.

.3 Acceptable manufacturers are:

.1 Taco Comfort Solutions;

.2 S.A. Armstrong;

.3 ITT Bell & Gossett;

.4 Grundfos CBS Inc. PACO;

.5 Patterson Pump Company.

2.21 CIRCULATING PUMP SUCTION CONNECTION ACCESSORIES

.1 Circulating pump manufacturer supplied suction guides with a cast iron body, stainless steel strainer screen, removable fine mesh start-up strainer screen and steel guide vanes. Unless otherwise shown or specified, suction connection accessories are to be piping line size.

2.22 GLYCOL SOLUTION MIXING AND STORAGE TANK

.1 Package type glycol solution mixing, storage and automatic feed assembly designed to maintain minimum system pressure levels and complete with:

.1 round, polyethylene or polypropylene tank sized to suit system capacity, complete with a solution level scale in litres and Imperial gallons, removable cover, and a welded steel angle stand assembly with legs, pump shelf, and control panel bracket, all factory finished with enamel;

.2 120 volt, 1-phase, 60 Hz electrical connection;

.3 factory pre-piped rotary bronze gear pump with capacity and pressure differential to suit system requirements, factory wired to control panel, mounted on a shelf integral with steel stand assembly, and complete with shut-off valve and strainer;

.4 tank pressure relief valve with discharge piped back into tank;

.5 tank low level switch;

.6 pressure gauge;

.7 Honeywell #L404A "Pressurtrol" or equal pipe mounting differential pressure switch with a 100 to 1000 kPa (15 to 150 psi) range;

.8 factory mounted and pre-wired control panel with a minimum NEMA 2 enamelled steel enclosure, designed to control and operate pump either manually or automatically to pump glycol solution into system, and to stop pump and initiate an audible/visual alarm if a low glycol solution level occurs in tank, and complete with:

.1 terminal blocks for power and control wiring connections;

.2 H-O-A switch with green "Power On" indicator light;

.3 120 volt/12 volt control transformer;

.4 low glycol solution level alarm buzzer with silencing switch, an alarm light which remains illuminated until low-level switch is reset, and an alarm push-to-test button;

.5 dry contacts for building automation system alarm annunciation.

.2 Acceptable products are:

.1 Calefactio Solutions Series GMP;

.2 ITT Bell & Gossett Series GMU;

.3 Axion Industries Ltd. Series SF;

.4 S. A. Armstrong Ltd. GLA Series.

2.23 GLYCOL

.1 Propylene glycol blended with Nitrite based corrosion inhibitors.

3 EXECUTION

3.01 HEATING WATER PIPING INSTALLATION REQUIREMENTS

.1 Provide all required heating water and glycol solution piping.

.2 Pipe, unless otherwise noted, shall be mild black steel, Schedule 40 for pipe to 8” (200 mm) diameter, Schedule 30 for pipe 10” to 18” (250 mm to 450 mm) diameter, and Schedule 20 for pipe 20" to 24” (500 mm to 600 mm) diameter.

.3 Piping to and including 2” (50 mm) diameter shall be screwed. Piping 2-1/2” (65 mm) diameter and larger shall be welded or flanged.

.4 Slope horizontal mains to provide a minimum continuous up-grade of 1” (25 mm) in 20’ (6 m) to high points. Slope branch supply and return piping connections to equipment a minimum of 1” (25 mm) in 4’ (1.2 m).

.5 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

.6 Provide an air relief vent in the high points of closed loop piping systems if the piping is not adequately vented into equipment.

.7 Provide circuit balancing valves in piping generally where shown on the drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation. Balancing valves shall be sized according to design flow Ensure that balancing valves are a minimum of 10 pipe diameters downstream of any pump or fitting and a minimum of 5 pipe diameters upstream of any fitting.

.8 Pipe the discharge of each liquid piping safety relief valve to drain unless otherwise shown or specified.

.9 Check and test the operation of each liquid piping safety relief valve. Replace defective

.10 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the work specified the Section 25 05 05. Refer to the drawing control diagrams.

3.02 CONDENSER WATER PIPING INSTALLATION REQUIREMENTS

.1 Provide required condenser water piping. Pipe, unless otherwise specified, is to be:

.1 for pipe to and including 65 mm (2-½") diameter, Schedule 40 black steel, screwed, or pressure coupled joints;

.2 for pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight black steel (10 mm [0.375"] thickness) pipe with welding fittings and welded joints;

.2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.

.3 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.

.4 Connect equipment provided as part of the work of other Sections with piping as indicated and/or required. Refer to pipe connection details on drawings.

.5 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.

.6 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

.7 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.

.8 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

.9 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

3.03 INSTALLATION OF PRESSURE RELIEF VALVES

.1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.

.2 Confirm relief valve settings.

3.04 INSTALLATION OF AIR VENTS

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.

.2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.05 INSTALLATION OF STRAINERS

.1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.06 INSTALLATION OF EXPANSION COMPENSATORS

.1 Provide expansion compensation in piping.

.2 Generally, locate expansion compensation where shown, but with exact locations to suit piping as installed.

.3 Provide double pipe alignment guides in horizontal piping at each side of expansion compensation facilities to permit movement in axial direction only. Secure guides to building structure only.

.4 Provide a pipe guide at each side of expansion joints in vertical risers.

3.07 INSTALLATION OF PIPING ANCHORS

.1 Provide anchors to secure piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.2 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a signed letter with engineer’s stamp from design engineer confirming each anchor is properly installed.

3.08 INSTALLATION OF FLEXIBLE PIPING CONNECTIONS

.1 Provide flexible connections in piping connections to equipment.

.2 Install in accordance with manufacturer's instructions.

3.09 INSTALLATION OF CIRCULATING PUMPS

.1 Provide centrifugal circulating pumps.

.2 Secure vertical inline pumps in place in accordance with requirements of drawing detail and provide flexible piping connections in vertical suction and discharge piping approximately 450 mm (18") above suction and discharge connection accessories.

.3 Provide a shut-off valve and suction guide in pump suction piping, and a shut-off valve, check valve and balancing valve in pump discharge piping, installed in accordance with manufacturer's instructions. Remove suction guide start-up strainer screens after piping flushing and cleaning is complete. Valves are to be 150 mm (6") away from pump discharge for discharge piping to 150 mm (6") dia., and 300 mm (12") away from pump discharge for discharge pipe larger than 150 mm (6") dia.

.4 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD's to electrical trade at site for installation as part of the electrical work.

.5 If circulating pumps are used for piping flushing and cleaning, and pump seal flush line filters are not installed, replace pump mechanical seals when flushing and cleaning is complete.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.8 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.10 INSTALLATION OF EXPANSION TANK

.1 Provide an expansion tank.

.2 Secure tank stand to a concrete housekeeping pad by means of machine bolts.

.3 Connect tank with system piping. Extend a drain line from tank piping and terminate drain line with a drain valve. Provide an air vent.

.4 Provide a water make-up connection line complete with relief valve and pressure gauge and connect to system piping. Terminate make-up piping for connection to domestic cold water piping as part of the work of Section entitled Domestic Water Piping and Valves. Check relief valve operation and adjust as required.

.5 Check tank air charge and adjust to suit system air.

3.11 INSTALLATION OF AIR SEPARATORS

.1 Provide an air separator in piping and connect with valved inlet and outlet piping.

.2 Extend valved blowdown piping from bottom pipe connection tapping to nearest floor drain location.

.3 Equip top pipe connection tapping with an automatic air vent, and piping as detailed.

3.12 INSTALLATION OF GLYCOL SOLUTION MIXING AND STORAGE TANK

.1 Provide a mixing and storage tank and feed assembly for each glycol solution circulating system.

.2 Secure tank stand to a concrete housekeeping pad. Connect with system piping. Refer to drawing detail.

.3 Fill tank with, unless otherwise specified, a solution of 50% water, 50% propylene glycol, and test solution to confirm proper concentrations.

.4 When installation is complete, test operation of assembly, including alarms, and adjust as required. Adjust pressure switch to suit glycol solution circulating system pressure.

3.13 FLUSHING AND CLEANING PIPING

.1 Flush and clean new piping in accordance with requirements specified in Section entitled HVAC Water Treatment.

3.14 TESTING, ADJUSTING AND BALANCING

.1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe and fittings.

.2 Submit, in shop drawing form, a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties. Piping schematics must be reviewed, approved, and signed by refrigeration equipment manufacturers prior to being submitted to Consultant for review.

.3 Submit letters from equipment suppliers certifying proper installation and start-up of piping systems and equipment as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Refrigerant piping systems are to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.

.2 Refrigerant piping installing contractor is to be certified by Technical Standards and Safety Authority (TSSA). Installing contractor is to install refrigerant piping in accordance with manufacturer's installation instructions and in accordance with local codes. Contractor is responsible for all regulatory approvals, if required. Upon completion of installation, documentation of refrigerant amount, test certificates and verification documentation, etc., is to be provided in a binder, in accordance with requirements of local authorities having jurisdiction.

.3 Refrigerant piping and direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Type ACR hard drawn seamless copper refrigerant tubing to ASTM B280, factory degreased, dehydrated and capped or nitrogen filled and capped, complete with factory washed and bagged wrought copper soldering fittings to ASME B16.22, and brazed joints made with high melting point silver brazing alloy conforming to AWS Classification BcuP-5.

2.02 PIPING LINE SETS

.1 Equal to Great Lakes Copper Inc. "EZ-Roll" soft annealed copper to ASTM B280, suitable for use with refrigerant involved, factory cleaned and capped, and with sizes and lengths as required.

2.03 GENERAL RE: VALVES AND PIPING SPECIALTIES

.1 Refrigerant valves and piping specialties specified below are to factory cleaned, degreased, and supplied to site with capped ends.

2.04 SHUT-OFF VALVES

.1 Ball Valves

.1 ¼ turn, CSA certified forged brass ball valves, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with carbon filled Teflon ball seals, 2 O-ring stem seals, a gasketed seal cap, a flow direction arrow cast into body, a ball position indicator on stem, and extended copper tube connections to permit brazing the valve into line without disassembling valve.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

.2 Diaphragm Valves

.1 Forged brass, frost-proof, Type 1 Series, CSA certified packless diaphragm valves, each suitable for a 3445 kPa (500 psi) working pressure and complete with an O-ring to prevent moisture from entering diaphragm chamber, one phosphor bronze and 2 stainless steel diaphragms, and extended copper tube brazing connections.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.05 CHECK VALVES

.1 Straight through type for valves 6.4 mm to 16 mm (¼" to 5/8") diameter, globe type for valves 22 mm (7/8") diameter and larger, each complete with extended tubing for brazing connections, and as follows:

.1 straight through type check valves complete with a machined brass gasketed body, phosphor bronze spring, and neoprene seat;

.2 globe type check valves complete with a cast bronze body, forged brass cap, phosphor bronze spring, Teflon seat disc, and neoprene O-ring seal.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.06 PIPING TRAPS

.1 Mueller Industries Inc. Style No. WE-554P brazing end copper "P" traps.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.07 PRESSURE VESSEL RELIEF VALVES

.1 Factory set pressure relief valves, straight through or angle type as required, each constructed in accordance with requirements of ANSI B9.1 and the ASME Code for Unfired Pressure Vessels, and each complete with a brass body, neoprene seat disc, and lead seal and locking wire.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.08 REFRIGERANT LIQUID MOISTURE INDICATORS

.1 Forged brass, triple sealed, CSA certified liquid moisture indicators, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with a liquid indicator which shows "FULL" when system is fully charged with refrigerant and remains blank when there is a restriction or shortage of refrigerant in liquid line, a moisture indicator which changes colour from blue to pink when moisture is present in system, a plastic dust cover, and extended copper tube brazing connections.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.09 LIQUID LINE FILTER-DRIER

.1 Mueller Industries Inc. "Drymaster" CSA certified filter-driers, each suitable for a maximum 3445 kPa (500 psi) working pressure and complete with a combination of desiccants in a fluted briquette for drying, and a fluted briquette type filter.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.10 FLEXIBLE PIPING CONNECTIONS

.1 Senior Flexonics Canada "VIBRA-SORBERS" phosphor bronze construction, factory cleaned, dried, and sealed flexible piping connections with copper tube brazing ends.

.2 Acceptable manufacturers are:

.1 Senior Flexonics Canada;

.2 The Metraflex Co.

2.11 THERMOSTATIC EXPANSION VALVES

.1 Factory tested, balanced port design thermostatic expansion valves, with exact selection to suit the application and refrigerant used, each complete within a replaceable stainless steel diaphragm and welded element construction thermostatic element charged with hydraulic fluid, and removable inlet strainer.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

3 EXECUTION

3.01 INSTALLATION OF REFRIGERANT PIPING, VALVES AND SPECIALTIES

.1 Provide required refrigerant piping. Piping is to be type ACR copper with wrought copper fittings. Install piping in accordance with requirements of reviewed refrigerant piping schematics referred to in Part 1 of this Section.

.2 Make refrigerant piping joints using a light coat of approved brazing flux applied to both pipe and fitting. Do not use acid flux. During brazing process, ensure pipe and fittings are kept full of nitrogen or carbon dioxide to prevent scale formation inside pipe and fitting.

.3 Where shown or specified, use soft copper refrigerant piping line sets.

.4 Provide shut-off valves to isolate each piece of equipment if shut-off valves are not supplied integral with equipment. Provide ball or diaphragm type shut-off valves inside building. Provide diaphragm shut-off valves outside building.

.5 Provide a refrigerant charging valve for each system if such a valve is not supplied integral with equipment.

.6 Provide refrigerant piping accessories shown and/or required and install in accordance with manufacturer’s recommendations.

.7 Provide required refrigerant.

.8 Provide flexible connections at piping connections to roof mounted condensing units. Install in accordance with manufacturer’s instructions.

.9 Provide expansion valves where shown and/or required, each matched to coil and installed in accordance with manufacturer’s instructions.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all water treatment chemical feed equipment and associated hardware.

.2 Submit product literature sheets for all chemicals, as well as WHMIS Material Safety Data Sheets for all chemicals.

.3 Submit water treatment manufacturer/supplier certification letters as specified in Part 3 of this Section.

.4 Submit water treatment test sets and spare chemicals as specified below and in Part 3 of this Section.

2 PRODUCTS

2.1 CHARACTERISTICS OF CHEMICALS AND SPARE CHEMICALS

.1 Chemicals specified in this Section are to be non-toxic when released to atmosphere, non-corrosive and non-staining if a leak occurs, and compatible with all system components.

.2 Chemicals must be approved by governing authorities for release into Municipal sewer system.

.3 For each treatment system for which chemicals are supplied, supply and hand to Owner, at Substantial Performance of the Work, spare chemical in original containers/packaging sufficient for 2 months of treatment system operation.

2.2 **MANUFACTURERS/SUPPLIERS OF CHEMICALS AND FEED EQUIPMENT**

.1 Acceptable manufacturers/suppliers are:

.1 Ashland Hercules Water Technologies;

.2 Klenzoid Inc.;

.3 Magnus Canada;

.4 Chem-Aqua Canada.

2.3 PIPING SYSTEM FLUSHING AND CLEANING CHEMICAL

.1 Liquid form alkaline type cleaner consisting of a concentrated blend of highly active penetrating agents and detergents with a 12.5 pH and specifically formulated to remove oil, mill scale and oxides from piping and equipment.

2.4 CLOSED HEAT TRANSFER SYSTEM TREATMENT

.1 Chemical Bypass Feeders

.1 Enamelled steel or cast iron by-pass feeders sized as shown, 2060 kPa (300 psi) rated and complete with 20 mm (¾") diam eter NPT pipe connection tappings, and a screw-on cast iron cap with "Buna N" "O" ring seal.

.2 Chemical Bypass Filter

.1 By-pass filter and flow indicator assembly equal to a Shelco Inc. FOS78, 1725 kPa (250 psi) rated replaceable cartridge filter assembly with a stainless steel housing and 20 mm (¾") diameter piping connections, sized for approximately 5% of rated circulating pump flow and complete with a minimum of 6, 20 micron filter cartridges, and a sight flow indicator equal to an Anderson Midwest Model 350SS with 20 mm (¾") diameter piping connections.

.3 Piping tee mounting coupon holders, each complete with 25 mm (1") diameter NPT plugs with a minimum of one coupon for copper and one coupon for steel.

.4 Chromate free, nitrite/borate type corrosion inhibitor suitable for use with both ferrous and non-ferrous metals.

.5 Test kit for measuring inhibitor level.

3 EXECUTION

3.1 PIPING SYSTEM FLUSHING AND CLEANING

.1 After new heat transfer system piping has been installed and leakage testing has been satisfactorily completed, but before mechanical equipment start-up and performance tests, flush and chemically clean piping systems. Do not flush/clean existing piping systems.

.2 Provide required temporary piping connections, including bypass piping to isolate dirt sensitive mechanical plant equipment. Remove instrumentation such as flow meters and switches, orifice plates, meter valves and similar devices and plug pipe openings. Reinstall when flushing and cleaning work has been certified complete by chemical manufacturer/installer. Ensure control valves are operational and fully open during flushing and cleaning.

.3 Prior to chemical cleaning, flush piping, including dead ends, with water to remove loose solids. Clean all strainers. Replace chemical feeder line filters as required. Flush and drain until water runs clear.

.4 When flushing with water is complete, fill systems with fresh clean water. Meter amount of water required to fill each system or otherwise calculate system capacity. Ensure all air is vented from systems. Add cleaning chemical as instructed by chemical manufacturer and circulate solution for a period of time and at a temperature as required to produce a clean piping system. Conduct daily pH, conductivity, and total iron tests in accordance with chemical supplier’s instructions.

.5 After chemical cleaning when test results indicate a clean system, drain solution from piping, refill with clean water and circulate water for a minimum of 24 hours to flush out remaining chemical solution, then drain water from piping using all drain points and again clean all system strainers and replace filters. Arrange for chemical supplier to check each system after flushing and cleaning is complete and to certify in writing that flushing and cleaning procedures have been properly performed. Submit a copy of the certification letter. Fill systems.

3.2 INSTALLATION OF CLOSED HEAT TRANSFER SYSTEM TREATMENT

.1 After flushing and cleaning procedures have been certified complete, provide a by-pass chemical feeder and a cartridge filter assembly. Install in accordance with requirements of drawing details.

.2 Supply and feed into each system sufficient chemical to charge system to proper concentrations of chemical, and maintain proper levels in system until Substantial Performance of the Work.

3.3 MANUFACTURER'S CERTIFICATION, START-UP, AND TRAINING

.1 For all water treatment equipment include for on-site certification, start-up supervision, and system training by treatment chemical manufacturer's representative as follows:

.1 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements;

.2 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.3 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except shop fabricated ductwork and fittings.

.2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

.3 Submit duct leakage test data prior to ductwork being covered from view.

.4 Include the following with fan & accessories shop drawing/product data sheet submission:
.1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;
.2 certified sound power data that conforms to specified levels;
.3 product data sheets for all accessories;
.4 product data sheets for fan motors.

1.2 QUALITY ASSURANCE

.1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2. PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK

.1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

.2 Rectangular
.1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

.3 Round
.1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.

2.2 FLEXIBLE METALLIC DUCTWORK

.1 Bare
.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.

.2 Insulated
.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m^3 (0.75 lb/ft^3) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC S102.

2.3 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber. Acceptable products are:
.1 Duro Dyne Canada Inc. "DUROLON";
.2 Dyn Air Inc. "HYPALON".

.2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber. Acceptable products are:
.1 Duro-Dyne Canada Inc. "THERMAFAB";
.2 Dyn Air Inc. "SILICON HI-T".

2.4 METAL DUCT SYSTEM JOINT SEALANT

.1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.

.2 Acceptable manufacturers are:
.1 Johns Manville;
.2 Manson Insulation;
.3 Knauf Insulation.

2.5 ACOUSTIC LINING

.1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.

.2 Acceptable manufacturers are:
.1 Johns Manville;
.2 Manson Insulation;
.3 Knauf Insulation.

2.6 CASING AND PLENUM MATERIAL AND ACCESSORIES

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.7 AIR FILTERS

.1 AAF-Canada, air filters as per the drawing schedule. All filters shall be ULC listed and labelled and rated as Class I or Class II.

.2 Pre-filter shall have a 20-25% average efficiency when tested by the ASHRAE 52 test method. The frame shall be constructed of high strength moisture resistant "beverage" board. Two mating die-cut boxes are bonded together to form a double wall construction. The media pad support retainers shall be bonded to the media on both the air entering and leaving sides.

.3 Final filters shall have an average efficiency of 90-95%, when tested by the ANSI/ASHRAE 52.1 test method. The Varicel filter shall have cell sides made of natural kraft pine and hardwood fibre board for high tear strength. Two mating die cut boxes shall be bonded together, forming a double wall around the perimeter of the filter. The mini-pleat media pack shall be bonded inside the double wall with a foil laminate frame on all four edges to prevent leakage and increase rigidity. The media shall be dual density micro-glass paper with a water repellent binder. The filters shall have a ULC Class II rating. The efficiency and size shall be as shown on the filter schedule.

.4 Acceptable manufacturers are Farr, AFF-Canada and Airguard Industries.

2.8 AIR FILTER GAUGES

.1 Dwyer Industries Inc. Series 2000 differential pressure gauge with a 0-500 Pa range, accurate to within 2% of full scale and complete with all required mounting and connection accessories. The 120 mm diameter dial shall have a zero (0) point adjustment and graduations in inches of wc.

2.9 CASING AND PLENUM MATERIAL AND ACCESSORIES

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.10 PLENUM ACCESS DOORS

.1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.11 SPLITTER DAMPERS

.1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.12 AIR TURNING VANES

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.13 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:
   .1 hexagonal or square shaft extension through frame;
   .2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;

.3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;
.4 linkage for multiple blade dampers;
.5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.

.3 Round Dampers: Nailor Industries Inc. Model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.

.5 Acceptable manufacturers are:
.1 Nailor Industries Inc.;
.2 T.A. Morrison & Co. Inc. "TAMCO";
.3 NCA Manufacturing Ltd.;
.4 Greenheck Fan Corp.;
.5 Ruskin Co.

2.14 BACKDRAFT DAMPERS

.1 Nailor Industries Inc., 1300 Series gravity type dampers each complete with a galvanized steel frame, aluminum damper blades with neoprene edges, galvanized steel linkage, and lifetime lubricated nylon bearings.

.2 Acceptable manufacturers are Nailor Industries Inc., Greenheck Fan Corp., NCA Manufacturing Limited, Ruskin Ltd., and Air Specialties Manufacturing Ltd.

.3 SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the pressure construction standard of the system.

2.15 FUSIBLE LINK DAMPERS

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.

.2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.

.3 Acceptable manufacturers are:
.1 Nailor Industries Inc.;
.2 Greenheck Fan Corp.;
.3 NCA Manufacturing Ltd.;
.4 Ruskin Co.;
.5 Ventex;
.6 Pottorff;
.7 Price Industries (E.H. Price).

2.16 SMOKE DAMPERS

.1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.

.2 Acceptable manufacturers are:
- .1 Nailor Industries Inc.;
- .2 Greenheck Fan Corp.;
- .3 NCA Manufacturing Ltd.;
- .4 Ruskin Co.;
- .5 Price Industries (E.H Price).

2.17 COMBINATION FIRE/SMOKE DAMPERS

.1 Nailor Industries Series 1220, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.

.2 For applications where supply or return ducts terminate at a grille, at your option, provide:
- .1 Nailor Industries 1221-OW “out of wall” high performance combination fire/smoke damper, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, intumescent thermal insulation on all sides of sleeve.
- .2 Nailor Industries 1221G combination fire/smoke damper for grilles, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, grille mounting flanges. Coordinate grille size and mounting with damper requirements.

.3 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.

.4 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.

.5 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.6 Acceptable manufacturers are:
- .1 Nailor Industries Inc.;
- .2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;
.4 Ruskin Co.;
.5 Price Industries (E.H. Price);
.6 Pottorff;
.7 United Enertech.

2.18 MOTORIZED DAMPERS

.1 TAMCO Series 9000 BF low leakage/thermal break thermally insulated air foil damper capable of achieving a 6.7 cfm/sq. ft. (34 l/s/sq. m.) at – 40 °F (– 40 °C) leakage rate at 4" (1 kPa) differential pressure and bearing the AMCA certification seal for air leakage and complete with:
.1 0.080" (2.03 mm) thick 4" (100 mm) deep extruded aluminium insulated frame with extruded TPE thermoplastic seals on the sides of the frame. Entire frame shall be thermally broken by means of polyurethane resin pockets, complete with thermal cuts;
.2 extruded aluminium, broken frame damper blade internally insulated with non-CFC expanded polyurethane foam, with EPDM gasketed blade seals integrally secured to the damper blade;
.3 acetal copolymer (Celcon) and polycarbonate bearings with no metal-to-metal contact;
.4 out-of-airstream linkages and crank arms constructed of aluminium and corrosion resistant, zinc & nickel plated steel, complete with cup-point trunnion screws.

.2 Dampers shall be sized for "flanged" installation (damper blade area to be equal to duct or plenum cross section area).

.3 Acceptable damper manufacturer is TAMCO only.

2.19 ROOF DUCT SUPPORTS

.1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

2.20 ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.21 PRESSURE RELIEF DOORS

.1 Greenheck model PRAD (positive) or VRAD (negative) pressure relief doors constructed of same material as duct or plenum they are associated with, each complete with a sealing gasket, special latches, cable assembly with spring to limit door opening to maximum 80° and factory set, field adjustable pressure relief magnet assembly.

.2 Size access doors to match requirements of system so pressure drop through open blow-out door at required flow rate will not exceed rated pressure of duct system.

.3 Acceptable manufacturers are:
.1 Greenheck Fan Corp.;
.2 United Enertech.

2.22 DUCT ACCESS DOORS

.1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.23 DUCTWORK DRAIN POINTS

.1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.24 INSTRUMENT TEST PORTS

.1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.25 WIRE MESH (BIRDSCREEN)

.1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.26 LOUVRES

.1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, storm-proof louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.

.2 Louvres are to be factory finished with a finish equal to PPG Industries "Duranar" fluoropolymer powder coating over primer with colour as selected by the architect.

.3 Acceptable manufacturers are:
.1 Price Industries Inc.;
.2 The Airolite Co. LLC;
.3 Construction Specialities;
.4 Nailor Industries Inc.;
.5 Ventex;
.6 Pottorff;
.7 Greenheck Fan Corp.

2.27 LOUVRE BLANK-OFF PANELS

.1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.28 GRILLES AND DIFFUSERS

.1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.

.2 Acceptable manufacturers are:
.1 Price Industries Inc.;
.2 Anemostat;
.3 Krueger Division of Air System Components Inc.;
.4 Titus;

.5 Nailor Industries Inc.;
.6 MetalAire;
.7 Tuttle & Bailey.

3. EXECUTION

3.1 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

.1 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.2 GENERAL RE: FABRICATION AND INSTALLATION OF DUCTWORK

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

.4 Construct ductwork so that manufacturer's gauge markings are external, and, unless otherwise specified, construct, seal and install ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designation. Sealing for ductwork with a pressure class less than 0.45 kPa shall be SMACNA Seal Class "C".

.5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.9 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.

.10 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.11 Factory made flanged joint system components are acceptable in rectangular duct installations. Install the components in strict accordance with the manufacturer's printed instructions and recommendations.

.12 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.13 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:
- .1 ductwork outside building or otherwise exposed to the elements;
- .2 shower exhaust ducts from grilles to duct main or riser;
- .3 fresh air intakes;
- .4 wherever else shown.

.14 Ductwork leakage shall not exceed the following:
- .1 ductwork to 2" W.C. Class - one (1) percent of the total air quantity handled by the respective fans;
- .2 ductwork exceeding 2" W.C. Class - two (2) percent of the total air quantity handled by the respective fans.

.15 Leakage testing of ductwork shall be provided by the Testing, Adjusting and Balancing (TAB) agency in accordance with the requirements of SMACNA "HVAC Air Duct Leak Test Manual" and as specified herein. In addition, be responsible for the following:
- .1 preparing ductwork 25' (7.5 m) and longer, for leakage testing prior to installation of external insulation including capping duct runouts and provision of tap-in for test equipment;
- .2 Ensuring notice is given to the TAB Agency and Commissioning Consultant so that they may be present for all testing;
- .3 resealing and/or replacement of defective ductwork;
- .4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.

.16 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.17 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.18 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.19 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

.20 Round exposed ductwork in Gymnasium is to be 2 metal gauges heavier than standard metal gauge for same size duct, and duct hangers are to be pairs of 9.5 mm (⅜") diameter hanger rods secured to 40 mm (1-½") wide #12 gauge galvanized steel split clamps around full circumference of duct at maximum 1.8 m (72") centres. Provide double nuts and lock washers on each hanger rod above and below each clamp.

.21 Provide automatic control dampers, except for dampers supplied as part of the cabinet fan assemblies. Leave each damper in satisfactory condition.

.22 Ensure that control dampers located in aluminium ductwork are constructed of type 316 stainless steel and are non-corrosive.

.23 Refer to Section entitled Basic Mechanical Materials and Methods for additional installation requirements.

3.3 INSTALLATION OF FLEXIBLE DUCTWORK

.1 Provide maximum 3 m (10') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.

.2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.3 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.4 Do not penetrate fire barriers with flexible duct.

3.4 INSTALLATION OF ACOUSTIC LINING

.1 Provide acoustic lining in ductwork in locations as follows:
.1 wherever shown and/or specified on drawings;
.2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;
.3 all transfer air ducts.

.2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.5 INSTALLATION OF CASINGS AND PLENUMS

.1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.

.2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.

.3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

3.6 INSTALLATION OF CASING AND PLENUM ACCESS DOORS

.1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.

.2 Construct access doors to open in or out to suit positive and negative pressures of system.

.3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.

.4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.7 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.8 INSTALLATION OF SPLITTER DAMPERS

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.9 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.10 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.11 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers where shown.

.2 Install and secure such that the dampers cannot move or rattle.

3.12 INSTALLATION OF FUSIBLE LINK DAMPERS

.1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr.) is suitable for fire barrier it is associated with.

.2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.

.4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.13 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.14 INSTALLATION OF SMOKE DAMPERS

.1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.15 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.16 INSTALLATION OF ROOF MOUNTED DUCT SUPPORTS

.1 Supply supports for roof mounted ductwork.

.2 Hand adjustable structural supports to roofing trade on roof for installation and flashing into roof construction as part of roofing work. Accurately mark exact locations and spacing of structural supports and supervise installation. Provide properly sized hot dip galvanized structural steel angles between structural supports and secure in place on support studs. Support ductwork on the angles and provide galvanized steel banding to secure ducts to the angles.

3.17 INSTALLATION OF PRESSURE RELIEF DOORS

.1 Provide pressure release access doors to prevent duct system explosion or implosion as a result of a duct obstruction, i.e. closed fire damper, which prevents normal air flow through the system. Size access doors in accordance with requirements of Part 2 of this Section.

.2 Where pressure release doors are shown in suction ducts or plenums, mount access door assembly so door swings in and latch mechanism is on the inside of duct or plenum. If latch mechanism is not accessible, provide a standard access door at latch side of the pressure release access door for maintenance purposes.

.3 Adjust each latch mechanism by means of the adjusting pin to suit static pressure of the particular system in accordance with latch mechanism manufacturer's instructions.

3.18 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.

.3 When requested, submit a sample of proposed duct access doors for review.

.4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.19 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.20 INSTALLATION OF ACOUSTIC LINING

.1 Provide acoustic lining to the extent shown and/or specified on the drawings.

.2 Install lining in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.21 INSTALLATION OF AIR FILTERS

.1 Provide all required air filters, located and arranged as shown and scheduled.

.2 Provide all required filter assembly frames and install to prevent air by-pass and to permit easy filter removal. Construct frames from the same material as the plenum, casing or duct the filters are associated.

.3 When air handling systems are complete and ready for start-up and testing, but building finishes are not complete and cleaning is not complete, provide minimum 20% average dust spot efficient (atmospheric) temporary glass fibre media in place of permanent filters prior to fan start-up, and provide temporary media over all return air openings in dirty, dusty, incomplete areas.

.4 Prior to application for a Certificate of Substantial Performance, and when the systems are ready for air balancing, remove temporary media and install permanent filters.

.5 For each filter bank, supply a spare set of replacement media and turn the filters over to the Project Manager prior to application for a Certificate of Substantial Performance of the Work.

3.22 INSTALLATION OF AIR FILTER GAUGES

.1 Provide a filter gauge for each main air handling system. For systems with pre-filters and after-filters, install the gauge across the after-filters.

.2 Secure gauges in place on the filter section casing in an easily readable location. Adjust each gauge to suit the design pressures of the system with new fresh filters in place.

3.23 INSTALLATION OF WIRE MESH (BIRDSCREEN)

.1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.

.2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.24 INSTALLATION OF LOUVRES

.1 Provide louvres for wall openings.

.2 Install louvre assemblies and secure in place in accordance with manufacturer’s instructions and details.

.3 Confirm exact louvre sizes and finish prior to ordering.

3.25 INSTALLATION OF LOUVRE BLANK-OFF PANELS

.1 Provide blank-off panels for inactive portions of exterior wall louvres.

.2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.

.3 Confirm exact finish of panels prior to fabrication.

3.26 INSTALLATION OF GRILLES AND DIFFUSERS

.1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.

.2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.

.4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

.5 Confirm grille and diffuser finishes prior to ordering.

3.27 DUCT SYSTEMS CLEANING AND START-UP

.1 Remove all dirt and foreign matter from the entire duct system and clean duct system terminals and the interior of supply air handling units prior to operating fans.

.2 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.3 Provide cheesecloth over all duct system inlets and outlets inside the building and run the system for twenty-four hours, after which remove the cheesecloth, the construction filters, and install new permanent filters.

.4 Include all labour for a complete site walk-through with testing and balancing personnel following the route of all duct systems to be tested, adjusted and balanced for the purpose of confirming the proper position and attitude of dampers, the location of pitot tube openings, and any other work affecting the testing and balancing procedures. Perform all corrective work required as a result of this walk-through.

3.28 TESTING, ADJUSTING AND BALANCING

.1 Testing, adjusting and balancing of air distribution work shall be performed by a balancing contractor retained directly by the Board and is not included in the mechanical contracts.

.2 The mechanical contractor shall co-operate with the balancing contractor and provide whatever assistance the balancing contractor may require in order to complete the work.

.3 Prepare the systems for balancing as follows:
- .1 check the operation of fan equipment, automatic dampers, and similar air flow control devices and ensure that they are operating properly;
- .2 ensure that air filters are new and clean;
- .3 ensure that any required duct leakage testing has been completed and that the duct systems are air-tight within tolerances specified in this Section.

.4 Perform all corrective work such as fan sheave replacement and duct sealing recommended by the Balancing Personnel.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop product data sheets for silencers. Include all construction, acoustic and aerodynamic performance data, and details with submission. Acoustical data is to demonstrate that duct systems with silencers will reduce mechanical fan system noise to required levels in occupied spaces.

.2 Submit manufacturer's test data to indicate results of factory tests on the silencers prior to shipment.

.3 Submit a copy of the silencer manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) accreditation certificate for latest ASTM E477 test standards.

.4 Submit an installation certification letter from silencer manufacturer as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Silencer performance must be substantiated by laboratory testing in a duct-to-reverberant room test facility according to ASTM E477, Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Material and Prefabricated Silencers.

.2 Silencer acoustic media and any lining/wrapping material must have a maximum flame spread rating of 25 and a smoke developed rating of 50 when tested in accordance with CAN/ULC S102, Surface Burning Characteristics of Building Materials, and Accessories.

.3 Acceptable silencer manufacturers are:

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Vibron Products Group;

.3 VAW Systems Ltd.;

.4 Price Industries Inc.

2 PRODUCTS

2.01 GENERAL RE: SILENCERS

.1 Silencers are to be factory fabricated by same manufacturer and are to be in accordance with drawing schedule, and tested in accordance with ASTM E477 through National Voluntary Laboratory Accreditation Program (NVLAP) with valid accreditation certificate.

.2 Silencer inlet and outlet dimensions are to be equal to duct sizes shown on drawings. Unless otherwise shown or specified, transitions will not be permitted.

.3 Silencers are to be constructed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit duct system pressure and velocity classification. Unless otherwise specified, casing seams and joints are to be lock-formed and sealed or stitch welded and sealed, and silencers are to be constructed so as not to fail when subjected to an internal static pressure of 3.9 kPa (8" wg).

.4 Perforated steel is to be adequately stiffened to ensure flatness and form, and welds are to be shop painted with zinc rich paint.

.5 Silencers are to be shipped with factory installed end caps.

.6 Galvanized steel is to be in accordance with ASTM A653.

2.02 OUTER CASING MATERIALS

.1 Rectangular Straight and Transitional Straight Silencers: Minimum #22 gauge lock forming quality galvanized steel.

.2 Elbow and Transitional Elbow Silencers: Minimum #18 gauge for elbow lock forming quality galvanized steel.

.3 High Transmission Loss (HTL) Rectangular and Elbow Silencers: # 16 or #10 gauge stitch-welded and caulked galvanized steel in accordance with drawing schedule.

.4 Circular Silencers: Lock forming quality galvanized steel with minimum gauges as follows:

.1 300 mm to 660 mm (12" to 26") dia. - #22 gauge;

.2 675 mm to 1.52 m (27" to 60") dia. - #18 gauge;

.3 1.55 m to 2.13 m (61" to 84") dia. - #16 gauge.

2.03 INTERIOR BAFFLE-LINER-BULLET MATERIAL

.1 Minimum #22 gauge lock forming quality galvanized steel.

2.04 INTERIOR BAFFLE TRANSITION

.1 Transitioning for interior transition silencers is to occur internal to silencer such that height of air passage is uniformly changing with the length of the air passage.

2.05 ACOUSTIC MEDIA MATERIAL

.1 Acoustic quality insulation which does not contain any formaldehydes, phenolic resins, or volatile organic compounds that can off-gas, but containing cotton fibres treated with an EPA registered non-toxic borate solution, "flash dried" to actively inhibit the growth of mould, mildew, bacteria, and fungi.

2.06 ACOUSTIC MEDIA PROTECTION MATERIAL

.1 Material for lining/wrapping acoustic media to help prevent shedding and erosion, in accordance with drawing schedule, is to be:

.1 polymer film material separated from perforated metal liner with a 12 mm (½") thick acoustically transparent spacer;

2.07 HIGH TRANSMISSION LOSS CASINGS

.1 High transmission loss (HTL) casings for silencers as scheduled are to be externally shop applied, and completely sealed to silencer casing. HTL walls are to consist of media, air space, mass, and an outer protective metal skin as required to obtain room noise criteria.

3 EXECUTION

3.01 INSTALLATION OF SILENCERS

.1 Provide silencers. Ensure silencers are installed with airflow arrows in the direction of airflow.

.2 Support each silencer independent of connecting ductwork.

.3 Properly layout ductwork for silencer locations to provide a minimum of 5 diameters of straight duct upstream of silencer and 10 diameters of straight duct downstream of silencer.

.4 Unless otherwise specified, do not install silencers in walls or slabs.

.5 Seal all silencer connections to ducts with proper fire/smoke rated duct sealer.

.6 When silencer installations are complete, arrange, and pay for silencer manufacturer to examine silencer installations. Perform any corrective work required by manufacturer, then obtain from manufacturer and submit a signed letter certifying proper installation and operation of all silencers.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for fans and accessories. Include following:

.1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;

.2 certified sound power data that conforms to specified levels;

.3 product data sheets for all accessories;

.4 product data sheets for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.4 Supply reviewed copies of fan/curb assembly shop drawings or product data to trade who will cut roof openings for fans, and ensure openings are properly located.

.5 Submit a signed copy of destratification fan manufacturer's 5 year extended parts and labour warranty.

1.2 QUALITY ASSURANCE

.1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:

.1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;

.4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;

.5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

2 PRODUCTS

2.1 **ACCEPTABLE MANUFACTURERS:**

.1 Acceptable manufacturers for HVAC fans are:

.1 Greenheck Fan Corp.;

.2 Loren Cook Co.;

.3 Soler & Palau;

.4 PennBarry;

.5 Canarm;

.6 Twin City Fan and Blower.

2.2 CENTRIFUGAL INLINE FANS

.1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.

.2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).

.3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of Section entitled Basic Mechanical Materials and Methods.

.5 TEFC motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.

.6 For fans as scheduled, factory supplied accessories as follows:

.1 for fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, permanently secured in place with no exposed edges;

.2 for fans as scheduled, a galvanized steel filter box with frame suitable for 25 mm (2") thick disposable panel type filters;

2.3 ROOF MOUNTED EXHAUST FANS

.1 Centrifugal, ULC listed, factory run tested roof mounted exhaust fans in accordance with drawing schedule.

.2 Spun aluminium housing with deep venturi inlet, aluminium curb cap with continuously welded corners, pre-punched mounting holes, galvanized steel or aluminium birdscreen, and EMT conduit chase to the motor compartment.

.3 Centrifugal, non-overloading aluminum wheel with backward inclined blades matched to inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and one-piece grease lubricated pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours at maximum catalogue operating speed and equipped with a lubrication fitting, and a heavy-gauge galvanized steel adjustable V-belt drive with guard conforming to requirements of Section entitled Basic Mechanical Materials and Methods.

.5 Motors are to conform to requirements specified in Section entitled Basic Mechanical Materials and Methods, mounted on vibration isolation in a compartment outside of the airstream, and factory pre-wired to a NEMA 4 disconnect switch.

.6 Prefabricated, minimum 300 mm (12") high heavy-duty aluminum roof mounting curb with factory installed wood nailer, 40 mm (1-½") thick insulation, continuously welded seams, and damper tray.

.7 For fans as scheduled, factory supplied accessories as follows:

.1 gravity backdraft damper with #20 gauge galvanized steel frame and #26 gauge aluminum blades with felt edge blade seals;

.2 non-corrosive motorized damper with linkage, end switch, and motor with voltage to match fan motor;

.3 continuous non-corrosive piano type curb hinge to permit access to fan, damper and connecting duct, complete with retaining chain and a security hasp to prevent removal of unit from curb cap and prevent building entry through connecting ductwork;

.4 2-speed switch and 2-speed double winding 1-phase motor in accordance with Section entitled Basic Mechanical Materials and Methods;

3 EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL INLINE FANS

.1 Provide inline centrifugal fans.

.2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer’s instructions.

.3 Ensure duct connections are made using flexible connection material.

.4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.2 INSTALLATION OF ROOF MOUNTED EXHAUST FANS

.1 Provide roof mounted exhaust fans.

.2 Supply a roof mounting curb with each fan and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of roofing work. Secure fans in place on curbs.

.3 Install dampers in curb damper tray and secure in place.

.4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for air terminals. Include following:

.1 capacity and pressure drop;

.2 sound power data to verify conformance with specified sound power levels;

.3 leakage and dimensions;

.4 mounting details to suit locations shown, indicating methods and hardware to be used;

.5 control components and a control wiring schematic.

.2 Submit with shop drawings/product data, a test report in accordance with ANSI/AMCA 210 requirements and ISO 3741, published test data on DIN (Direct Internal Noise) made by an independent testing agency for 2.5 and 6 m/s (8.2 and 19.7 ft/min) branch velocity or inlet velocity, sound power levels with a minimum inlet pressure of 0.25 kPa (0.036 psi) in accordance with ISO 3741 for the 2nd through 7th octave bands, and confirmation pressure loss through a silencer will not exceed 60% of inlet velocity pressure maximum.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Air terminals manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), and terminals are to be in accordance with requirements of following standards:

.1 ANSI/AHRI Standard 880, Performance Rating of Air Terminals;

.2 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.3 International Organization of Standardization (ISO) Standard 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Rooms.

.2 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 Titus;

.3 Nailor Industries Inc.;

.4 Krueger Division of Air System Components Inc.

2 PRODUCTS

2.01 VARIABLE AIR VOLUME (VAV) TERMINAL BOXES

.1 Single duct, controller type, pressure independent variable air volume boxes in accordance with drawing schedule, each individually field adjustable to minimum and maximum air volumes, and complete with:

.1 #22 gauge galvanized steel housing, sealed and gasketed, internally lined with 25 mm (1") thick glass fibre duct lining material with a neoprene coating meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with:

.1 exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC S102 approved sealant;

.2 50 mm (2") long, round inlet duct connection;

.3 rectangular discharge opening with slip and drive cleat duct connection facilities;

.4 protective galvanized steel shroud for controller and damper actuator.

.2 air valve damper, normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure;

.3 air flow sensor located at box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of box with an accuracy of within 5% with a 90° sheet metal elbow located directly at inlet, and amplify the sensed air flow signal;

.4 controller/actuator supplied as part of controls work specified in Section entitled Automatic Control Systems, shipped to box manufacturer’s plant by controls supplier, and factory installed, connected, tested, calibrated and set by box manufacturer;

.5 galvanized steel attenuators, lined as per box housings, each factory supplied loose and with a length in accordance with drawing schedule;

.6 factory tested hot water reheat coils in accordance with drawing schedule, each complete with copper tubes mechanically expanded into plate type aluminum fins, factory mounted in an enclosure insulated with foil faced insulation meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with a quick-opening insulated access panel sized and located for coil inspection and maintenance;

.2 Terminal box to be complete with attenuator or lined discharge duct in place. Maximum sound power levels in decibels and specific static pressure are scheduled on drawings for each size of box.

3 EXECUTION

3.01 INSTALLATION OF TERMINAL BOXES

.1 Provide ceiling mounted terminal boxes.

.2 Secure each box in place from structure by means of galvanized steel angles and hanger rods, independent of connecting ductwork.

.3 Coordinate provision of transformers, actuators and controllers with Controls Contractor.

.4 Connect each box with ductwork as indicated. Provide straight inlet duct same size as box inlet and of a length equal to a minimum of 4 duct diameters. Refer to drawing detail. Coordinate final box adjustments and settings with personnel doing system testing and balancing work.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, and setting and adjusting controls.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for heat exchangers, including accessories.

.2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Heat exchanger equipment is to be stamped with a Canadian Registration Number (CRN).

.2 Heat exchangers and accessories are to be in accordance with following:

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code;

.2 ASME Boiler and Pressure Vessel Code;

.3 governing Provincial and/or Municipal Codes and Regulations.

2. PRODUCTS

2.01 PLATE TYPE HEAT EXCHANGERS

.1 Vertical plate type heat exchangers in accordance with drawing schedule, 1035 kPa (150 psi) working pressure rated, factory pressure tested and complete with:

.1 electro-galvanized carbon steel frames with baked epoxy enamel finish, same end ANSI 150 flanged connections, a fixed end panel and a removable end panel, and molybdenum greased electro-galvanized steel bolts protected by means of sleeves;

.2 type 316 stainless steel plates, fully supported and steered by upper and lower carrying bars to prevent misalignment in both vertical and horizontal directions, space between ports not feeding channels, and channels vented to atmosphere;

.3 one-piece snap-on nitrile rubber gaskets moulded in a groove around heat transfer area and plate portholes, and continually supported along inner and outer edges.

.2 Acceptable manufacturers are:

.1 Taco (Canada) Ltd;

.2 S. A. Armstrong Ltd.;

.3 Bell & Gossett (Xylem);

.4 Alfa Laval Inc.;

.5 Tranter Heat Exchangers (Canada) Ltd.;

.6 APV an SPX Brand;

.7 Danfoss Inc;

.8 GEA Canada Inc.

2.02 EXECUTION

2.03 INSTALLATION OF PLATE TYPE HEAT EXCHANGERS

.1 Provide plate type heat exchangers.

.2 Secure each heat exchanger in place, level, and plumb, on a concrete housekeeping pad.

.3 Connect with piping in accordance with drawing detail.

.4 When installation is complete and piping has been permanently filled, start-up each heat exchanger, check and test all safeties and operating controls, and set controls to design conditions.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.7 Include for a one half day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all make-up air units. Include following:

.1 certified fan performance curves;

.2 certified sound power data;

.3 computer generated psychrometric chart for each cooling coil;

.4 hardware for section-to-section site connections;

.5 dimensioned layouts, including dimensioned curb layouts as applicable;

.6 product data for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection and fire test report as specified in Part 2 of this Section, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.4 Submit spare air filters as specified in Part 2 of this Section.

1.02 QUALITY ASSURANCE

.1 Make-up air units and installation are to be in accordance with requirements of following:

.1 all applicable Provincial Codes and Standards;

.2 CAN/CSA B149, Natural Gas and Propane Installation Codes;

.3 CSA or ETL listed and labelled electrical components.

.2 Unit installation tradesmen are to be journeyman and licensed gas fitters.

1.03 WARRANTY

.1 The warranty period shall commence at the date of Substantial Performance of the Contract as certified by the consultant and shall continue for a period of five (5) years for Labour and ten (10) years for Materials/Parts.

.2 Manufacturer shall furnish a factory trained service technician to perform the unit start-up assistance to the installing contractor with licensed gas personnel. Factory technician to provide copy of start-up log to owner and to demonstrate operation and maintenance to owner's representative.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers of air handling unit are:

.1 Trane – Voyager;

.2 Daikin Industries Ltd. – Rebel Applied;

.3 Envent.

2.02 GENERAL

.1 The units shall be dedicated downflow, horizontal, or mixed airflow configuration. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with AHRI testing procedures.

.2 All units shall be factory assembled, internally wired, fully charged with R-454B refrigerant and 100% run tested to check cooling operation, fan and blower rotation and control sequence before leaving the factory.

.3 Wiring internal to the unit shall be numbered for simplified identification.

.4 Units shall be UL listed to U.S. and Canadian safety standards.

2.03 CERTIFIED AHRI PERFORMANCE

.1 Packaged Rooftop units cooling, heating capacities and efficiencies shall be rated within the scope of the Air-Conditioning, Heating & Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 340-360 (I-P) and ANSI Z83.8/CSA 2.6 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces.

2.04 CASING

.1 Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel phosphatized, and finished with a pre-applied baked polyurethane enamel.

.2 All components shall be mounted in a weather resistant steel cabinet with a painted exterior. Cabinet surface shall be tested 672 hours in salt spray in compliance with ASTM B117.

.3 Fully gasketed removable access panels.

.4 Structural members shall be heavy gauge with access doors and removable panels of heavy gauge.

.5 Provide 1/2 inch thick foil faced fiberglass insulation on all exterior panels and roof in contact with the return and conditioned air stream. Where top cover seams exist, they shall be double hemmed and gasket sealed to prevent water leakage.

.6 Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have handles and shall be removable while providing a water and air tight seal. Control box access shall be hinged.

.7 The indoor air section shall be completely insulated with fire resistant, permanent, odorless, foil faced glass fiber material.

.8 The base of the unit shall have provisions for crane lifting.

2.05 FILTERS

.1 MERV 14, 100mm (4") "high efficiency" filters.

.2 Provide six (6) full sets of replacement filters with unit.

2.06 COMPRESSORS

.1 The 3-D Scroll shall include a direct-drive, 3600 rpm, suction gas cooled hermetic motor.

.2 Dependent on the compressor model, motor protection shall be provided by either a patented motor cap and integral line break motor protector or an external 24 Vac module which provides protection against incorrect phase sequence, excess motor temperatures, over current protection, and phase loss.

.3 Trane 3-D compressor shall include centrifugal oil pump, scroll tips seals, internal heat shield that lowers the heat transfer from discharge and suction gas, oil level sight glass and oil charge valve. Where required, compressor models shall also provide a dip tube that allows for oil draining, in addition to a low leakage internal discharge check valve to help prevent refrigerant migration.

.4 Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.07 COMPRESSOR STAGING OPTION

.1 The compressor staging option shall provide five stages of mechanical cooling with the ability to be at or below 25% compressor displacement at stage one.

2.08 REFRIGERANT CIRCUITS

.1 Each refrigerant circuit shall have independent thermostatic expansion devices, service pressure ports and refrigerant line filter driers factory-installed as standard. An area shall be provided for replacement suction line driers.

2.09 LEAK DETECTION SENSORS

.1 Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 4 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.

2.10 COILS (HEAT PUMP)

.1 Coils shall be internally finned Copper tubes mechanically bonded to high performance Aluminum plate fins.

.2 All coils shall be leak tested at the factory to ensure pressure integrity.

.3 The evaporator coil is pressure tested to 450 psig and the condenser coil at 650 psig. All dual circuit evaporator coils shall be of intermingled configuration.

.4 Sloped condensate drain pans are standard.

2.11 OUTDOOR FANS

.1 The outdoor fan shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection in a weather tight casing.

2.12 INDOOR FAN

.1 Units shall have belt driven, FC, centrifugal fans with fixed motor sheaves. Complete fan assemblies shall be statically and dynamically balanced. Fan shaft shall be mounted on grease lubricated ball bearings. All motors shall be circuit breaker protected. All 50 Hz indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT). All 60 Hz indoor fan motors meet the Energy Independence & Security Act of 2007 (EISA).

2.13 VARIABLE FREQUENCY DRIVES (VFDS)

.1 VFDs shall be factory installed and tested to provide supply fan motor speed modulation. If the unit is configured for traditional VAV control, the VFD shall receive a signal from the unit controls via Modbus communication based upon supply static pressure and shall cause the drive to accelerate or decelerate as required to maintain the supply static pressure setpoint. The VFD shall receive a feedback signal from the unit controls via Modbus communication based on zone demand if configured for Single Zone VAV control and shall cause the drive to accelerate or decelerate as required to maintain the load of the zone. When subjected to high ambient return conditions the VFD shall reduce its output frequency to maintain operation. Bypass control to provide full nominal air flow in the event of drive failure shall be provided.

2.14 GAS HEATING SECTION

.1 The heating section shall have a tubular heat exchanger(s) design with primary and secondary surfaces of corrosion resistant aluminized steel or optional stainless steel (all modulating gas heat units shall have stainless steel).

.2 Heat exchangers shall have a tubular design with in-shot burners. Direct spark ignition shall be provided. All tubes shall be dimpled for proper heat transfer. Heating system shall incorporate induced draft fans and include a chimney that exhausts away from the air intake.

.3 Two stage and modulating gas heat units will be suitable for use with natural gas or propane (field installed kit).

.4 Modulating gas turn down ratio on high fire units shall be accomplished by allowing the furnaces to act independently of one another. The modulating bank shall be activated first and is allowed to modulate itself to meet the heating needs. If the modulating bank is unable to meet the need at high fire, the second bank shall be turned on and then the first bank again modulates to the appropriate level. This system shall create a range of capacity from low fire on the modulating bank to high fire of both furnaces together.

2.15 ECONOMIZER

.1 Economizer shall be factory installed. The assembly includes: fully modulating 0-100 percent motor and dampers, minimum position setting(s), preset linkage, wiring harness, and fixed dry bulb control. Differential enthalpy control shall be provided.

2.16 CLOGGED FILTER INDICATION

.1 This optional factory installed differential pressure switch allows dirty filter indication at the zone sensor with service LED. When closed, the dirty filter switch will light the service LED on the zone sensor and allow the unit to continue normal operation.

2.17 CONDENSER COIL GUARDS

.1 Factory installed condenser vinyl coated wire mesh coil guards shall be available to provide full area protection against debris and vandalism.

2.18 GFI CONVENIENCE OUTLET (FIELD POWERED)

.1 A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed and shall be field powered by 115V circuit.

2.19 HINGED SERVICE ACCESS

.1 Filter access panel and supply fan access panel shall be hinged for ease of unit service.

2.20 MODULATING GAS

.1 Modulating Gas Heaters shall be made from grades of stainless steel suitable for condensing situations. The natural gas heater shall have a turn down ratio of 10:1.

2.21 NON-FUSED DISCONNECT SWITCH

.1 A factory installed non-fused disconnect switch with external handle shall be provided and shall satisfy NEC requirements for a service disconnect. The non-fused disconnect shall be mounted inside the unit control box.

2.22 PHASE MONITOR

.1 Standard on all Voyager 3 units. Protects 3-phase equipment from phase loss, phase reversal, and phase unbalance. Any fault condition shall send the unit into an emergency stop condition that shall not require field adjustments for resets. cULus approved.

2.23 ROOF CURB

.1 The roof curb shall be designed to mate with the unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb when used with downflow units. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips.

2.24 SERVICE VALVES

.1 Discharge service valve standard with all units. Suction service valve optional.

2.25 STAINLESS STEEL DRAIN PANS

.1 Sloped stainless steel evaporator coil drain pans shall be durable, long-lasting and highly corrosion resistant.

2.26 CONDENSATE OVERFLOW SWITCH

.1 This option shall shut the unit down in the event that a clogged condensate drain line prevents proper condensate removal from the unit.

2.27 STAINLESS STEEL HEAT EXCHANGER

.1 Stainless steel heat exchangers shall be durable, long-lasting and highly corrosion resistant.

2.28 THROUGH-THE-BASE ELECTRICAL PROVISION

.1 An electrical service entrance shall be provided which allows access to route all high and low voltage electrical wiring inside the curb, through the bottom of the outdoor section of the unit and into the control box area.

2.29 ENERGY RECOVERY SYSTEM

.1 Energy Wheel:

.1 The rotor media must be made of aluminum, which is coated to prohibit corrosion; etched, polymer, or oxidized surfaces are not acceptable.

.2 All surfaces must be coated with a non-migrating adsorbent layer of desiccant prior to being formed into the honeycomb media structure to insure that all surfaces are coated and that adequate latent capacity is provided.

.3 The desiccant must be designed for the adsorption of water vapor. Equal sensible and latent recovery efficiencies must be clearly documented through a certification program conducted in accordance with ASHRAE 87-78P and ARI 1060 standards.

.4 The certification must have been conducted by a qualified independent organization. The cross-contamination and performance certification reports must be provided for engineering review as part of the submittals for this project.

.5 The media shall be cleanable with low temperature steam, hot water or light detergent without degrading the latent recovery. Dry particles up to 800 microns shall freely pass through the media. Wheel media shall be independently tested and shown to have a flame spread of less than 25 and a smoke generation rating of less than 50 when tested in accordance with ASTM-E-87.

.6 The wheel media “flutes” shall have laminar flow and the openings shall allow particles to pass without clogging. Larger particles can collect on the face and be removed as the wheel turns to the exhaust side. This non clogging feature allows the wheel to be used without filters with only periodic cleaning of the face, with compressed air and a mild cleaner such as 409, thus reducing costly filter maintenance costs.

.2 Bypass: Wheel section will be capable of taking in 100% outside air around the wheel during the unit’s economizer cycle.

.3 Purge Sector: The unit must be provided with a factory set, field adjustable purge sector designed to limit cross-contamination of the exhaust air stream concentration when operated under appropriate design conditions.

.4 Rotor Seals:

.1 The rotor shall be supplied with labyrinth seals, which at no time are required to make contact with any rotating surface of the exchanger media.

.2 These multi-pass seals shall utilize four labyrinth stages for optimum performance.

.5 Rotor Support System:

.1 The rotor media must be provided in segmented fashion to allow for field replacement of one section at a time.

.2 The media shall be rigidly held by a structural spoke system made of extruded aluminum.

.6 Wheel Housing:

.1 The rotor housing must be a structural framework that limits the deflection of the rotor due to air pressure loss to less than 1/32 inch.

.2 The housing sheet metal shall be made of galvanized steel to prevent corrosion.

.3 The rotor shall be supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system.

.7 Drive System:

.1 The rotor must be driven by a self adjusting belt system.

.2 An A/C motor is utilized for constant and variable speed applications.

.8 Installation: The rotor must be installed in the RTU by the RTU manufacturer for single-point power and single-point lift. Field-installation or bolt-on modules are not acceptable.

3. EXECUTION

3.01 INSTALLATION OF SEMI-CUSTOM ROOFTOP UNITS

.1 Provide outdoor modular air handling units on roof.

.2 Provide required rigging and hoisting/moving equipment required to move units to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Locate curbs on roof where required for installation and flashing into roof construction as part of roofing work of Division 07. Secure units in place, level, and plumb, on gasketing material.

.4 Remove fan base hold-down clamps and other shipping restraints and protective packaging.

.5 Carefully coordinate installation of each unit with other trades making connections to unit, in particular, control connections.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start- up requirements.

.7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification. Submit a copy of the letter prior to Substantial Performance.

.8 Include for a one half day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all make-up air units. Include following:
.1 certified fan performance curves;
.2 certified sound power data;
.3 computer generated psychrometric chart for each cooling coil;
.4 hardware for section-to-section site connections;
.5 dimensioned layouts, including dimensioned curb layouts as applicable;
.6 product data for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection and fire test report as specified in Part 2 of this Section, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.4 Submit spare air filters as specified in Part 2 of this Section.

1.2 QUALITY ASSURANCE

.1 Air handling units and installation are to be in accordance with requirements of the following:
.1 all applicable Provincial Codes and Standards;
.2 CAN/CSA B149, Natural Gas and Propane Installation Codes;
.3 CSA or ETL listed and labelled electrical components.

.2 Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

.3 Air handling units shall be ETL-Canada safety listed to conform to UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on ARI Standard 410.

.4 Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

.5 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

1.3 WARRANTY

2. The warranty period shall commence at the date of Substantial Performance of the Contract as certified by the consultant and shall continue for a period of five (5) years for Labour and ten (10) years for Materials/Parts.

.1 Manufacturer shall furnish a factory trained service technician to perform the unit start-up assistance to the installing contractor with licensed gas personnel. Factory technician to provide copy of start-up log to owner and to demonstrate operation and maintenance to owner's representative.

3. PRODUCTS

3.1 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers of Custom Indoor Air Handling Units are:
- .1 EnVent;
- .2 Trane – Custom;
- .3 Daikin – Vision.

3.2 CASING

.1 Fabricate unit with 16 gauge nominal channel posts and panels secured with mechanical fasteners. All panels and access doors shall be sealed with bulb-type gasket.

.2 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick, thermal broke double wall assembly, injected with foam insulation for an R-value of not less than R-13. The outer casing shall be constructed of heavy gauge G90 galvanized steel phosphatized and painted with baked on enamel.

.3 The inner liner shall be constructed of G90 galvanized steel. Panel deflection shall not exceed L/240 at 125% of design static pressure, minimum +/- 8”. Deflection shall be measured at the midpoint of the panel height.

.4 The casing leakage rate shall not exceed 0.5 cfm per square foot of cabinet area at 6 inches of negative static pressure or 5 inches of positive static pressure.

.5 Access doors shall be flush mounted to the cabinetry and secured with heavy-duty stainless steel hinges. The door latch handle assembly shall be provided with a full-size grip handle and roller pall for smooth operation. The assembly shall be gasketed and sealed to prevent thermal bridging. All access doors shall open against pressure. (Provide inspection window for each access door).

.6 Construct drain pans from stainless steel with cross break and pitch to drain connection. Provide drain pans under cooling coil section and humidifier sections.

.7 All outdoor units mounted on roof curbs with openings to the conditioned space below, shall be designed with a drip shield under the unit to catch and remove any potential moisture created by condensation.

.8 Provide unit with a factory installed full perimeter channel base rail.

.9 Floor plate shall be constructed of 20 gauge G90 galvanized steel.

3.3 MIXING SECTION & ECONOMIZER SECTION

.1 Provide mixing box sections with factory mounted low leak airfoil outside and return air dampers of galvanized steel in galvanized frame. Dampers shall be hollow core airfoil blades, fully gasketed. Provide continuous vinyl seals between damper blades. Provide stainless steel end seals along end of dampers. Provide linkage and ABS plastic end caps provided.

.2 Provide economizer section with factory mounted low leak hollow core airfoil blade outside, and return dampers, and exhaust damper. Dampers shall be constructed of galvanized steel in galvanized frame. Provide fully gasketed outside exhaust, and return dampers. Provide continuous vinyl seals between damper blades. Provide stainless steel end seals along end of dampers. Provide linkage and ABS plastic end caps.

.3 Damper leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate shall be tested in accordance with AMCA Standard 500.

3.4 FILTERS

.1 Provide filter box section with filter guides, hinged and latching access doors as shown on drawings, for side loading of filters. Where applicable, front loading filters shall be accessed via upstream access section.

.2 Filter media shall be UL 900 listed, Class I or Class II.

.3 Provide extended surface filter box with holding frames suitable for (2") MERV 8 pleated panel prefilter and (4”) MERV 13 final filter, media and blank-off sheets, extended surface cartridge media filters.

.4 Provide Minihelic filter gauges for each filter bank flush mounted into unit casing with factory mounted probes.

3.5 FANS

.1 Provide forward curved or air foil fans as scheduled. Dynamically balance fans before and after installation in fan cabinet section. Ensure maximum fan RPM is below the first critical speed fan.

.2 Locate fan and motor internally on a steel base. Factory mount motor on a slide base that can be slid out of unit. Provide access to motor, drive and bearings through hinged access door. Provide fan and motor assembly mounted on (2") deflection spring vibration isolators inside cabinet.

.3 Provide self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit. Provide grease fittings attached to fan base assembly near access door.

.4 Bearings and Drives (not applicable to fan array)

.1 Provide bearings with basic load rating computed in accordance with AFBMA - ANSI Standards, L-50 life at 200,000 hours, heavy duty pillow block type, self-aligning, grease-lubricated ball bearings.

.2 Provide solid, hot rolled steel, ground and polished shaft, protectively coated with lubricating oil.

.3 Provide variable pitch sheaves on all motors 7 1/2 HP and lower. Provide constant pitch sheaves on all motors greater than 7 1/2 HP sizes V-belt drive for a service factor of 1.25. On constant pitch units, allow for one sheave change including belts (parts only, labour by balancing contractor).

.5 Provide TEFC premium efficiency motors.

.6 Inverter duty rated motors shall be supplied with a factory installed shaft grounding kit. The kit shall consist of brushes or conductive rings with micro fibers which divert unwanted shaft currents away from the bearings to the ground.

3.6 COILS

.1 Provide access to coils as shown on drawings for service and cleaning. Enclose coil headers and return bends fully within unit casing. Fabricate coil connections, vents and drains to extend beyond unit casing including gromments for an airtight unit casing. Coils shall be removable

through side panels and/or top panels of unit without removal and disassembly of entire section.

.2 Provide stainless steel drain pan located underneath and extending downstream of coil and intermediate drain pans.

.3 Coil performance shall be as per schedule. Coil performance data shall be certified in accordance with ARI Standard 410 where applicable.

.4 Construction:

.1 Tubes: Copper.

.2 Fins: Aluminum mechanically bonded to tubes.

.3 Headers: Seamless copper with vent and drain connections.

.4 Casing: 16 gauge, galvanized steel channels with 16 gauge center and end supports.

.5 Water cooling and heating coils shall be circuited drainable with a vent connection at the highest point and a drain connection at the lowest point. Coil headers shall be copper with steel male pipe connections.

.6 Refrigerant cooling coils shall be designed for use with Refrigerant noted in schedules. Sweat type copper suction connections shall be located at the bottom of the suction headers for gravity oil drainage.

3.7 ACCESS

.1 Provide access doors of galvanized steel flush mounted, with gasket, latch and handle assembly. Provide stainless steel drip pan in access section.

3.8 ENERGY RECOVERY WHEEL

.1 Provide enthalpy wheels factory installed in units where scheduled.

.2 Energy recovery wheel shall be constructed of corrugated synthetic fibrous media. All surfaces shall be coated or uniformly bound with a non-migrating absorbent specifically developed for the selective transfer of water vapor.

.3 Media shall be engineered to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. The rotor media shall be capable of being cleaned with low temperature steam without degrading unit performance.

.4 The desiccant material shall be a molecular sieve, and specifically a 4A or smaller molecular sieve to minimize cross contamination.

.5 The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. Adjustable brush seals must be provided along the periphery of the rotor and between the inlet and outlet air passages to effectively prevent air leakage and cross-contamination between airflows.

.6 Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing. Cassettes shall have a built in adjustable purge section minimizing cross contamination of supply air. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged or pillow block bearings.

.7 The rotor drive system shall consist of a self-adjusting belt around the rotor perimeter driven by an AC motor with gear reduction. The variable speed drive shall be specifically designed for heat wheel applications and include: an AC inverter, soft start/stop, rotation detection w/alarm contacts, automatic self-cleaning jog cycle, and self-testing capability. The speed controller shall be capable of accepting a potentiometer, VDC, or mA control signal.

.8 The wheel shall be ARI certified by the energy recovery wheel supplier to ARI Standard 1060 and must bear the ARI certification stamp. Private independent testing performed "in accordance with" various standards is not a substitute for ARI certification and shall not be accepted. The wheel shall be listed or recognized by UL or equivalent.

3.9 GAS HEATING SECTION

.1 Where shown on plans, furnish and install a Gas-fired Section. Furnace shall have a minimum thermal efficiency of 80%. The module shall employ tubular heat exchangers with a draft inducer assembly to provide for positive venting of flue gases.

.2 Tubular heat exchanger shall be constructed of 16 gauge, minimum, type 304 stainless tubes, 2 1/4" diameter having a minimum tube wall thickness of .049" and shall be produced to ASTM A249 construction standards for heat exchanger application. Tubes shall employ integral formed-dimple restrictors to eliminate noise associated with expansion and contraction of internal baffles during heating cycles, and to provide for unobstructed drainage of condensate that occurs in the tubes during cooling operation. Drainage shall be configured so that burners and burner surfaces are not exposed to condensate during cooling system operation.

.3 The furnace shall have the modulating control. Shall control the firing rate between 25% and 100% of rated capacity. Stepped modulation is not acceptable.

.4 All burners shall include an ignition control, roll out switch and air proving switch. Additionally, on full modulation models a fan relay, delay timer and high fire gas valve control relay shall be included. Burners shall accept either 0 to 10vDC or 4 to 20ma input signals (signal provided by others). Two independent and adjustable (when compared to the analog input signal) SPDT relays shall be provided for fan and valve control.

3.10 UNIT ELECTRICAL

.1 Optional: Provide factory mounted and wired starters for each fan motor. Each starter shall have a Hand-OFF-Auto control switch, thermal overload and disconnect switch.

.2 Fan arrays shall be wired to a single source motor control panel with short circuit protection and non fused disconnect factory wired from the panel to the motors. Refer to spec section 20 05 30 for variable speed drive details.

.3 Unit manufacturer shall provide wiring from each fan motor to a non fused disconnect type disconnect switch. Disconnect switch shall be furnished with a rotary or switch-blade type handle that can be padlocked in the OFF position.

.4 Supply a factory installed hand-off-auto switch

.5 Provide lights in all access sections. Lights shall be wired to an ON-OFF switch mounted on the outside of the cabinet. Interconnecting wiring between split sections shall be field supplied and installed.

4. EXECUTION

4.1 INSTALLATION OF SEMI-CUSTOM INDOOR AIR HANDLING UNITS

.1 Provide semi-custom indoor air handling units.

.2 Provide required rigging and hoisting/moving equipment required to move units to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Site assemble units shipped in sections in strict accordance with unit manufacturer's instructions.

.4 Secure base mounting units in place, level, and plumb, on a concrete pad.

.5 Remove fan base hold-down clamps and other shipping restraints and protective packaging.

.6 Carefully coordinate the installation of each unit with other trades making connections to unit, in particular, control connections.

.7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.8 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements. Submit a copy of the letter prior to Substantial Performance.

.9 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

.2 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this Section.

.3 Submittals shall include the following: performance and capacity details of all units at specified indoor and outdoor conditions, piping schematics outputted from manufacturer specific software including pipe sizes and estimated piping lengths, refrigerant charge per system including CSA B52 analysis, wiring diagrams, and 10 year parts only warranty information.

.4 Submittal shall include a copy of the installing contractor's certification of VRF manufacturer approved training.

1.02 QUALITY ASSURANCE

.1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:

.1 all applicable Provincial Codes and Standards;

.2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

2 PRODUCTS

2.01 GENERAL

.1 This section includes the design, performance, refrigerant details, controls and installation requirements for Variable Refrigerant Flow Systems

.2 All units shall be listed and rated by ANSI/AHRI Standard 1230-2010 and meet all minimum IEER performance requirements as scheduled.

.3 The units shall be CSA approved, ANSI/UL STD 1995 listed and listed by Electrical Testing Labs (ETL) and bear the cETL label.

.4 All wiring shall be in accordance with the National Electric Code (NEC).

.5 The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

.6 The system and the design shall be in compliance with CSA B52 Mechanical Refrigerant Code.

2.02 ACCEPTABLE MANUFACTURERS ARE:

.1 LG;

.2 Mitsubishi Electric Sales Canada Inc.;

.3 Daikin Industries Ltd;

.4 Samsung.

2.03 SYSTEM DESCRIPTION

.1 Per the equipment schedule, the variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system (or approved equal).

.2 The Y-Series system shall consist of a PUMY outdoor unit, and M-NET DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

2.04 START-UP AND WARRANTY

.1 The units shall be covered by the manufacturer’s limited warranty for a period of one (1) year from date of commissioning.

.2 If the systems composing the units are:

.1 Installed by a contractor that has successfully met the manufacturer’s requirements for service training; AND

.2 Verified with a completed commissioning report submitted to and approved by the manufacturer,

.3 then the units shall be covered by an extended manufacturer’s limited warranty for a period of five (5) years from date of commissioning.

.4 In addition, the compressor(s) of the units shall have a manufacturer’s limited warranty for a period of seven (7) years from date of commissioning.

.5 If, during the above period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

.6 This warranty shall not include labour.

.7 Installing contractor shall meet the manufacturer’s requirements to obtain an extended manufacturer’s limited parts and compressor warranty for a period of ten (10) years to the original owner from date of commissioning. This extended warranty shall not include labour.

.8 All manufacturer technical and service manuals shall be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

.9 The VRF system shall be installed by a contractor with extensive install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

2.05 OUTDOOR HEAT PUMP UNIT

.1 The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Controls Session. The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

.2 Outdoor unit shall have a sound rating no higher than 65 dB(A) individually or 70 dB(A) twinned. Units shall have night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

.3 Both refrigerant lines from the outdoor unit to the indoor unit(s) shall be insulated in accordance with the installation manual.

.4 The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

.5 Outdoor unit shall be able to connect to up to 50 indoor units depending upon model and configuration.

.6 The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

.7 The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

.8 The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.

.9 The outdoor unit shall be capable of operating in heating mode down to -13F ambient temperatures or cooling mode down to 23F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

.10 Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.

.11 Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

.12 Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.

.13 The outdoor unit shall be provided with a manufacturer supplied snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

.14 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

.15 Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.

.16 Unit Cabinet:

.1 The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

.2 Outdoor unit components shall be coated with the Seacoast Protection Coating (Brine Spray – BS coating) to protect components from premature corrosion due to a seacoast environment. Coating shall be applied to components before original outdoor unit assembly to ensure manufacturer quality standards are not compromised and shall meet the following minimum requirements:

.1 ≥85µm thermoset polyester-resin powder coating on External Front Panel

.2 ≥70µm thermoset polyester-resin powder coating on External Panel Base, Pillar, Compressor Cover, Fan Motor Support, Electrical Box

.3 ≥1µm cellulose and polyurethane-resin coating on heat exchanger fins

.4 ≥10µm polyurethane coating on printed circuit boards

.3 The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.

.4 Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately

.17 Fan:

.1 Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.32 in. WG external static pressure via dipswitch.

.2 All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

.3 All fan motors shall be mounted for quiet operation.

.4 All fans shall be provided with a raised guard to prevent contact with moving parts.

.5 The outdoor unit shall have vertical discharge airflow.

.18 Refrigerant

.1 R410A refrigerant shall be required for systems.

.2 Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

.3 Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

.4 All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

.5 Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

.19 Coil:

.1 Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil.

.2 The coil fins shall have a factory applied corrosion resistant blue-fin finish.

.3 The coil shall be protected with an integral metal guard.

.4 Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

.5 The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

.6 The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

.7 Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed in markets where the outdoor unit will see temperatures below freezing.

.8 Unit shall have prewired plugs for optional panel heaters.

.20 Compressor:

.1 Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.

.2 Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting “belly-band” type crankcase heaters are not allowed. Manufacturer’s that utilize belly-band crankcase heaters will be considered as alternate only.

.3 The outdoor unit compressor shall have an inverter to modulate capacity. The operating range shall be completely variable with range down to 15% depending upon unit capacity, operation, and configuration.

.4 The compressor will be equipped with an internal thermal overload.

.5 Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

.6 Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

.21 Controls:

.1 Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand.

.2 The unit shall be an integral part of the system & control network described in section under Control and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

.3 Each outdoor unit module shall have the capability of multi levels of demand control based on external input.

.22 Electrical:

.1 The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.

.2 The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).

.3 The outdoor unit shall be controlled by integral microprocessors.

.4 The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.06 LOCAL CONTROLS

.1 The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

.2 The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

.3 System controls and control components shall be installed in accordance with the manufacturer’s written installation instructions.

.4 Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

.5 System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

.6 Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

.7 System shall be capable of email generation for remote alarm annunciation.

2.07 BACNET MS/TP DEVICES

.1 Provide VRF system with the ability to connect to the building BMS with BACnet Application Specific Controller (B-ASC) via BACnet IP or MS/TP.

.2 B-ASC device shall enable a direct connection to a BACnet IP or MS/TP master device (SCADA, PLC, DDC or equivalent) via an CAT6 or EIA485 network.

.3 B-ASC shall be wired and installed by the BMS contractor. B-ASC shall not require external power.

.4 VRF manufacturer shall commission the BACnet devices. BMS contractor shall provide VRF manufacturer with the address points for commissioning.

.5 All programming for monitoring and control of VRF system via the BACnet IP or MS/TP devices shall be by BMS contractor, as per the Sequence of Operation.

2.08 ELECTRICAL

.1 Independent electrical power for fan coils shall be 208/230 volts, 1 phase, 60 hertz. The unit shall be capable of operating within the limits of 187 volts to 253 volts.

.2 Unless limited by local electrical codes and standards, multiple fan coils can be connected to the same breaker. Field provided individual disconnect switches for each fan coil are required.

.3 Electrical power for condensing units shall be 208/230 volts, 1 phase, 60 hertz. The unit shall be capable of operating within the limits of 187 volts to 253 volts.

.4 The control voltage between the indoor and outdoor unit shall be 16VDC. The control wiring shall be communication type stranded non-shielded 18-2 AWG.

.5 Control wiring shall be installed in a daisy chain configuration between all VRF components as per Manufacturer.

3 EXECUTION

3.01 INSTALLATION OF VARIALBLE REFRIGERANT FLOW HVAC EQUIPMENT

.1 Provide variable refrigerant flow HVAC equipment.

.2 Install condensing units on a flat surface level within 1/8 inch, and elevated a minimum of 18” from ground or roof surface. Provide intermediate supports as recommended by the equipment manufacturer.

.3 Provide all necessary control wiring as recommended by the manufacturer.

.4 High/low pressure gas line, liquid, and suction lines must be individually insulated between the outdoor and indoor units.

.5 Contact manufacturer prior to installation to review and confirm piping layout and lengths.

.6 Use refrigeration best practice to allow pipes to expand and contract freely. Review manufacturer installation instructions to ensure expansion joints are properly designed.

.7 Pressure test ALL systems to 550 PSI after system was vacuumed and held to below 500 microns for at least one hour. Review manufacturer installation instructions for proper pressure test procedures.

.8 Design and install all piping as per TSSA and CSA B52 regulations, and apply and obtain TSSA certification for all systems.

.9 Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained controls system configuration and operation. The representative shall provide proof of certification indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for radiation units, including accessories, and any required control wiring schematics.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

1.2 QUALITY ASSURANCE

.1 Each Units shall be fully tested at the factory.

.2 All aluminum components shall be certified to meet ASTM G53 UV-resistance

.3 Surface temperature remains safe at all times based on DHSS DN 4 1992 regulation and subsequent revision.

.4 All units shall be individually packaged and labeled for eased on site locating and installation

2 PRODUCTS

2.1 FIN-TUBE TYPE DIRECTION RADIATION

.1 Wall-fin convectors complete with:

.1 copper-aluminum elements consisting of minimum 32 mm (1-¼") IPS seamless copper tubing mechanically expanded into and permanently bonded to 110 mm (4-½") square plate type aluminum fins;

.2 enclosures, as indicated on drawings, each removable and constructed of #16 gauge cold rolled steel, factory cleaned, phosphatized and finished with primer, and equipped with stamped grilles, flush slip joint enclosure to enclosure joints where required, access doors for valve access, and any required enclosure trim such as column to column extension pieces, column enclosures, etc.;

.3 continuous minimum #20 gauge steel top support wall guard strip prime coat painted as for enclosure and arranged to maintain the top back edge of enclosure 20 mm (¾") from face of wall, enclosure supports with enclosure locks constructed and finished as for wall strip and designed to hook onto top strip, and steel element support cradles which attach to slots in wall guard strip;

.2 Acceptable manufacturers are:

.1 Engineered Air;

.2 Sigma Corporation;

.3 Rosemex Inc.;

.4 Slant/Fin Ltd.

2.2 LINEAR RADIANT CEILING PANELS

.1 Continuous linear radiant ceiling panels sized and arranged as shown and scheduled on drawings, complete with:

.1 extruded aluminum panels with aluminum saddles to secure 12 mm (½") diameter type "L" copper piping, non-hardening heat conductive paste between piping and panels, and a white finish factory applied to face of each panel;

.2 cross channel braces in quantities as recommended by panel manufacturer to suit panel length, and end and centre clips;

.3 all required type "L" copper piping return bends and connection fittings.

.2 Acceptable manufacturers are:

.1 Adair Industries "Airtex";

.2 Rosemex Inc;

.3 Giacomini;

.4 TWA Panel Systems Inc.;

.5 Sigma Corp.

3 EXECUTION

3.1 INSTALLATION OF FIN-TUBE DIRECT RADIATION UNITS

.1 Provide fin-tube type direct radiation units.

.2 Secure enclosure brackets in place at maximum 900 mm (35") centres and install element supports or cradles. Slope elements to ensure proper water circulating and to eliminate air. Ensure enclosures are level and plumb. Provide required enclosure accessories.

.3 Connect elements with piping. Provide radiator type valves in piping at each element or group of series connected elements, shut-off type in supply piping, balancing type in return piping. Unless otherwise noted or specified, locate valves and accessories inside enclosures or behind trim, and ensure valves are accessible.

.4 Where 2 or more heating elements are connected in series, join elements with piping the full size of the element tubes or use piping sized to supply pipe size and connect elements with eccentric fittings.

.5 Equip each element or group of series connected elements with a manual air vent installed in an accessible location.

3.2 INSTALLATION OF RADIANT CEILING PANELS

.1 Provide linear radiant ceiling panels. Install cross channel braces, end and centre clips in accordance with panel manufacturer’s details.

.2 Secure panels in place on T-bars and/or wall channel moulding provided as part of suspended ceiling system work, and provide ceiling hanger wire at 1.2 m (48") centres between structure and cross channel braces.

.3 Interconnect radiant panels by means of 12 mm dia. (1/2") soft copper tubing or connection accessories supplied with panels, as required. Ensure heating piping system has been flushed and cleaned prior to connecting radiant panels.

.4 Personnel handling unprotected panels are to wear clean white gloves to avoid soiling panel face finish.

.5 When installation of the panels is complete, cover the top of active panels with 25 mm (1") thick glass fibre batt insulation.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for motorized heaters, including accessories.

.2 Submit a site start-up report from manufacturer's representative as specified in Part 3 of this Section.

2. PRODUCTS

2.1 UNIT HEATERS

.1 CSA certified hot water unit heaters in accordance with drawing schedule, each complete with:

.1 for horizontal unit casing, minimum #20 gauge die-formed steel front and back casing halves with formed ribs and rounded corners, both halves secured together top and bottom with screws and equipped with threaded hanger rod connections in the top, a formed fan venturi with bolt-on wire grid guard in the back, and a rectangular formed discharge opening with adjustable horizontal and vertical air deflectors in the front;

.2 factory applied casing finish, consisting of electrostatically applied baked powder epoxy on cleaned and primed casing surfaces;

.3 factory leak tested heating coil, consisting of minimum 16 mm (5/8") OD seamless copper tubing mechanically expanded into and permanently bonded to continuous plate type aluminum fins, and equipped with screwed steel supply and return piping connections and silver braced tube joints;

.4 continuous duty TEFC motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, direct connected to a balanced propeller type fan wheel with aluminum blades secured to a steel hub;

.2 Acceptable manufacturers are:

.1 Modine Manufacturing Co.;

.2 Rosemex Inc.;

.3 Armstrong-Hunt Inc.;

.4 McQuay International;

.5 Sigma;

.6 Engineered Air.

2.2 **CABINET UNIT HEATERS**

.1 CSA certified hot water cabinet unit heaters in accordance with drawing schedule, each complete with:

.1 cabinet, of welded fabrication, constructed from one-piece top and sides, and one-piece partition panels and backsheet, both die-formed from single sheets of minimum #18 gauge insulated furniture grade steel and complete with minimum 825 mm (32-½") space at each end for piping and wiring, stamped grilles where required, and, for surface floor and wall mounted cabinets, key lock access doors for access to valves and speed controls;

.2 #16 gauge removable front panel with tamperproof fasteners, stamped grille where required, and insulation applied to the inside face;

.3 for all exposed cabinet surfaces, a baked enamel prime coat finish applied to cleaned metal surfaces;

.4 factory leak tested heating coil, consisting of seamless copper tubing mechanically expanded into and permanently bonded to continuous plate type aluminum fins, and equipped with screwed steel supply and return piping connections and silver brazed tube joints;

.5 removable galvanized steel fan board with centrifugal forward curved, formed aluminum fan wheel(s) with galvanized steel housings, direct connected to a continuous duty, three-speed, permanent split capacitor motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods;

.6 permanent, cleanable aluminum mesh filter;

.2 Acceptable manufacturers are:

.1 Modine Manufacturing Co.;

.2 Rosemex Inc.;

.3 Armstrong-Hunt Inc.;

.4 McQuay International;

.5 Sigma;

.6 Engineered Air.

3. EXECUTION

3.1 INSTALLATION OF MOTORIZED HEATERS

.1 Provide motorized heaters.

.2 Secure unit heaters in place at proper height by means of hanger rods attached to structure. Ensure heaters are level and plumb. Confirm exact locations prior to roughing-in.

.3 Carefully coordinate installation of cabinet heaters with trades constructing building surfaces in or on which heaters are located. Confirm exact locations prior to roughing-in.

.4 Connect with piping in accordance with drawing detail.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 4 hour on-site heater operation demonstration and training session. Training is to be a full review of all components including but not limited to construction details, operation, and maintenance.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The BAS shall efficiently manage and optimize systems and equipment to minimize energy consumption and prolong equipment life, adapting to variations in loads, occupancies, schedules, and weather conditions.

.2 The BAS shall operate on a management-by-exception concept, capable of self-operation based on programmable schedules, events, etc., requiring minimal manual intervention and supervision.

.3 The Building Automation System shall elevate building efficiency while providing a user-friendly interface for monitoring and managing the building.

.4 The Building Automation System shall encompass all necessary hardware, software, and network communication capabilities to facilitate scheduling, monitoring, trending, historical storage, alarm functions, and management of building equipment and systems.

.5 Control capabilities shall encompass but not be limited to; time-of-day scheduling, direct digital control, custom control, Boolean logic, optimum start/stop, duty cycling, electrical demand control, temperature control, after-hours override, reports and logs, trend prints, remote communications, alarm logging, run time and maintenance, and expanded informational messages.

.6 The Building Automation System shall enable full user operation with a minimal training requirement. It shall feature an English language display, with both user prompts and a "help" user tutorial.

.7 Prior to submitting a tender for existing sites, conduct a preliminary visit to familiarize oneself with on-site conditions and the existing equipment.

.8 Conform to the General Mechanical requirements of the Mechanical Division

.9 Conform to the General Electrical requirements of the Electrical Division

1.2 WORK INCLUDED

.1 The installation of the control system will be carried out by the control subcontractor, seamlessly integrated into the mechanical sub-contract. Trade-certified electricians regularly employed by the control sub-contractor will handle the installation.

.2 The controls contractor is obligated to thoroughly review all mechanical and electrical drawings, specifications, and addenda. They are tasked with deciphering the controls work outlined by the mechanical contractor, their subcontractors, and the electrical contractor. The controls contractor is expected to possess the expertise necessary to coordinate the efforts of other contractors, creating a fully functioning Building Automation System (BAS). The controls specifications are crafted to synchronize mechanical and electrical systems. Where others are specifically designated for controls work, the BAS contractor will not include that work. This provision is not intended to make the controls

contractor accountable for unspecified work but to assign responsibility to the BAS contractor for scrutinizing the specifications for contradictions and overlap.

.3 The BAS contractor is tasked with providing the essential engineering, installation, supervision, commissioning, and programming for a fully operational system. The contractor will make as many trips to the job site for installation, supervision, and commissioning as necessary to complete the project to the satisfaction of the consultant and/or SMCDSB project supervisor.

.4 Provide all labour, materials, products, equipment, and services to supply, install and commission a fully functioning BAS.

.5 The controls contractor is responsible for all their own CATS/Fibre and network infrastructure required for BACNet IP networks.

.6 Th controls contractor is responsible for all of their own 120 volt wiring.

.7 The scope of this project entails, but is not limited to, the following tasks:

.1 The preparation of control shop drawings for review and approval. (see submittal section)

.2 The supply and installation of a network comprising Building Automation Control System (BAS) panels and field devices.

.3 The supply and installation of customized graphics software adhering to SMCDSB standards, along with system software and specified third-party software.

.4 The installation, wiring, and labeling of all BAS control system components.

.5 The calibration and commissioning of the installed control system and the provision of maintenance manuals and as-built drawings.

1.3 WORK EXCLUDED

.1 Placing access doors and positioning valves, flow meters, water pressure and differential taps, flow switches, thermal wells, dampers, airflow stations, and current transformers.

.2 Installing flow switches, low water cutoffs, and high-temperature limit controls for boilers.

.3 Setting up air proving switches and high humidity limit controls for humidifiers.

.4 Implementing level controllers for sump pumps.

.5 Other divisions within Division 15 should incorporate the following work, to be provided by this section:

.1 Installing control dampers and actuators, excluding those integral to packaged equipment, to be supplied by equipment manufacturers.

.2 Installing control valves and actuators.

.3 Installing flow switches.

.4 Installing thermowells.

1.4 EXISTING SYSTEM

.1 The current facility has a Johnson Controls Metasys Automation System.

.2 The chosen contractor must locate any communication lines that are to remain after the project and mark its entire length with yellow caution tape. The contractor is responsible for maintaining it throughout construction, ensuring proper operation post-construction, educating other trades, and repairing any damages incurred.

.3 Adjust controls and wiring to accommodate the installation of new services, such as ductwork and piping.

.4 All new controls (whether JCI or Distech product) shall be integrated into the existing Metasys ADS server. If products other than JCI are provided there shall not be any modifications to the existing NCE, NAE or other global controllers.

1.5 LICENSING

.1 SMCDSB shall pay for any required licenses to implement the BAS system expansion outside of the contract.

1.6 APPROVED SYSTEM AND VENDORS

.1 Only bids submitted by prequalified vendors will be considered for the BAS contract.

.1 Prequalified Vender list:

.1 Johnson Controls International. (JCI Metasys)

.2 HTS Engineering Ltd. (Distech)

.2 All network protocols to be BACNet and communicate using MSTP/IP protocol. All control systems and controllers shall be native BACnet and not feature any proprietary programming which will prevent another controls contractor from performing service work on the system.

.3 The system should possess a modular design, allowing for both capacity and functionality expansion by integrating additional sensors, actuators, DDC controllers, Application Specific Controllers, and operator devices.

.4 DDC Controllers must have the capability to access data from, or transmit control commands and alarm reports directly to, any other DDC controller or a combination of controllers within the network, without relying on a central processing device. Additionally, DDC controllers should be able to dispatch alarm reports to multiple operator workstations independently of a central processing device.

.5 Implement an operator interface in the English language that is easily understandable. The intention is to create a user-friendly interface, fostering the acceptance of the BAS by building operators.

1.7 SUBMITTALS

.1 Provide the Engineer, within four weeks of contract award, with all necessary Shop Drawings, diagrams, schedules, and equipment and software data sheets deemed necessary by the Engineer to verify that the Specification and schedule of work intentions are being met.

.2 Develop a controller schedule that adheres to the BACnet addressing practices followed by SMCDSB.

.3 Submit a sheet or catalogue cut for all field devices.

.4 Create a Sequence of Operations in plain English for each system, providing detailed explanations of how each function will be programmed and the points used to fulfill the Sequence of Operation.

.5 Present a comprehensive testing and commissioning plan.

.6 Provide a clear and detailed general arrangement of each control panel, indicating construction and dimensions, as well as the location of internal and external components and wiring. All components must be identified in accordance with specifications and the sequence of operation.

.7 Supply a schematic of each control system illustrating electrical/electronic connections, including terminal numbers, component locations and operations. Include a system description, component names, and numbers.

.8 Furnish electrical connection wiring diagrams of control panels, displaying internal wiring connections between all components with terminal numbers and outgoing terminal blocks. Include necessary field interlocks to ensure specified system operations.

.9 Develop a 24 VAC power layout and load calculation for each transformer.

.10 All data, plans, specifications, drawings, sketches, correspondence, and documents related to the work or the project, whether generated by SMCDSB (hereinafter referred to as the Board), the BAS Contractor, or any subcontractors, shall be considered the property of the Board. The BAS Contractor is not entitled to use any such data, plans, specifications, drawings, sketches, correspondence, or documents for any purpose without the Board's written consent.

1.8 QUALITY ASSURANCE

.1 Materials and equipment shall be the catalogue products of a single manufacturer regularly engage in production and installation of automatic temperature control systems and shall be manufacturer’s latest standard design that complies with the specification requirements.

.2 Install system using competent worker who are fully trained in the installation of temperature control equipment. Single source responsibility of the supplier shall be the complete installation and proper operation of the DDC control system and BAS shall include debugging and proper calibration of each component in the entire system.

.3 Install all controllers and components within the system and on the network in accordance with the manufacturer's recommendations and general installation standards for digital controls.

.4 The system components must be certified by Underwriters Laboratories Inc. and the Canadian Standards Association.

1.9 SYSTEM ACCEPTANCE

.1 Upon the completion of the project, the contractor is required to submit a report to the consultant, confirming the system's completion. The report should state

that all hardware and software functions have been verified, and the system is operating in accordance with the specifications. Furthermore, a demonstration showing the full operation of the system shall be conducted for the owner's authorized representative.

.2 Following successful completion of the system demonstration, the owner's representative will be asked to provide written approval for the satisfactory operation of the DDC System, interface devices, and accessories.

.3 The consultant will verify, through the owner's representatives, that the entire system is complete and operating to the owner's satisfaction before granting final acceptance approval.

1.10 MAINTENANCE DATA AND SERVICEE

.1 Provide maintenance data for controls and instrumentation to be integrated into the maintenance manual.

.2 Following acceptance, perform seasonal checks and readjust control systems during changeovers. Conduct two on-site trips, notifying the Engineer of scheduled dates. Execute any necessary preventive maintenance, including parts and labor. Submit a written report to the Engineer detailing the results or adjustments made.

1.11 WARRANTY

.1 The system, along with all components, parts, and assemblies supplied by the manufacturer and contractor, shall be covered by a warranty against defects in material and workmanship under normal use for a period of twelve months (1 year) following the start-up and written certified acceptance of the system by the owner's consultant. An extended warranty shall be provided for a period of 48 months (4 years) from the date of Substantial Completion. The contractor is responsible for providing warranty service during this period.

1.12 REFERENCE STANDARDS

.1 Provide electrical material and installation in accordance with the appropriate sections of the current edition of the applicable local codes for signaling systems. Install wiring in conduit or approved totally enclosed raceways. Do not use cable raceways or troughs.

.2 Provide materials and equipment, which are standard components regularly manufactured and guaranteed to be available as regular inventory as replacement parts.

.3 Provide electrical and electronic equipment which is CSA or Ontario Hydro approved where such approvals are required by the regulatory authorities.

.4 Provide ASCII American Standard for Communication and Information Interchange code input/output devices with standard EIA Electronic Industry Association interface.

1.13 AS-BUILT DRAWINGS

.1 Within two (2) weeks of achieving substantial completion of the project, revise the initial submittal documents to depict the "As Built" conditions of the project and

present three (3) copies to the consultant and/or the SMCDSB Project Supervisor.

.2 Furnish a laminated version of the control drawings for installation in the mechanical room or on the control panels.

.3 Inform the BAS Supervisor of the project's completion and emphasize the necessity of a comprehensive backup for the site.

.4 Provide one (1) electronic copy and one (1) printed copy of the final programs containing all point definitions, weekly and annual schedule settings, controller setpoints, tuning parameters, and documented programmed sequences of operation.

.5 Submit an accurate wiring layout, specifying the location of all low voltage control transformers and the corresponding electrical panel breakers.

.6 A comprehensive outline of maintenance protocols for every system component is required, encompassing inspection, routine preventive maintenance, fault diagnosis, and the repair or replacement of faulty modules. This should encompass calibration, maintenance, and repair procedures for sensors, transmitters, transducers, and panels, along with diagnostics and the repair or replacement of all system hardware.

.7 Specifications and data sheets for all control system components, such as relays, switches, thermostats, controllers, dampers, indicators, flow switches, sensors, and analogous elements, are required.

1.14 WIRING RESPONSIBILITY OF THIS CONTRACTOR

.1 This contractor is responsible for the following wiring:

.1 **All fibre cabling required to implement the ethernet network.**

.2 **All ethernet wiring, switches etc. required to implement the Building Level Network.**

.3 **All ethernet wiring, switches, routers etc. required to implement the Floor Level Network(s).**

.4 **All BACNet MS/TP wiring required to implement the Floor Level Network(s).**

.5 All 120V wiring associated with control device power and line voltage control devices, including, but not limited to actuators, line voltage thermostats etc.

.6 All low voltage electrical wiring between sensors, starters, etc., and control device input and output wiring as required to provide a complete and operable system.

.7 All raceways, boxes, cables, circuit breakers, grounding, relays, motors, starters and wirings from existing panel boards or switchgear through splitters, starters, and field disconnect switches to complete power supply required for equipment supplied under this Contract not indicated on the electrical plans and specifications.

Part 2 Products

2.1 SYSTEM HARDWARE

.1 DDC Controllers must be 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 must be adequate to fully meet the specification requirements and the attached point I/O schedule.

.2 Each DDC Controller should have enough memory to support its 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 specified points.
- .5 Maintenance support applications.
- .6 Custom processes.
- .7 Operation I/O.
- .8 Dial-up communications.
- .9 Manual override monitoring.

.3 Each DDC Controller must 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 adding the appropriate point input/output termination module and wiring.

.5 DDC Controllers should offer a minimum of two RS-232C serial data communication ports for operating operator I/O devices, such as industry-standard printers, operator terminals, modems, and portable laptop operator's terminals. DDC Controllers should allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals.

.6 The operator should have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

- .1 Switches should be mounted either within the DDC Controllers key-accessed enclosure or externally mounted, with each switch keyed to prevent unauthorized overrides.
- .2 DDC Controllers must monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers must also collect override activity information for reports.

.7 DDC Controllers must provide local LED status indication for each digital input and output, ensuring constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LED's or analog indication of value must also be provided for each analog output. Status indication should be visible without opening the panel door.

.8 Each DDC Controller must continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The DDC Controller should provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication.

.9 Isolation must be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587.

.10 In the event of the loss of normal power, there should be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory must be incorporated for all critical controller configuration data, and battery backup must be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

.1 Upon restoration of normal power, the DDC Controller should automatically resume full operation without manual intervention. Should DDC Controller memory be lost for any reason, the user must have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in, or from a network workstation PC.

2.2 SYSTEM SOFTWARE

.1 DDC Controller Resident Software Features

.1 General:

.1 The software programs outlined in this Section should be an integral part of DDC Controllers and not rely on any higher-level computer for execution.

.2 All points must be identified by up to a 30-character point name and a 16-character point descriptor. The same names should be used at the PC workstation.

.3 All digital points must have user-defined two-state status indication (descriptors with a minimum of 8 characters allowed per state, e.g., summer/winter).

.2 Control Software Description:

.1 DDC Controllers must have the ability to perform the following pre-tested control algorithms:

.1 Two-position control

.2 Proportional control

.3 Proportional plus integral control

.4 Proportional, integral, plus derivative control

.5 Automatic tuning of control loops

.3 DDC Controllers must have the ability to perform any or all of the following energy management routines:

.1 Time-of-day scheduling - up to a year in advance.
.2 Calendar-based scheduling.
.3 Holiday scheduling.
.4 Temporary schedule overrides.
.5 Start-Stop Time Optimization (automatically coordinated with TOD scheduling).
.6 Automation Daylight Savings Time Switchover.
.7 Night setback control.
.8 Enthalpy switchover (economizer).
.9 Peak demand limiting.
.10 Temperature-compensated duty cycling.

.4 DDC Controllers must be able to execute custom, job-specific processes defined by the user to automatically perform calculations and special control routines.

.1 A single process should be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process should be able to issue commands to points in any and all other DDC Controllers on the network. The database should support 30-character, English language point names, structured for searching and logs.
.2 Processes should be able to generate operator messages and advisories to operator I/O devices. A process should 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 must provide a HELP function key. Enhanced context-sensitive on-line help with task-oriented information from the user manual.
.4 DDC Controller should be capable of comment lines for sequence of operation explanation.

.5 Alarm management should be provided to monitor and direct alarm information to operator devices. Each DDC Controller should 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 should the DDC Controller's ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device, or communication with other panels on the network.

.1 All alarm or point change reports should include the point’s English language description and the time and date of occurrence.
.2 The user should be able to define the specific reaction for each point. Alarms should be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels should be provided for each point. Point priority levels should 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 should automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users should 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 hours destinations) or based on priority.

.4 In addition to the point's descriptor and the time and date, the user should be able to print, display, or store a 200-character alarm message to fully describe the alarm condition or direct operator response.

.5 In dial-up applications, operator-selected alarms should initiate a call to a remote operator device.

.6 A variety of historical data collection utilities should be provided to manually or automatically sample, store, and display system data for points as specified in the I/O summary.

.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 Controller's point group. Two methods of collection should 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 should be provided. Each DDC Controller should have a dedicated RAM-based buffer for trend data and should be capable of storing a minimum of 10,000 data samples. All trend data should be available for use in 3rd party personal computer applications (i.e., Microsoft® Excel, Lotus 123).

.2 DDC Controllers should also provide high-resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms should be provided for operator-selected PID control loops as identified in the point I/O summary.

.1 Loop tuning should 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 should be limited to authorized personnel through password protection.

.7 DDC Controllers should 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 should allow the DDC Controllers to access any data from or send control commands to alarm reports directly to any other DDC Controller or combination of controllers on the network without dependence on a central or intermediate processing device. DDC Controllers should send alarm reports to multiple workstations without dependence on a central or intermediate processing device. The peer-to-peer network should also allow any DDC Controller to access.

2.3 GRAPHICS

.1 Provide linked graphic pictures as follows:

.1 Building Identification front plate with menu.
.2 Photo of front elevation of building.
.3 Floor Plan of each building level.
.4 Schematic for each system.
.5 Tables summarizing temperatures in each zone.
.6 Tables summarizing the monitored functions of all air handling units.
.7 Table summarizing weekly schedules.
.8 Tables summarizing fault detection results.
.9 Outside Lighting Schematic.
.10 Time of Day schedules.
.11 Up to five additional graphics as defined by the owner.
.12 Global Setpoints, summarizing items such as Min/Max Setpoints, Override Period, etc.
.13 Global Statistics, summarizing lowest temp, highest temp, number of heat pumps heating/cooling, number of zones occupied, number of zones in override, etc.
.14 The graphics shall be submitted to the Owner for preapproval before final implementation.

.2 Graphic Display Screens

.1 Individual schematics shall include, where applicable:

.1 Navigation buttons to each major system in the building which indicate current screen display by a change in button colour.
.2 Outdoor air temperature shall be displayed on every graphic screen.
.3 Access links to all global schedules or specific screens affecting entire building operation.
.4 Access buttons links to Set Time, Holiday Schedule, Alarms, Points on Manual, Conversion °C - °F, 24 Hour Clock, Operations Manual, Autocad Drawings, BAS Manual, and Work Orders
.5 Status of monitored and controlled on/off points;
.6 Current value of analog input;
.7 Identification for each point;
.8 Current value of the setpoint & DDC output for each control loop;
.9 Current state of each control loop (computer auto/computer manual);
.10 Schematic and systems identification;
.11 Point alarm lock-out status;
.12 Equipment symbolic information (pump, fan, etc.);
.13 Alarm/normal indication
.14 All points pertinent to one system shall be on one screen.

.15 Symbols shall have the ability to change colour, depending on the status.

.16 Animations are to indicate point status. Animations are to include pumps, fans, and boilers. The BMS contractor shall obtain from the owner the final numbering and name convention to be used for all spaces in the building for incorporation in the “As Built” drawings and manuals.

.2 System Architecture.

.1 Control panel layout and network architecture.

.2 Indicating BAS panels and panel type (model).

.3 Panel locations room number text on screen.

.4 Systems controlled by each panel.

.5 Links to points list accessible from each panel.

.3 Architecture Panel Layout (Locations on Floor Plans)

.1 Locations of each panel on each floor plan level.

.2 Panel types indicated by different icon.

.3 Controls transformers locations.

.4 Main network wiring and sub-network wiring layout.

.4 Floor Plans Graphics

.1 Room numbers accurate as per room signage.

.2 Mechanical rooms locations and signage tags.

.3 space temperatures for every temperature on each floor in appropriate room.

.4 space focus pick area for individual room control where applicable shall be yellow text.

.5 Air Handler symbols indicating areas of the floor plan serviced by each air handler by a corresponding colour.

.6 Status of Air Handler by colour change Red for off status, or text indication.

.7 Supply air temperature for each air handler.

.5 HVAC/AHU Unit Graphic

.1 Accurate representation of the HVAC design.

.2 All associated control points to be displayed.

.3 A calculated percentage of fresh air shall be indicated on the HVAC graphic.

.4 Operator offset adjustment of the supply air setpoint, adjustable directly from the graphic.

.5 HVAC physical location shall be indicated on the graphic.

.6 Weekly occupied time of day schedule for the associated HVAC shall be accessible directly from the graphic by selecting an icon.

.7 Trend logs shall be accessible directly from the graphic by selecting an icon.

.6 Exhaust Fans Graphic

.1 Exhaust fans control shall be editable directly from the graphic.

.2 Exhaust fan status shall be indicated in text and a change in the exhaust fan icon.

.3 Exhaust fan physical location shall be indicated on the graphic.

.4 Area of the building being exhausted shall be indicated on the graphic.

.7 Boiler and Chilled Water Plants

.1 Accurate representation of piping design and layout.

.2 All associated control points to be displayed.

.3 Temperature reset curve to be displayed, along with calculated value.

.4 Operator shall be able to adjust set point from the graphic.

.5 Physical location of the plant equipment shall be indicated.

.6 All piping loops shall be labelled.

.7 Weekly occupied time of day schedule for the associated HVAC shall be accessible directly from the graphic by selecting an icon.

.8 Trend logs shall be accessible directly from the graphic by selecting an icon.

.8 Terminal Units/Misc. Items

.1 Accurate representation of equipment.

.2 All associated control points to be displayed.

.3 Space temperature.

.4 Mode of operation.

.5 Current setpoint.

.6 Trend logs shall be accessible directly from the graphic by selecting an icon.

2.4 FIELD DEVICES

.1 General Requirements

.1 Actuation of control devices shall be electronic. Spring return fail-safe actuation shall be provided when loss of property and/or property damage is possible and where specified.

.2 All equipment, unless specified to contrary, shall be fully proportioning, modulating in operation.

.3 Space and duct sensors shall be electronic suitably located for specific application. Space sensing units shall be mounted 1500 mm from floor to centre for non-adjustable and 1200 mm from floor for adjustable unless otherwise noted or agreed to by the consultant.

.4 Sensors shall meet or exceed the specified standards.

.5 All sensors shall be capable of operating over the expected operating range and humidity.

.2 Automatic Control Valves

.1 Provide a valve schedule for all valves supplied under this contract, including the following information for each valve:

.1 Valve type, size, manufacturer, model number, flow coefficient, design flow, pressure drop across the valve, maximum close-off pressure, actuator manufacturer and model number, and maximum torque.

.2 Zone valves should have a design pressure drop of approximately 1.0 psi, while HVAC control valves should have a design pressure drop between 3 and 5 psi. The minimum allowable CV shall be 0.8, regardless of the pressure drop.

.3 Valves utilized for throttling applications must exhibit a linear percentage-to-flow characteristic.

.4 Ball valves are the preferred type for zone and HVAC control valves. Globe and butterfly valves may be employed where necessary to achieve the desired pressure drop and CV.

.3 Motorized Control Damper

.1 Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.

.1 Outdoor and/or return air mixing dampers and face and bypass (F & BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.

.2 Other modulating dampers shall be the opposed blade type.

.3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.

.2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.

.3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.

.4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.

.5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 1% of total flow based on a approach velocity of 7.62 m/s (1500 ft/min) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).

.6 Individual damper sections shall not be larger than 125 cm x 150 cm (48 in. x 60 in.). Provide a minimum of one damper actuator per section.

.7 Modulating dampers shall provide a linear flow characteristic where possible.

.8 Dampers shall have exposed linkages.

.9 Aluminum Airfoil Dampers

.1 Aluminum airfoil frames and blades shall be a minimum of 12 gauge extruded aluminum. Blades to be 6" wide single air foil design.

.2 Frames shall be extruded aluminum channel and grooved inserts for vinyl seals. Standard frames 2" x 4" x 5/8" on linkage side, 1" x 4" x 1" on the other sides.

.3 Pivot rods shall be 7/8" hexagon extruded aluminum interlocking into blade section. Bearings to be double sealed type with a Celcon inner bearing on a rod within a Polycarbonate outer bearing inserted into frame so that the outer bearing cannot rotate.

.4 Bearing shall be designed so that there is no metal-to-metal or metal-to-bearing riding surfaces. Interconnecting linkage shall have a separate Celcon bearing to eliminate friction in linkage.

.5 Blade linage hardware is to be installed in frame out of airstream. All hardware to be on non-corrosive reinforced material or cadmium plated steel.

.6 Damper seals shall be designed for minimum air leakage by means of overlapping seals.

.7 Damper blades shall be maximum 48" long per section

.8 Dampers greater than 1 section wide shall be arranged so they can be operated from either side. Note: this means the maximum damper width is 96". No jackshafts shall be used.

.9 Dampers on building exterior to be the insulated type.

.4 Control Valve Actuators

.1 Size control valve actuators to ensure a secure close-off against system head pressures and pressure differentials.

.2 Valve actuators must be compatible with a 2-10VDC control voltage for all proportional applications.

.3 Floating point control of valves is not acceptable under any circumstances.

.4 Heating valve actuators should spring-return to fail open, while cooling valve actuators should spring-return to fail closed. Non-spring-return control valves may be utilized for terminal reheat coils and large HVAC control valves requiring a higher close-off pressure.

.5 Damper Actuators

.1 Actuators must be direct-coupled for either modulating or two-position control. They should be powered by an overload-proof synchronous motor. Provide a 2-10 VDC control voltage for all proportional applications and utilize either line or low voltage actuators for all two-position applications.

.6 Automatic Control Dampers

.1 All automatic control dampers not provided with packaged equipment must be supplied by the controls subcontractor and installed by the sheet metal subcontractor, excluding VAV Boxes, which will be supplied by the Mechanical Contractor. In mixing applications, dampers must be opposed blade, while parallel blade dampers are permissible in other applications. Dampers should be of a tight-closing, low-leakage type, featuring replaceable extruded vinyl seals on all outdoor and exhaust applications.

.7 Room Sensors/Thermostats

.1 Use only 1,000 ohm nickel type-3 thermistors, ensuring end-to-end accuracy of
+/- 0.3 °C over the entire operating range.

.2 Deploy stainless steel plate sensors in public areas such as stairways, vestibules, lobbies, and gymnasiums to prevent vandalism.

.3 Room sensors typically should not have setpoint adjustment or temperature display. Provide external setpoint adjustment only when specified for specific offices or meeting rooms.

.4 Install thermostats and space sensors as indicated on the drawing. Do not mount on outside walls without the consultant's permission.

.5 Provide and install heavy-duty thermostats for unit heaters, electric radiation, or fan coil units where specified.

.8 Switches (Digital)

.1 Implement a MOSFET-type digital switch to provide Building Automation System (BAS) status for fan and pump motors.

.2 Install a momentary push button on the exterior of the BAS panel nearest to the Custodial office, enabling a building override. This override will operate all equipment for a duration of two (2) hours when pressed.

.3 Incorporate a toggle switch on the exterior of the BAS panel nearest to the Custodial office for an outside lighting override. This switch will operate all exterior lights as long as it is turned on. Program an alarm to notify the building operator if the override switch has been on for more than four (4) hours.

.9 Pressure Transmitters

.1 Install fluid pressure transmitters in both hot water heating systems and glycol heating systems.

.2 Technical Performance: Utilize a solid-state design operating on the capacitance principle, featuring non-interactive fine resolution, zero and span adjustments. Ensure end-to-end accuracy within +/- 2% of the full-scale pressure range, inclusive of temperature compensation. Output options include 4-20mA or 0-5 VDC.

.10 Air Temperature Sensors

.1 Sensors shall be a minimum of 1.5 m (5ft) in length per 1 sq. m of duct cross-section.

.2 All supply air sensors and mixed air sensors shall be 1000 OHM nickel, resistance temperature detector (RTD) type with a 7.5 m (25') averaging element. Each RTD may be provided with an industry standard, 4-20mA, transmitter mounted at the RTD as required.

.1	Temperature monitoring range	-7°C to 49°C (20°F to 120°F)
.2	Output signal	Changing resistance
.3	Accuracy at calibration point	± 0.3C (± 0.5F°)

.3 All return air sensors shall be RTD or thermistor type temperature detectors. The sensor probe shall have a minimum length of 450 mm (18"). Each RTD may be provided with an industry standard, 4-20mA, transmitter mounted at the RTD as required.

.1	Temperature and monitoring range	4°C to 66°C (40°F to 150°F).
.2	Output Signal	Changing Resistance
.3	Accuracy ant calibration point	0.3°C (± 0.5F°)

.4 Outdoor air sensor shall be the 1000 ohm nickle, 3 wire RTD type with a 4-20mA transmitter mounted at the sensor. The RTD shall be mounted in a weatherproof enclosure, the 4-20mA transmitter shall be mounted inside the building within an electrical box.

.1	Temperature and monitoring range	-18°C to 49°C (0°F to 120°F).
.2	Output Signal	Changing Resistance
.3	Accuracy at calibration point	± 0.3°C (± 0.5°F) over a range of

.5 Sensors shall be provided with vented protective covers, mounted 1500 mm (60") from floor level.

.11 High Limit Thermostats

.1 Thermostats shall have liquid filled insertion probe.

.2 Range shall be -3.9 to 101.7°C.

.3 Switch shall be snap acting and rated for 16 amperes at 120 VAC or 8 amperes at 575 VAC as required.

.4 Thermostat shall have manual reset feature.

.5 Provide one thermostat for each 1 sq. m of duct area.

.6 Thermostats shall be CSA approved and have a dust tight enclosure.

.7 Thermostats shall be SPDT or DPDT to facilitate monitoring by BMS.

.12 Low Limit Thermostats

.1 Thermostats shall have 6000 mm vapour tension sensing element sensitive to a temperature below its setpoint over 300 mm of its length.

.2 Range shall be 1.7 to 7.2 ° C.

.3 Switch shall be snap acting and rated for 16 amperes at 120 VAC or 8 amperes at 575 VAC as required.

.4 **Thermostat shall have manual reset feature.**

.5 Provide one thermostat for each 1 sq. m of coil face area or part thereof.

.6 Thermostats shall be DPDT to facilitate monitoring by BMS.

.7 Mount sensing element rigidly and as close as possible to the downstream face of the coil being protected or where shown on schematic diagrams. Freeze controls shall have 6 m capillary arranged in ducts for best possible protection.

.8 Provide freeze stat for each 5.5 square meters of duct area where necessary, wired in series. Sensing element shall extend at least to two diagonally opposite corners of the coil.

.13 Outdoor Air Temperature Sensor

.1 Install two outdoor air temperature sensors programmed to cross-check for accuracy. In the event of sensor failure, the sensor deemed accurate will be utilized to control the systems. Locate the outdoor air sensors on a north wall if possible, ensuring a minimum distance of three (3) feet from any building envelope opening that could impact sensor readings. Insulate the back face of the sensor enclosure to prevent temperature pickup from the building wall.

.2 Technical Performance: Use a 1000 ohm nickel thermistor with a temperature range of -50°C to 50°C, housed in a weatherproof enclosure mounted on the north exposure. End accuracy should be within +/- 0.3 °C across the entire operating range.

.14 Pipe Temperature Sensor

.1 Well: Technical Performance - Employ a 1000 ohm nickel thermistor sensor enclosed in a 6mm OD, 50mm long probe, featuring a screw fitting for insertion into a standard thermowell. The operating range is -10 to +100 °C, with end-to-end accuracy of +/- 0.3 °C over the entire operating range. The sensor comes complete with a brass thermowell. Utilize heat transfer paste during the sensor's mounting in the thermowell. Surface mount strap-on temperature sensors for monitoring fluid temperature are not permitted unless approved by the engineer or SMCDSB.

.15 CO_2 Detector

.1 Install CO_2 detectors on all return air systems for demand control ventilation.

.2 Technical Performance: Employ an Infrared CO_2 monitor with a 4-20mA or 0-5 VDC output, ensuring an accuracy of +/- 40 ppm +3% reading.

.3 Standard of Acceptance: AC manufacturers meeting specified criteria.

.16 Humidity Sensors

.1 The humidity sensor shall meet the following operating characteristics:

.1	Range	5-90% RH between 0°C to 60°C (32°F to 140°F).
.2	Output Signal	4-20 mA
.3	Accuracy	±2% RH over the humidity range

.2 Duct mounted sensors shall be mounted half way across the duct. Room mounted sensor shall be provided with vented covers.

.17 Separable Brass Thermowells

.1 These shall be provided with immersion type bulbs for installation by plumbing section. (Stainless steel shall be used for immersion in glycol solutions.) Wells shall be packed with thermal conductive grease to increase speed of response. Thermowells shall have ½" IPS threads to receive sensor, and be of suitable length for the pipe diameter.

.18 Photo Sensor

.1 Weathertight.
.2 Operating Temperature –30 to +70 °C.
.3 Resistance at 0 Lux 15 Kohms minimum.
.4 Resistance at 10 Lux 3 Kohms typical.

.19 Electrical Devices

.1 Relays

.1 Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

.2 Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

.2 Override Timers

.1 Override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and located on local control panels or where shown.

.3 Current Transmitters

.1 AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and +1 % full-scale accuracy at 500 ohm maximum burden.

.2 Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.

.3 Unit shall be split-core type for clamp-on installation on existing wiring.

.4 Current Transformers

.1 AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic material.

.2 Transformers shall be available in various current ratios and shall be selected for ±1 % accuracy at 5 A full-scale output.

.3 Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.

.4 Status inputs for motors (pumps and fans) shall use inductive coils to monitor current draw from one phase of power.

.5 Current transformers shall be selected and configured for appropriate amperage range and shall have 0 to 5 Volt output.

.6 BMS shall use AI points to monitor current transformers.

.5 Voltage Transmitters

.1 AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.

.2 Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with ±1 % full-scale accuracy with 500 ohm maximum burden.

.3 Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

.6 Voltage Transformers

.1 AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.

.2 Transformers shall be suitable for ambient temperatures of 4°C to 55°C (40°F to 130°F) and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.

.3 Windings (except for terminals) shall be completely enclosed with metal or plastic material.

.7 Power Monitors

.1 Power monitors shall be the three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers, and UL Listed split-core current transformers.

.2 They shall provide a selectable rate pulse output for kWh reading and a 4 to 20mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

.8 Current Switches

.1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system. Switch shall be complete with LED and have four turn adjustment.

.20 Acceptable Manufacturers

.1 Any devices listed in this specification shall be branded by the BAS supplier or one of the following manufacturers:

.1 Sensors, Relays, Etc.

.1 Greystones
.2 Enercorp
.3 Johnson
.4 Siemens
.5 ACI
.6 Honeywell
.7 Setra

.2 Thermostats

.1 Match BAS provider

.3 Control Valves

.1 Belimo
.2 Johnson Controls

.4 Actuators

.1 Belimo
.2 Johnson Controls
.3 Honeywell
.4 Schneider Electric

2.5 WIRING

.1 Fibre Cabling

.1 One (1) fibre cable run will be included between building level controllers that exceed the Category 6 length specifications for distance.

.2 Fibre cable shall be laser-optimized single mode fibre.

.3 Provide Fibre patch panels and cords as required.

.4 Fibre optic cables shall be tested in accordance to ISO/IEC IS 11801 standards using an EXFO optical time domain reflectometer. Test results such as DB loss, cable length and fibre deficiencies, if any, shall be conducted. Verification documentation and warranty shall be provided.

.2 BACNet Ethernet Communication Cabling

.1 Data cable shall Category 6 or better Ethernet cable.

.2 Data cable shall be four twisted pair 24 AWG solid copper, Plenum Rated FT-6 / CMP or Riser Rated FT-4 / CMR (as required by local codes) unshielded twisted cable meeting EIA / TIA 568B.1 Category 5e classification.

.3 The maximum cable length for each run shall be limited to 90 meters.

.4 All cables must be Power Sum accepted and recognized by the manufacturer.

.5 Cable Skew must be specified as 20Ns or less per 100 meters.

.6 Cables must display the manufacturer's stamp stating that the cable is included in the latest UL verified publication for respective Category standards.

.7 Cables shall be rated for installation in return air plenums (where allowed in this specification).

.8 Cables shall be colored to match owner's BAS standard. If owner does not have a standard a different color than the data contractor shall be used.

.3 120 Volt Wiring

.1 This contractor is responsible to provide all of their own power wiring, including 120V to transformers. Wiring shall meet the requirements of the electrical division specifications.

.4 Low Voltage and Control Wiring

.1 Minimum #20 AWG stranded copper conductors (larger gauge wire/cable shall be provided where required by BAS equipment and where applications warrant (e.g. rated load, long runs, etc.).

.2 Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot, and preferred 20 AWG or lower. A shield wire shall be included for ground connection.

.3 All BMS input/output point wire/cable and communication cable shall be shielded.

.4 Non-shielded cables may be approved for BAS input and output field point wiring following certification from the BAS manufacturer that non-shielded cables will function satisfactorily for the life of the building and that the use of non-shielded cables will not negatively affect other building systems/cabling.

.5 The manufacturers certification shall guarantee to the Board that should it be determined that BAS system performance is negatively affected or another building system or equipment is negatively affected due to the non-shielded cable, the BAS manufacturer shall replace the cable at no cost to the Board.

.6 Provide FT-6 rated cable where cable is run free air.

.5 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.

.1 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 0^0C and 50^0C (32^0F and 120^0F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.

.2 Line voltage units shall be UL recognized and CSA approved.

.2 Power Line Filtering

.1 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.

.3 Battery Backup with Surge Protection

.1 Provide a battery backup unit with surge protection on the supply to the Supervisory Controller with a minimum capacity of 1000 Volt-amps.

2.6 NAME PLATES OF EQUIPMENT

.1 Sensors and panels must be equipped with lamicoid nameplates, with a minimum size of 80 mm x 25 mm x 3 mm (3" x 1" x 1/8"). These nameplates are required to clearly identify the equipment and functions through letter and number designations. The nameplates should be mechanically secured and listed in the Operating and Maintenance Manual.

Part 3 Installation

3.1 ACTUATORS

.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 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

.4 Provide all mounting hardware and linkages for actuator installation.

.5 The controls contractor shall provide wiring as follows:

.1 All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.

.2 All wiring between the central control system (ATC/BAS) and the valve actuator shall be wired by the controls contractor.

.3 All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls' contractor.

.4 All wiring shall comply with code requirements. Segregate high and low voltage wiring and circuits and segregate the FAS and controls (BAS) terminals.

.6 Control Valve Installation

.1 Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

.2 All automatic control valves shall be installed by the mechanical trade.

.3 BAS contractor shall co-ordinate porting of valves with mechanical contractor.

.4 Slip-stem control valves shall be installed so that the stem position is not more than 60 ° from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.

.5 Valves shall be installed in accordance with the manufacturer's recommendations.

.6 Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

.7 Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system.

.8 Unions shall be installed at all connections to screw-type control valves.

.9 Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5" in diameter, with 1/4" high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

.7 Control Damper Installation

.1 Damper style and construction shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

.2 Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4" larger than damper dimensions and shall be square, straight, and level.

.3 Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8") of each other.

.4 Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

.5 Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

.6 Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

.7 Provide a visible and accessible indication of damper position on the drive shaft end.

.8 Support ductwork in area of damper when required to prevent sagging due to damper weight.

.9 After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

.8 Installation of Thermostats

.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 Install thermostats at handicapped elevations 1200 mm above finish floor (AFF) or in accordance with local bylaws.

.6 Where not indicated on drawing, place where directed by consultant.

.7 Coordinate location with architectural and electrical items.

.9 Installation of Sensors - 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 All wires attached to sensors shall be IN EMT raceways.

.4 All din rail or screw mounted transmitters, shall be mounted in steel box of suitable size with removable cover and secured in place.

.5 **The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.**

.10 Air Temperature Sensor Installation

.1 Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

.2 Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (10 ft) of sensing element for each 1 m^2 (1 ft of sensing element for each 1 ft^2) of coil area.

.11 Liquid Temperature Sensor Installation

.1 All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

.12 Outdoor Air Temperature Sensor Installation

.1 Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

.13 Low Limit Thermostat Installation

.1 Locate detectors after preheat coil or before cooling coil in air systems utilizing outside air.

.14 Differential Pressure Sensor Installation

.1 Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.

.2 Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.

.3 Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.

.4 All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.

.5 All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

.15 Flow Switch Installation

.1 Use correct paddle for pipe diameter.

.2 Adjust flow switch in accordance with manufacturer’s instructions.

3.2 POINT NAMING

.1 Object and Point Naming

.1 All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Device number

.4 Fourth group of characters = Controller / Equipment Identifier

.5 Last segment = Point name abbreviation

.2 Example: S1156_2_15_HP10_RmTemp

.3 Object name segment shall be delimited by (_) character; however, must be consistent by Vendor across all owner sites.

.2 Controller and Device Addressing and Naming

.1 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

.1 Device Instance

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Device number

.4 Fourth group of characters = Controller / Equipment Identifier

.5 Example: S1156_2_15_HP10

.2 BACnet Network Number

.1 First group of characters = Building Unique Identifier (Enterprise systems only)

.2 Second group of characters = Network number

.3 Third group of characters = Network and Type

.4 Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

.3 MAC Addresses

.1 B-BC

.2 Maintenance Connection

.3 Reserved

.4 -127. Master Range

.5 128.– 254. Slave Range

.6 255. Broadcast

.4 Object name segment shall be delimited by (_) character; however, must be consistent by Vendor across all owner sites

.2 Controller and Equipment identifiers shall match the standard adopted within the owner's enterprise level network. In the case of no enterprise level network or owner standard identifiers shall match the drawings.

3.3 OCCUPIED/UNOCCUPIED SCHEDULING

.1 Equip all controls and application programs to facilitate time-of-day scheduling, optimal start/stop, night setback, duty cycling, and load shedding.

.2 Enable mode override for all zones. Override functionality can be accessed via pushbuttons on adjustable DDC thermostats. For areas controlled by non-adjustable DDC temperature sensors, mode override shall be accessible through the Operator Console.

.3 During unoccupied mode, deactivate all fans serving the zone, and revert the temperature setpoint to heating setback/cooling setup settings.

.4 In the event of a mode override in a heating zone, the temperature setpoint will revert to the occupied setpoint for a predetermined period of two hours, which is adjustable at the Operator Console within a range of 1 to 8 hours. If half of the zones in an area served by an air-handling unit are overridden, the operation of the air-handling unit will resume until the override period concludes.

.5 Time Scheduling (T/S)

.1 Time scheduling (T/S) SHALL be applied to all start/stop points.

.2 The time scheduling table will support unlimited OCCUPIED, UNOCCUPIED, START, and STOP assignments per day for any selected equipment at 1-minute intervals, 24 hours per day. It should also be capable of daily, weekly, and annual scheduling for any piece of equipment on an individual basis.

.3 Install an override control allowing scheduling of an override period at least 30 days in advance. The program will automatically reset to the normal schedule afterward. Outside dampers will open to their minimum position within an operator-adjustable time period after the warm-up cycle begins.

.4 During a cool-down cycle, the fan system will operate with the outside damper in the minimum position, unless the system includes the enthalpy economizer program specified in the control strategies. For systems with the economizer program, an enthalpy comparison between outside and return air will be conducted. If the economizer program determines that outside air can be used for free cooling, the maximum outside air dampers will open during the cool-down cycle. In any case, the outside dampers will be opened no later than an operator-adjustable time period after the cycle begins.

.5 Provide summaries for each applicable system, including:

.1 Programmed occupancy and unoccupied times and desired occupant comfort levels.

.2 Times at which the system was actually started and stopped.

.3 Outside and inside temperatures at the time the system was started.

.4 Outside and inside temperatures at the time of occupancy.

.6 Duty Cycle (DC)

.1 All equipment associated with a start/stop program must be suitable for duty cycling. The following are requirements of duty cycling:

.1 Applicability with the peak demand limiting program or as a stand-alone program.

.2 Establishment of minimum and maximum on-time settings and minimum and maximum off-time settings.

.3 Duty cycling will be automatically deferred if the maximum or minimum space temperatures are exceeded.

3.4 RUNTIME TOTALIZATION

.1 The system will track equipment "on" time for all binary status points. A program will totalize runtime for each individual point based on open or closed contact conditions.

.2 Individual runtime limits will be assigned to runtime points. The system will output a 60-character maintenance message when the runtime for a point exceeds its limit.

.3 The runtime program will be capable of storing totalized values up to 9999 hours in increments of five (5) minutes.

.4 A runtime totalization summary will be provided, containing a listing of all runtime points, their current totals, and operator-set runtime limits.

.5 The system will automatically output a runtime totalization summary based on a pre-selected time, as detailed in the program function description.

.6 An operator command will be available to reset or pre-set the accumulated runtime for any point.

3.5 TRENDS AND ANALYTICAL REPORTING

.1 Implement trending functionalities to capture system information at various operating points. Generate reports based on specific points or groups of points such as status, room temperatures, etc., and store trend-logged data in a file for operator review on the screen.

.2 Incorporate trend analysis for all physical points and "mode" variables across all systems. Ensure the system possesses sufficient RAM to store a minimum of 100 samples per trend in the panel before transferring to the OWS hard drive.

.3 Utilize Change of State trending for digital points on major equipment.

.4 Employ Change of Value trending for analogue points on major equipment.

.5 Utilize conventional trending for other types of points.

.6 Alarm Functions

.1 Enable alarming capabilities on all points by setting maximum or minimum values, detecting incorrect states, or errors. Generate alarm messages using either a standard library or a 25-character alphanumeric text.

.2 Incorporate interlock and time delay functions to lock out alarms.

.3 Do not reset alarms until acknowledged, unless the point returns to a normal condition. In such cases, record the alarm in an alarm history file for a minimum of three (3) months' storage.

.4 Establish automatic call-outs to remote terminals for alarms.

.5 Implement alarms and dial-outs for all logical conditions, such as HWST out of range, Flame Failure Space Too Cold, Pump Failed to Start, Fan Failed to Start, Bad Thermostat, etc.

.6 Configure all Critical Alarms to be dialed out in Real Time.

.7 Schedule all other alarms to be dialed out during normal business hours.

.7 Advisory Notifications

.1 Continuously monitor hardware for failures and/or tampering and report any changes in hardware status to the operator in English language. Advisories should cover at least the following:

.2 System's ability to communicate with a point.

.3 System's ability to communicate with field processing unit/DDC system controller.

.4 Operational status of the field processing unit.

.5 System's ability to communicate with operator device(s).

.6 Detection of a power failure at (time) (date).

.8 Maintenance Time Notifications

.1 Generate maintenance time reminders based on either run time or calendar date.

3.6 TESTING AND COMMISSIONING

.1 Ensure sensors, valves, damper operators, and relays are calibrated to achieve optimal performance. Collaborate with other trades and sections during the testing and balancing of each mechanical system to guarantee its seamless operation.

.2 The testing phase encompasses pre-delivery, field tests, and adjustments of all major components, as well as the complete Building Automation System (BAS), culminating in a final on-site operational acceptance test of the entire system.

.3 All tests must be witnessed and approved by the Consultant, with the Contractor issuing a Performance Certificate upon completion.

.4 Upon the BAS installation's conclusion, calibrate all sensors and equipment, and verify transmission functionality.

.5 The final operational test must span a minimum of 30 days, operating 24 hours a day, to demonstrate the BAS's compliance with contract drawings and specifications. Any hardware or software defects must be rectified promptly before test resumption.

.6 The Contractor is responsible for conducting the following tests, subject to verification by the Consultant:

.1 Automatic restart after power outage.

.2 BAS software program downloading and uploading to DDC controllers and floppy disks.

.3 System-by-system point displays.

.4 System-by-system graphic displays.

.5 Change of output status.

.6 System response to field alarm conditions.

.7 System response to field communication failure.

.8 Display and alteration of time schedules.

.9 Presence and proper functioning of the On-screen Help menu.

.10 Verify the proper functioning of safety circuits in both "Hand" and "Auto" modes.

.7 Showcase each DDC panel's capability to uphold appropriate control strategies in the event of a communication failure with the central control facility and the field interface, utilizing a portable terminal supplied by the Contractor.

.8 Enable remote access for comprehensive direct access to the BAS, facilitating monitoring or modification of setpoints, sequence of operation, etc.

3.7 WIRING WORKMANSHIP

.1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

.2 Install wiring in EMT conduit in exposed areas and drops in walls. Comply with all requirements of Electrical Division.

.3 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

.4 Install all equipment in readily accessible locations as defined in the Ontario Electrical Code.

.5 Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with Ontario Electrical Code, CSA C22.2 and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

.6 All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.

.7 Follow manufacturer recommendations for installation of all wiring

.8 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

.9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

.10 Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.

.11 Wiring located in combustible rated buildings above T-bar ceiling shall be run in free air using fire rated cable with a minimum rating of FT-6.

.12 Note: all free air cabling used in combustible rated buildings to interface to security or fire alarm systems shall be FT-6 rated.

.13 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

.14 Cables be installed in bundles resting in a cabling support system (J-hooks) where provided by the electrical division.

.15 Cable supports shall be attached to the wall or ceiling of the area they are running through. Cable supports shall not be attached to:

.1 Electrical raceways,

.2 Duct work,

.3 Ceiling suspension systems,

.4 Piping,

.5 Wilson joists.

.6 All wire/cable terminations shall be made at screw type terminal strips. Wire nut terpotenminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.

.16 All BAS equipment and components shall be grounded to building ground facilities.

.17 BAS shall only be capable of controlling electric motors when the associated hand/off/auto (HOA) motor control switches are in the "auto" position. BAS control shall be wired into the auto circuit of the hand/off/auto motor control circuit only. Where hand/off/auto switches do not exist, they shall be provided by the Controls Contractor.

.18 Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.

.19 Existing interlocks and override control should typically not be removed or overridden by the application of new BAS control without the specific instruction and/or approval of the Owner.

.20 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

.21 Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).

.22 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

.23 Adhere to this specification’s Electrical Division requirements where raceway crosses building expansion joints.

.24 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

.25 Size of raceway 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.

.26 All wiring in mechanical, electrical, or service rooms-or where subject to mechanical damage- shall be installed in raceway at levels below 3 m (loft).

.27 Include one pull string in each raceway 2.5 cm (1 in.) or larger.

.28 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

Part 4 Sequences

4.1 HIGH-TEMPERATURE HEATING WATER SYSTEM (P-3 & P-4)

.1 General

.1 The existing boiler system provides primary hot water for the addition.

.2 The two high temperature heating water pumps will be rotated weekly to equalize runtimes. The duty pump designation shall alternate weekly. If the duty pump should fail, the standby pump will be started after a 15 second delay.

.2 Safeties and Limits

.1 Minimum start and stop time delays are provided on all outputs to prevent short cycling of equipment.

.2 If the outdoor air sensor fails, the boiler system will be enabled. The setpoints will set to -5° C outside air temperature.

.3 The system pumps will run for 10 minutes after the boilers shut down to dissipate heat.

.3 System Start/Stop

.1 The system will be enabled whenever any of the following occurs:

.1 The outside air temperature is less than 5° C.

.2 The outside air temperature is less than 15° C, and the building is occupied.

.2 The system will be disabled whenever any of the following occur:

.1 There are no heat-requests from the building and the outside air temperature rises above 18° C for more than 30 minutes.

.2 There are no heat requests from the building and the outside air temperature rises above 5° C for more than 1 hour and the building is unoccupied.

.3 When the system is enabled the duty high temperature heating pump shall operate continuously.

.4 Control Strategy

.1 Pressure Control

.1 The BAS shall control the pump set point to maintain the system pressure set point.

.2 Pressure set point reset shall be provided to maximize energy savings. Reset shall use a PID loop based on valve commands in the system.

.5 Alarms

.1 An alarm for the following shall be generated on the BAS:

.1 Pump status is received, and the command is off (10 minute delay).

.2 Pump status is not received, and the command is on, or status and command mismatch (5 minute delay).

.3 The heating system is on, and the primary supply water temperature is more than 10 degrees from setpoint (10 minute delay).

.4 An alarm will be generated if any space temperature is below 10° C.

.5 An alarm will be generated if the boiler loop pressure sensor drops below an adjustable threshold.

.6 System differential pressure deviates from set point.

.2 Points List. Refer to Controls Schematic.

4.2 ROOFTOP AIR HANDLING UNIT (RTU-1)

.1 General

.1 The variable volume air handling units consists of a mixed air section with outdoor air, exhaust air and return air dampers, energy recovery wheel, filter, gas fired burner, packaged heat pump, supply and exhaust fans with variable frequency drives. The unit is DDC controlled using electric actuation.

.2 Time delays shall be provided to prevent unit short cycling.

.3 Fan status shall be reported.

.4 Units shall have a staggered start delay programmed into them for start-up on power failure.

.5 Refrigeration Detection System

.1 The Refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point, nonadjustable in the field, to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Sensor within the equipment, near potential source of leaks.

.3 Field calibration of the system is not allowed.

.4 Be capable of detecting the refrigerant used in the system.

.5 Have self diagnostics

.6 Energize fans upon failure of a self-diagnostic check

.2 Safeties and Limits

.1 Freeze Protection: Provide programming to ASHRAE Guideline 36 standard. There are three levels of freeze protection to be programmed into the software:

.1 If supply air temperature drops below 4.4°C (40°F) for 5 minutes, enable heating plant, override outdoor air damper position/ERV operation to minimum, and modulate the heat to maintain a supply air temperature of at least 6°C (42°F). Disable this function once the supply air temperature rises above 7°C (45°F) for 5 minutes.

.2 Provide a hardwired freeze stat that must be manually reset as a final safety.

.3 System Start/Stop

.1 The unit fan may run in any mode except for unoccupied mode.

.2 The unit shall only run in setback/unoccupied mode if there is a perimeter zone without perimeter radiation, or after the perimeter radiation has failed to maintain set point for a minimum of 15 minutes.

.3 Provide an override switch at the OWS to enable the unit for 3 hours.

.4 Control Strategy

.1 Provide a summation of total airflow from the VAV boxes on the graphic for the unit.

.2 Determination of AHU Mode of Operation

.1 AHU system modes are the same as the zone groups served by the system. When zone groups served by an air-handling system are in different modes, the following hierarchy applies:

.1 Occupied mode

.2 Cool down mode

.3 Setup mode

.4 Warm-up mode

.5 Setback mode

.6 Freeze Protection setback mode

.7 Unoccupied mode

.3 Static Pressure Control

.1 Static Pressure Reset. Provide static pressure reset using Trim and Respond Set-Point Logic to ASHRAE Standard 36, High-Performance Sequences of Operation. All parameters shall be adjustable by the operator at the OWS.

.2 BAS shall modulate the VFD of the supply and exhaust fans to maintain the static pressure set point.

.3 The speed AO sent to the VFDs shall be configured such that 0% speed corresponds to 0 Hz, and 100% speed corresponds to maximum speed configured at the VFD. This does not necessarily correspond to 60 Hz.

.4 Supply Air Temperature Control

.1 The Supply Air temperature control loop is enabled at all times that the supply air fan is proven on and disabled and output set to deadband (no heating, outdoor air damper closed) otherwise.

.2 Supply Air Temperature Set Point. Supply Air Temperature is to be reset and controlled to ASHRAE Guideline 36, using Trim and Respond logic. Design variables are as follows:

.1 Minimum Cooling Supply Air Temperature: 12°C (55°F)

.2 Maximum Cooling Supply Air Temperature: 18°C (65°F)

.3 OAT Minimum: 16°C (60°F)

.4 OAT Maximum: 21°C (70°F)

.3 Supply air temperature in heating mode shall be kept as low as possible so that heat can be delivered by the VAV reheat coils.

.4 All Trim and Respond variables and set points shall be adjustable from the OWS.

.5 During occupied mode and setup mode, the SAT set point shall be reset from Minimum Cooling Supply Air Temperature when the OAT is at OAT maximum and above, proportionally up to a maximum temperature, T-max when the outdoor air temperature is at OAT minimum and below.

.6 T-max shall be reset using Trim and Respond Logic between the minimum cooling supply air temperature and the maximum cooling supply air temperature.

.7 See controls diagram from ASHRAE Guideline 36 below:

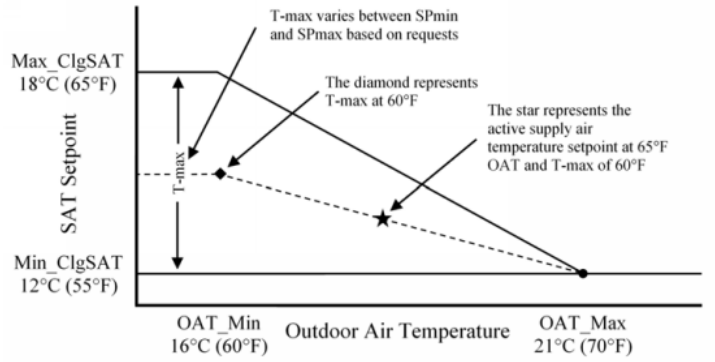


Figure 5.16.2.2 Example supply air temperature reset diagram.

.8 During the cooldown mode, the set point shall be the minimum cooling supply air temperature.

.9 During the warm-up and setback modes the set point shall be:

.1 35°C (95°F) for systems with zones without reheat.

.2 21°C (70°F) for systems with VAV reheat or perimeter heat in all zones.

.10 Provide logic to allow the VAV unit to act as the primary heat source and increase supply air temperature to 32°C (90°F) in case of central plant failure or branch piping shut down.

.11 The supply air temperature shall be controlled to set point shall be sent to the AHU.

.12 In heating mode, heat pump heating to be enabled above -5°C OAT and natural gas heating to be enabled below -5°C OAT. Heat pump operation temperatures to be confirmed with manufacturer and are to be adjustable.

.5 Minimum Outdoor Airflow Control

.1 ASHRAE Guideline 36 logic shall be modified to allow for CO_2 demand control ventilation based on a CO_2 reading in the return air duct.

.2 The ERV shall be enabled during all occupied hours and represents the minimum ventilation rate. When in minimum ventilation rate, the AHUs OA damper shall be open to 5% (adj.).

.3 The ERV shall be set to free cooling mode when conditions are appropriate.

.4 Provide a minimum outdoor air control loop which is enabled whenever the AHU is in operation and in occupied mode. Set output to zero otherwise.

.5 During occupied times:

.1 The outdoor air damper will remain closed until a preset value of 1000 ppm is reached. Beyond that value the damper shall modulate open until a minimum value of 800 ppm is reached.

.2 Reset the CO_2 setpoint up by 200 ppm with the mechanical cooling is in operation.

.6 The demand for economizer operation shall override the outdoor air damper position and exhaust/return fan control.

.6 Air Side Economizer

.1 The unit shall control the air side economizer operation.

.7 Energy Recovery Wheel Control

.1 In occupied cooling mode the energy Recovery Wheel shall be enabled and run at full speed.

.2 During Free Cooling, Energy Recovery Wheel shall be disabled and by-pass dampers shall open.

.3 During heating mode, Energy Recovery wheel shall be enabled and operate at full speed. When OAT is below 0°C (32°F), Energy Recovery Wheel speed shall modulate to maintain exhaust air temperature of 2°C (36°F). Temperatures for frost prevention are to be confirmed with the manufacturer.

.8 Filter Monitoring

.1 Pressure drop across filters shall be monitored and a “dirty filter” alarm shall be provided when filter exceeds pressure limit.

.9 Exhaust Fan and Building Pressure Control

.1 Exhaust fan shall operate whenever the associated supply fan is proven on and shall be off otherwise.

.2 Exhaust fan shall be controlled to maintain return fan discharge static pressure at set point.

.3 Exhaust fan shall only be enabled when the associated exhaust damper is proven to be open, and the minimum outdoor air damper is open. The exhaust dampers shall be closed otherwise.

.4 The exhaust fan shall not be controlled via building pressure sensor. Rather, the BAS Contractor shall work with the TAB contractor to determine a suitable offset/exhaust fan VFD setting to maintain the building at positive pressure.

.5 When exhaust dampers are enabled, a control loop shall modulate exhaust dampers in sequence with the exhaust fan static pressure set point as indicated below to maintain the building pressure at a set point of 12 Pa (0.05 in. of water):

.1 From 0% to 50%, the building pressure control loop shall modulate the exhaust dampers from 0% to 100% open.

.2 From 51% to 100%, the building pressure control loop shall reset the return-fan discharge static pressure set point from its minimum to maximum. Static set points to be provided by the balancer.

.3 Increase O.A. damper position as required to maintain building pressure.

.5 Alarms

.1 Maintenance interval alarm once fan has operated for 1500 hrs.

.2 Supply fan status/command mismatch (1 minute delay)

.3 Return fan status/command mismatch (1 minute delay)

.4 Freeze stat alarms as listed under Limits and Safeties section.

.5 Supply air temperature above 35°C (5 minute delay)

.6 Return air temperature is more than 5 degrees from space set point (5 minute delay)

.7 Unit is running and return air CO2 levels are above 800 ppm (1 hour delay)

.8 Heat wheel or other alarm is received from unit controller (immediate)

.9 Unit not cooling when commanded, as indicated by SAT (5 minute delay)

.10 Unit not heating when commanded, as indicated by SAT (5 minute delay)

.11 High Building Pressure (more than 25 Pa (0.10". of water)

.12 Low Building Pressure (less than 0 Pa (0.0"of water)

.13 Dirty filter alarm

.6 Refrigerant Detection System

.1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.

.2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

.3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

.7 Points List. Refer to Controls Schematic.

4.3 RADIANT PANELS AND WALLFIN HEATERS

.1 Space Temperature Control

.1 Occupied Mode

.1 Radiation valves shall be modulated to maintain space temp.

.2 Unoccupied Mode

.1 The heat setpoint shall be lowered to maintain space temperature.

.2 Points List**.** Refer to Controls Schematic.

4.4 MOTORIZED HEATERS

.1 A temperature sensor energizes the fan and modulates heating control valve to maintain setpoint. Fan status is monitored and alarms to BAS when it does not match command.

.2 Temperature sensor shall also modulate associated Temperature Control Valve.

.3 The control system shall maintain the following temperatures:

.4 Occupied mode 18°C for vestibules/stairwells.

.5 Unoccupied mode: 13°C.

.6 Provide alarm if space temperature is below 10°C.

.7 Points List**.** Refer to Controls Schematic.

4.5 VAV BOXES

.1 Description

.1 The variable volume terminal consists of a damper air flow sensor and modulating two-way hot water reheat control valve.

.2 The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

.1 Occupied Cooling

.1 The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper to maintain the room temperature at set point.

.2 Occupied Heating

.1 The VAV terminal unit is set to user defined minimum supply air volume setpoint. The VAV box heating control valve is normally closed. The controller monitors the room temperature sensor modulates the perimeter heating

control valve to maintain the room temperature at set point. If setpoint is not satisfied within 15 minutes (adjustable), then the controller shall modulate the VAV box heating control valve to maintain the room temperature at set point until setpoint is satisfied.

.3 Unoccupied

.1 The two-way hot water reheat control valve is closed to boiler plant hot water.

.2 Should additional heat be required at night the controller may reset to the terminal unit Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

.4 CO_2 Level

.1 Space CO_2 level shall be monitored. Reset minimum damper position from the value shown on the schedules to 80% of design airflow as CO_2 varies between 800 and 1000 ppm. Utilize reheat coil to maintain space temperature if necessary.

.2 Points List**.** Refer to Controls Schematic.

4.6 GENERAL EXHAUST FANS (WE-1 & CRE-1)

.1 Start/stop exhaust fans on time of day schedule.

.2 The DDC system uses a current switch to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.3 Points List**.** Refer to Controls Schematic.

4.7 EQUIPMENT STORAGE ROOM TEMPERATURE CONTROL (ERE-1 & UH-1)

.1 Room Temperature Control.

.1 The room temperature control consists of a temperature sensor, a unit heater, modulating control valve, an exhaust fan, and an outdoor air motorized damper.

.2 The DDC will control using electric actuation.

.3 The controller monitors the room temperature sensor.

.4 On a call for cooling the unit heater control valve is closed, the unit heater is disabled, the fan motor is off, controller will start exhaust fan motor/open OA damper to maintain room temperature setpoint.

.5 Exhaust air fan shall not start until OA damper has been proved open.

.6 On a call for heating the exhaust fan motor is off, the unit heater shall be enabled and the controller will modulate control valve to maintain room temperature setpoint.

.7 The DDC system uses current switches to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.2 Points List**.** Refer to Controls Schematic.

4.8 OUTDOOR TEMPERATURE AND HUMIDITY

.1 Utilize existing sensor for outdoor air temperature.

.2 Utilize existing sensor for outdoor humidity.

4.9 EXTERIOR LIGHTING CONTROL

.1 The outdoor lighting consists of two lighting zones (parking lot poles and wall packs) and one astrological clock.

.2 The DDC will control using electric actuation Start/stop of each lighting zone on time of day schedule. Photocell will override program turning lights on should outdoor elements reach a low illumination during program stop period.

.3 The DDC system will monitor lighting zone operation and generates an alarm if status deviates from DDC start/stop control.

4.10 SECURITY SYSTEM INTEGRATION

.1 Monitor the armed/un-armed operation of the security system. Provide alarm indication at the OWS.

.2 Use security setting to program interior and exterior lighting on in the event of an armed signal, program to go off when system is disarmed.

.3 Include readings in the graphics package.

4.11 FIRE ALARM INTEGRATION

.1 The fire panel monitoring consists of one dry contact at fire alarm panel as supplied by panel manufacture.

.2 The DDC will monitor fire panel contact and generate an alarm if contact closes.

.3 If the Fire Alarm system enters and alarmed state, both interior and exterior lighting will be turned on.

.4 The BAS/DDC system will enter fire alarm system mode as approved by local fire authority and mechanical engineer.

4.12 HEAT RECOVERY UNIT (HRU-1)

.1 General

.1 The constant volume air handling unit consists of an outdoor air section with motorized dampers, filter, glycol heating coil, split VRF coil with remote Heat Pump unit for heating and cooling, supply fan with variable frequency drive, and return fan with variable frequency drive. The unit is DDC controlled using electric actuation.

.2 Time delays shall be provided to prevent unit short cycling.

.3 Fan status shall be reported.

.4 Units shall have a staggered start delay programmed into them for start-up on power failure.

.5 Refrigeration Detection System

.1 The Refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point, nonadjustable in the field, to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Sensor within the equipment, near potential source of leaks.

.3 Field calibration of the system is not allowed.

.4 Be capable of detecting the refrigerant used in the system.

.5 Have self diagnostics

.6 Energize fans upon failure of a self-diagnostic check

.2 Safeties and Limits

.1 Unit shall utilize internal safeties.

.2 Unit shall be disabled if discharge air temperature drops below 6°C. (5 minute delay).

.3 System Start/Stop

.1 The unit fan shall only run during occupied mode.

.2 Provide an override switch at the OWS to enable the unit for 3 hours.

.4 Control Strategy

.1 Supply Air Temperature Control

.1 The Supply Air temperature control loop is enabled at all times that the supply air fan is proven on and disabled and output set to deadband (no heating, outdoor air damper closed) otherwise.

.2 Supply Air Temperature Set Point. Supply Air Temperature is to be reset and controlled to ASHRAE Guideline 36, using Trim and Respond logic. Design variables are as follows:

.1 Minimum Cooling Supply Air Temperature: 12°C (55°F)

.2 Maximum Cooling Supply Air Temperature: 18°C (65°F)

.3 OAT Minimum: 16°C (60°F)

.4 OAT Maximum: 21°C (70°F)

.3 Supply air temperature in heating mode shall be kept as low as possible so that heat can be delivered by the terminal heat pump coils.

.4 All Trim and Respond variables and set points shall be adjustable from the OWS.

.5 During occupied mode and setup mode, the SAT set point shall be reset from Minimum Cooling Supply Air Temperature when the OAT is at OAT maximum and above, proportionally up to a maximum temperature, T-max when the outdoor air temperature is at OAT minimum and below.

.6 T-max shall be reset using Trim and Respond Logic between the minimum cooling supply air temperature and the maximum cooling supply air temperature.

.7 Heat pump heating to be enabled above -5°C OAT and hydronic glycol heating to be enabled below -5°C OAT. Heat pump operation temperatures to be confirmed with manufacturer and are to be adjustable.

.8 On call for heating during hydronic glycol heating operation, the heat pump shall be disabled, and the duty glycol heating pump shall be enabled and run at a constant speed. Glycol heating control valve shall modulate to maintain the supply air temperature setpoint. The two glycol heating water pumps (P-5 & P-6) will be rotated weekly to equalize runtimes. The duty pump designation shall alternate weekly. If the duty pump should fail, the standby pump will be started after a 15 second delay.

.9 See controls diagram from ASHRAE Guideline 36 below:

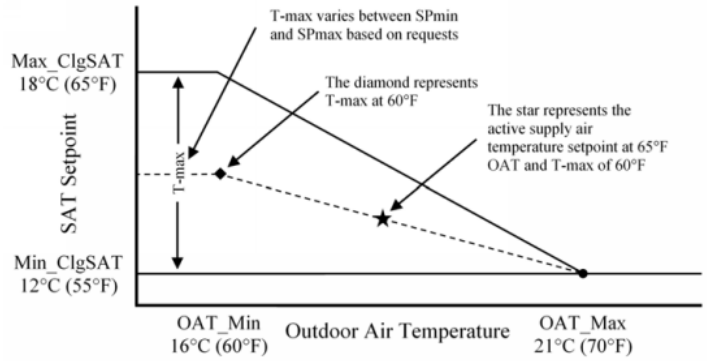


Figure 5.16.2.2 Example supply air temperature reset diagram.

.10 During the cooldown mode, the set point shall be the minimum cooling supply air temperature.

.11 Provide logic to allow the unit to act as the primary heat source and increase supply air temperature to 32°C (90°F) in case of central plant failure or branch piping shut down.

.12 The supply air temperature shall be controlled to set point shall be sent to the AHU.

.2 Filter Monitoring

.1 Pressure drop across filters shall be monitored and a “dirty filter” alarm shall be provided when filter exceeds pressure limit.

.3 Energy Recovery Wheel Control

.1 In occupied cooling mode the energy Recovery Wheel shall be enabled and run at full speed.

.2 During Free Cooling, Energy Recovery Wheel shall be disabled and by-pass dampers shall open.

.3 During heating mode, Energy Recovery wheel shall be enabled and operate at full speed. When OAT is below 0°C (32°F), Energy Recovery Wheel speed shall modulate to maintain exhaust air temperature of 2°C (36°F). Temperatures for frost prevention are to be confirmed with the manufacturer.

.5 Alarms

.1 Maintenance interval alarm once fan has operated for 1500 hrs.

.2 Supply fan status/command mismatch (1 minute delay)

.3 Freeze stat alarms as listed under Limits and Safeties section.

.4 Supply air temperature above 35°C (5 minute delay)

.5 Unit not cooling when commanded, as indicated by SAT (5 minute delay)

.6 Unit not heating when commanded, as indicated by SAT (5 minute delay)

.7 Dirty filter alarm

.6 Refrigerant Detection System

.1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.

.2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

.3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

.7 Points List. Refer to Controls Schematic.

END OF SECTION

PROJECT NAME: NOTRE DAME C.S. RENOVATION & ADDITION
140 Atlantis Dr., Orillia, ON

RDZ PROJECT NUMBER: 25092

Following Supplementary Electrical Bid Form is submitted by:

…….

(Bidding Company)

…….

(Street Address or P. O. Box No.)

…….

(City, Province and Postal Code)

Dated …… And which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Electrical Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Where instructions are not provided, submit Supplementary Electrical Bid Form by time of Bid closing, via e-mail addressed to:

RDZ Engineers Ltd.
Attention: Fei Han
E-mail : Fei@rdzeng.ca

Supplementary Bid Form Signature:

…….

(Signature of Authorized Representative)

…….

(Print Name)

…….

(Title)

A. LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance, and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance, and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
26 24 16	Panel Boards	
26 27 26	Wiring Devices	
26 28 23	Disconnect Switches-Fused and Non-Fused	
26 29 01	Contactors	
26 50 00	Lighting	
26 52 00	Emergency Lighting	
26 53 00	Exit Signs	
27 11 19	Structured Cabling For Communication Systems	
28 46 00	Fire Detection and Alarm System	

B. SUBCONTRACTORS

We enclose herewith a list of Subcontractors to the Electrical Building Services which is an integral part of the Bid. We agree that the Subcontractors shall not be changed without good reason and permission for same must be obtained from the Owner.

Section	Subcontractor
27 11 19 - Structured Cabling for Communications System	_____
28 31 00 - Intrusion Detection System	_____
28 46 00 - Fire Detection and Alarm System	_____

C. UNIT PRICES AND LABOUR RATES

We enclose herewith Unit Prices and Labour Rates which are an integral part of the Bid. Unit prices and labour rates are in effect for the duration of this Project's construction period. Owner is not obligated to accept unit prices and labour rates quoted.

1. Labour Rates:
Labour at the following rates shall be applied for additions or deletions to the work not covered by unit prices. The prices consist of salary, all agreed local union benefits. The rate quoted represents the net cost to the Contractor, exclusive of overhead and profit.

Journeyman $/hour _____

Foreman $/hour _____

2. Unit Prices:
The following unit costs will apply to all additional or deleted work from the Contract and should include their proportional share of all labour equipment, materials, accessories, profits, overhead and taxes for a job completely installed. Applications of unit prices will be to the net difference of quantities of individual products and materials in each contemplated Change Notice or Revision Notice.

3. The unit prices will be used for additions and deletions. Credit rate for deletions shall be at 80%

4. Conduit and Cable:
Supply and install the following conduit and cables including fastenings, clips, connectors, coupling boxes, etc. as required based on length as shown.

27mm Empty Conduit for length of 3500mm	$ _____
2#12-16mmC for length of 3500mm	$ _____
3#12-16mmC for length of 3500mm	$ _____
2#10-21mmC for length of 3500mm	$ _____
3#10-21mmC for length of 3500mm	$ _____
3#8-21mmC for length of 3500mm	$ _____

5. Receptacles:
Supply and installation of one duplex receptacle, shall include the receptacle box, cover plate, 3000mm of conduit and wiring, including connection to adjacent receptacle and/or outlet box.

$ _____

6. Light Switches:
Supply and installation of one light switch shall include the switch box, cover plate, conduit, wiring and connection to box containing the lighting circuit.

$ _____

7. Fire Alarm System:
Supply and installation of one fire alarm pull station, including conduits, wiring and connections, to the nearest fire alarm pull station based on 15000mm conduit and wiring length.

$ _____

Supply and installation of one fire alarm cone speaker complete with strobe lights including,

conduit, wiring and connections to nearest fire alarm cone speaker based on 15000mm conduit and wiring length.

$ _____

8. Light Fixtures:

Supply and installation of the following lighting fixtures. The supply and installation of lighting fixtures shall include the fixtures, flexible conduit, wiring and connection to nearest outlet box containing 347 and/or 120volt circuits and the supply and installation of built-in drivers, 0-10V dimmers, etc. (Base conduit and wiring on 4500mm length).

.1 Supply and installation of one type 'A' fixture. $ _____

.2 Supply and installation of one type ‘A1’ fixture. $ _____

.3 Supply and installation of one type ‘A2’ fixture. $ _____

.4 Supply and installation of one type ‘A3' fixture. $ _____

.5 Supply and installation of one type ‘B' fixture. $ _____

.6 Supply and installation of one type ‘B1' fixture. $ _____

.7 Supply and installation of one type ‘D' fixture. $ _____

.8 Supply and installation of one type ‘F' fixture. $ _____

.9 Supply and installation of one type ‘H' fixture. $ _____

.10 Supply and installation of one type ‘G' fixture. $ _____

.11 Supply and installation of one type ‘J' fixture. $ _____

.12 Supply and installation of one type ‘K' fixture. $ _____

.13 Supply and installation of one type ‘S' fixture. $ _____

.14 Supply and installation of one type ‘U-T2' fixture. $ _____

.15 Supply and installation of one type ‘U-T4' fixture. $ _____

.16 Supply and installation of one type ‘U1' fixture. $ _____

.17 Supply and installation of one type ‘U2' fixture. $ _____

.18 Supply and installation of one type ‘R' fixture. $ _____

END OF DOCUMENT

1. General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26, Division 27, and Division 28. The General Conditions, Supplementary Conditions and Division 1 are a part of this Specification and shall apply to this Division. This section also supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33, and Division 34.

.2 Issued for Construction documents are issued for Contractors' convenience for reference only and are a consolidation of issued drawings, specifications, and addenda. Consultant makes no representation of their completeness. Exact construction requirements to be based on official Bid issued drawings, specifications, and issued separate addenda. Contact Consultant for any clarifications.

1.2 APPLICATION

.1 This Section specifies requirements that are common to Electrical Divisions work Sections, and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.

.2 Mention herein, or indication on the Drawings of articles, materials, operations, or methods requires that all such items shall be provided in the quality and quantity required, and that the operations shall be performed according to the methods prescribed, complete with all necessary labour and incidentals.

.3 <u>These Specifications shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings, but which is mentioned or reasonably specified in the other shall be considered as properly and sufficiently specified and shall be provided.</u>

1.3 REFERENCES

.1 All work shall conform to the latest Codes, requirements and approval of the Authorities having jurisdiction and shall be subject to acceptance by the Consultant, and the following codes and standards:

- OBC, Latest Edition and Local Building Department requirements.
- Ontario Fire Marshall latest requirements.
- OESC – Latest Edition
- Electrical Safety Authority – Latest Inspection Bulletins
- CSA C22.1, Canadian Electrical Code, Part 1 - Latest Edition

1.4 DEFINITIONS

.1 The following are definitions of words found in Electrical Divisions of the Specification and on associated drawings:
  .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.
  .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
  .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
  .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete. Include labour, materials, and services necessary to supply and install items or work referred to.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify, and certify.
.6 "As instructed" or where instructed" – means as instructed by the Consultant including supplementary instruction notices and job site instruction notices.
.7 "listed" - means that the materials or equipment has been tested in accordance with applicable standards and methods and has been approved and listed for the intended use by a testing company approved by the Authorities having jurisdiction.
.8 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery, and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties, and assistance to Contractor.
.9 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, remove obsolete materials and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by consultant.
.10 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
.11 "Governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules, and regulations that apply to and govern work and to which work must adhere.
.12 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
.13 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
.14 "Approved" or "Approval" - means approved by Authorities having jurisdiction as conforming to Codes, Standards, By-Laws, etc.
.15 "Acceptable" or "Acceptance" – means acceptable to the Consultant as conforming together to the requirements of the contract documents.
.16 "Submit for Review" or "Submit Notice" – means submit to the Consultant.
.17 "Subject to Review" – means work shall be laid out for review by the Consultant. No work shall proceed until instructions have been obtained from the Consultant. Submit further information, shop drawings, samples etc. as specified and as may be requested by the Consultants.
.18 "Accessible" - means reachable by person with tools as required and where obstacles may be removed and replaced without cutting or breaking out materials.
.19 "board", "owner" - means School board.

.2 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.3 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.5 DOCUMENTS

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Drawings and Specifications are portions of Contract Documents and identify labour, products, and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.3 Read Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.

.4 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

.5 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.

.6 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

.7 Locations of equipment and materials shown may be altered, when reviewed by consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.8 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa in Specification.

.9 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission and confirm exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.10 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered a contract and there are no representations of any kind made by consultant to any other party.

.11 When scale and date of Drawings are the same, or when discrepancy exists within Specification, include most costly arrangement to take precedence.

.12 Unless otherwise specified in Division 00, Division 01, or "General Conditions", in the case of discrepancies or conflicts between Drawings and Specification, documents will govern in following order:
- .1 Specification.
- .2 Drawings of larger scale.
- .3 Drawings of smaller scale.
- .4 Drawings of later date when scale of Drawings is same.

1.6 IMPERIAL AND METRIC MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.7 EXAMINATION OF DOCUMENTS AND EXISTING SITE CONDITIONS

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work and include for such conditions in Bid Price.

.2 Carefully examine electrical, structural, mechanical, and architectural drawings, and fully understand the functioning of the system described and specified under this Section. If in doubt, contact the engineer before submitting the Bid Price.

.3 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.4 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.8 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction are quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards, or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
- .1 Ontario Building Code (OBC)
- .2 Electrical Safety Authority (ESA)
- .3 Ontario Electrical Safety Code (OESC)
- .4 Canadian Standards Association (CSA)
- .5 Underwriters' Laboratories of Canada (ULC)
- .6 National Standards of Canada (CAN)
- .7 National Building Code of Canada (NBC)
- .8 National Fire Protection Association (NFPA)
- .9 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE)
- .10 National Electrical Manufacturers Association (NEMA)
- .11 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
- .12 American National Standards Institute (ANSI)
- .13 Illuminating Engineering Society (IES)
- .14 Building Industry Consulting Services, International (BICSI)
- .15 Electronic Industries Association (EIA)
- .16 Canadian General Standards Board (CGSB)
- .17 Institute of Electrical and Electronic Engineers (IEEE)

.18 Occupational Health and Safety Act (OHSA)
.19 Technical Standards and Safety Authority (TSSA)
.20 Workplace Hazardous Materials Information System (WHMIS)
.21 International Standards Organization (ISO)
.22 Material Safety Data Sheets by product manufacturers.
.23 Local utility inspection permits.
.24 Codes, standards, and regulations of local governing authorities having jurisdiction.
.25 Additional codes and standards listed in Trade Sections.
.26 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay associated costs associated with these submittals.

.6 Unless otherwise specified, equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined as stated in Ontario College of Trades and Apprenticeship Act.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to consultant and submission of reports and certificates to consultant.

.11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.12 Electrical equipment and devices shall be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

.13 Makes and quality of the materials used shall be approved by the Consultants and authority having jurisdiction.

.14 Products and materials provided shall be new and free from all defects. Related materials shall be of the same manufacturer throughout the Project.

.15 Products and materials called for on the drawings or in the specifications by trade names, manufacturer names and catalogue reference are those which shall be used based on the Tender.

.16 Alternative products and materials to those specified shall only be considered if they are shown in the Tender as a material variation with an appropriate price adjustment. The Consultant reserves the right to accept or reject any alternative without explanation.

.17 Assume full responsibilities for ensuring that when providing alternative products or materials, all space, weight, connections, power, and wiring requirements, etc., are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts, and plans, etc., that may be necessary will be borne by this Division.

.18 Materials or equipment rejected by the Consultants shall be immediately removed from the project and suitable materials shall be provided.

1.9 PERMITS, CERTIFICATES AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.

.3 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities to certify that completed Work is in accordance with regulations of regulatory authorities and is acceptable to them.

1.10 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regards to Project work, i.e., seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with local Association of Professional Engineers and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's Consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned Consultants and their respective servants, agents, and employees in regard to the Work of this Contract.

.3 Liability insurance requirements are as follows:
- .1 coverage is to be a minimum of $1,000,000.00 inclusive of any one occurrence.
- .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice.
- .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work.
- .4 retained Consultants are to ascertain that Sub-Consultants employed by them carry insurance in the form and limits specified above.
- .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner’s Consultant, and Municipal Authorities as required prior to commencement of aforementioned Consultant’s services.

1.11 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces".

1.12 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
.1 large ducts (main runs)
.2 cable tray and bus duct
.3 conduit 100 mm (4") dia. and larger
.4 smaller branch ductwork
.5 conduit less than 100 mm (4") dia.

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.

.4 Do not use Contract Drawing measurements for distribution equipment layout, conduit installation work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established benchmarks for both horizontal and vertical measurements. Coordinate with and make allowances for work of other trades. Accurately layout work and be entirely responsible for work installed in accordance with layout drawings. Where any grade or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of the work for coordination with General Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, disks of engineering drawings for this use. Prints and/or disks of Contractors' interference drawings are to be distributed among other Trade Contractors and General Contractor. Submit drawings to consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Junction boxes for lighting, power, fire alarm, power packs, lighting controllers and such other systems devices and products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination by this Division.

1.13 COORDINATION OF THE WORK

.1 Fully understands the functions of the systems specified and have no doubts regarding the extent of the Contract.

.2 Examine the Architectural, Structural, Mechanical and Electrical drawings and become fully familiar with the work of other Divisions.

.3 Co-ordinate with all Divisions providing equipment and services and ensure that there is no confliction. Coordination requirements are to include but not be limited to following:
- .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work.
- .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.
- .3 depth and routing of excavation required for work, and requirements for bedding and backfill.
- .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.4 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes to enter building and be moved into spaces where they are to be located without difficulty.

.5 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building and protected from elements.

.6 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.7 Arrange equipment in proper relation with other apparatus, the building construction, the Architectural finish and with all work specified.

.8 Where space is shown for future equipment leave such space clear and ensure that the necessary connections can be made to the future equipment.

.9 Where work is to be integrated or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

.10 Failures to fully understand Drawings and allow for the work of other Divisions or where relocations are necessary due to lack of co-ordination between Divisions shall be remedied at the expense of this Division.

1.14 WORKMANSHIP

.1 All work shall be executed in a workmanlike manner and present a neat mechanical appearance.

1.15 EQUIPMENT AND MATERIALS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction.

.3 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.

.4 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Note that above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.5 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimension of such equipment differs from the specified equipment, prepare, and submit for review, accurately dimensioned layouts of rooms affected.

.6 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.

.7 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.

.8 Only base specified products specified acceptable products or equipment listed as alternate will be considered for acceptance by the owner. No proposed substitutions will be accepted.

.9 Indicate in Form of Supplementary Electrical Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for products unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

1.16 SHOP DRAWINGS

.1 At start-up meeting, confirm with consultant products to be included in shop drawing submission. Prepare and submit list of products to consultant for review.

.2 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
.1 Product literature cuts.
.2 Equipment data sheets.
.3 Equipment dimension drawings.
.4 System block diagrams.
.5 Sequence of operation.
.6 Connection wiring schematic diagrams.
.7 Functionality with integrated systems.

.3 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification section reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.4 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.5 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated, and signed will be returned to be resubmitted. Submit electronic copies of shop drawings unless otherwise directed by consultant. Confirm exact requirements with consultant.

.6 Approval of a drawing by this Division implies the following:

1. The drawing has been checked by the person making the approval.

2. The equipment or material complies in all respects with the requirements of the specifications and drawings.

3. The quantities, if indicated on the drawing, are correct.

4. The physical dimensions of the components are such that they can be installed without interference with the building structure or other equipment, and that, after installation, there are sufficient clearances on all sides for the maintenance, servicing, and operation of the equipment.

.7 Consultant will review shop drawings and indicate review status by stamping shop drawing copies as follows:
.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing.
.2 "REVISE AND RESUBMIT" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAIL DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR, AND SUCH REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Resubmit any drawing on which notations have been made, after it has been modified or corrected.

.10 Drawings that are re-submitted shall have a distinct notation of the fact made on each drawing.

.11 Works shall not proceed on any equipment, material or installation until the drawings have been reviewed by the Consultant.

.12 Each system and each major component are to be separate shop drawing submissions. Shop drawings for common devices such as devices of each system are to be submitted together.

.13 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.14 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

1.17 EQUIPMENT LOADS

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to consultant, via shop drawing submissions, prior to construction.

.2 When choice of specific equipment is made by Contractor, actual weight, location, and method of support of equipment may differ from those initially given to consultants and thus from those assumed for design. Consequently, it is necessary to back-check equipment loads, location, and supports.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with consultant prior to construction.

1.18 OPENINGS

.1 Supply opening sizes and locations to consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval of consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to consultant for review, well in advance of doing work.

.3 Chases, openings, cutting, patching, etc. shall be provided by this Division in accordance with those sections of the specification detailing the requirements.

.4 Flashing required for openings in walls, floors and roofs shall, unless otherwise noted, be provided by this Division.

.5 Electrical conduit roof flashing shall be similar to National Roofing supply product code# ECP-PVCH (electrical conduit post PVCH), Gooseneck S.S.A ARPGN2 (2”)/ ARPGN3 (3”).

.6 Drilling for hangers, rods, inserts and work of a similar nature shall be provided by this Division.

.7 Provide all necessary sleeves, inserts, anchor bolts, etc., prior to pouring of concrete or building of walls, roofs, etc.

.8 Advise the extent of such work and supply all information and details as to sizes and locations within thirty days after the award of the Contract.

.9 Failures to comply with the above requirements shall be remedied at this Division's expense.

.10 Where conduits pass through fire rated walls/ areas, proper fire stop material shall be used by Division 26. Submit shop drawings for review before installation.

1.19 SCAFFOLDING, RIGGING, AND HOISTING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to review by and coordination with consultant.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from consultant.

1.20 TEMPORARY CRANES

.1 Submit following to consultant for review:
  .1 Propose details showing existing structures and surfaces being used for lifting locations.
  .2 Copies of approvals of authorities for work.
  .3 Copies of approvals of property management of buildings affected by hoisting work, allowing for work.
  .4 Copies of required insurance for work.

1.21 CHANGES OR REVISIONS TO THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of work from that required by Contract Documents, prepare, and submit to consultant for approval, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as confirmed with consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.4 Unless otherwise specified in Divisions 00 or 01, following requirements apply to all quotations submitted:
- .1 When change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work.
- .2 Material costs are not to exceed those published in local estimating price guides.
- .3 Electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labour Units.
- .4 Costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work.
- .5 Cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision and change or revision must be such that site superintendent's involvement is necessary.
- .6 Costs for rental tools and/or equipment are not to exceed local rental costs.
- .7 Overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals.
- .8 Quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from consultant.

1.22 BREAKDOWN OF ELECTRICAL WORK COST

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.

.3 Indicate equipment, material, and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.23 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.24 PRELIMINARY TESTING

.1 When directed by consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant’s opinion, tests are required to be performed by a certified testing agency, arrange, and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant’s opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.25 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

.1 Confirm with Consultant what equipment can be used during construction.

.2 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.

.3 During this period of construction, such systems/equipment to not become property of Owner or be Owner’s responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment to maintain validity of warranties after turning over to Owner.

.4 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched up" etc.

1.26 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing, and commissioning.

1.27 PROTECTION

.1 Protect all finished and unfinished work from damage due to carrying out the work specified.

.2 Repair all damage resulting from execution of the work to the satisfaction of the Consultant.

.3 Should the project be stopped for any cause, provide all necessary protection to prevent damage by weather or other causes while such stoppage exists.

1.28 HANDLING AND STORAGE

.1 Materials and equipment shall be handled and stored in such a manner so that no damage shall be done to the materials, the structure of the building or surrounding property.

.2 Packaged or bundled materials and equipment shall be stored in dry weathertight secure enclosures in original undamaged condition with manufacturer's seals and labels intact.

.3 All metals shall be protected against corrosion and bending.

.4 Storage of materials, equipment etc. in the building structure shall not be permitted unless otherwise noted.

1.29 MINOR FIELD CHANGES

.1 The location, arrangement and connection of equipment and materials as shown on the drawings represents a close approximation to the intent and requirements of the Contract.

.2 The right is reserved to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes, if made prior to the installation, shall be done at no additional cost, unless the location, arrangement or connection is more than six feet from that shown on the drawings.

1.30 CLEANING UP

.1 During construction, and daily, keep the site reasonably clear of rubbish and waste material resulting from electrical work to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of electrical work.

.2 Clean the interior and exterior of all equipment and remove any debris during construction.

.3 Inspect and clean all systems and equipment prior to energizing and ensure that they are safe.

Perform a complete and thorough clean-up to the exterior and interiors of all systems and equipment before the final inspection. The interiors shall be cleaned using an industrial vacuum cleaner.

1.31 ELECTRICAL CONDUCTOR FIRE PTROTECTION

.1 Fire rated enclosures shall be provided to form service spaces for conduits containing electrical conductors for emergency power, elevators, and life safety equipment in accordance with the requirements of the Authorities having jurisdiction.

.2 Fire rated access panels shall be provided in the enclosures where required.

.3 The fire rated enclosures required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the sections of the specification detailing the fire rated enclosures requirements.

.4 Advise the extent of the fire rated enclosures required and supply all information and details as to size and locations within thirty days after the award of the contract.

.5 Failures to comply with the above requirements shall be remedied at this Division's expense.

.6 Where fire rated cables, that comply with the requirements of the Authorities having jurisdiction, are provided it shall not be required that they be installed in fire rated enclosures.

1.32 SPRINKLER PROOF EQUIPMENT

.1 Where sprinklers are installed; electrical equipment shall be constructed so that water from the sprinkler heads shall not impair the effectiveness of the equipment.

.2 A separate and complete roof shall be provided on free standing or surface mounted equipment. An overhang at the front, rear and sides shall prevent the entrance of water either at the top or through projecting face plates, meters, etc. Provide complete gaskets to suit.

.3 Where openings are required in the roofs or sides of incoming and outgoing conduits and cables, removable gasketed plates shall be provided and the conduits and cables shall be installed using waterproof fittings. The plates are to be grounded by a separate copper strap to the equipment.

.4 Distribution and power panels, panel boards, etc. and switchboards shall be complete with gaskets and doors.

1.33 EQUIPMNENT AND MATERIAL COLOURS

.1 Where materials and equipment are specified to be a specific colour, a sample of the colour proposed by the manufacturer shall be submitted with the shop drawing.

.2 Where materials and equipment are specified to be of colours as selected by the Consultant, these shall be determined during the Contract. Obtain the colour requirements from the Consultant prior to submitting shop drawings so that the appropriate sample of the colour can be submitted with the shop drawings.

1.34 SLEEVES

.1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.

.2 For wall partitions and ceilings, the ends of the sleeves shall be flush with the finish on both sides. For floors they shall extend 50mm above and below finished floor level.

.3 The space between the sleeve and the conduit and spare sleeves shall be filled with Dow Corning silicone RTV foam for fire stop. Caulk around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound.

1.35 EXCAVATION AND BACKFILL

.1 The excavation and backfill required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the Sections of the Specification detailing the excavation and backfill requirements.

.2 Advise the extent of the excavation and backfill work required by this Division and supply all information and details as to size and locations within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.36 HOUSEKEEPING PAD

.1 All floor mounted electrical equipment installed by this Division shall be mounted on concrete housekeeping pads which shall, unless otherwise noted, be provided by this Division.

.2 Advise the extent of the housekeeping pads required by this Division and supply all information and details as to size and location within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.37 CONCRETE

.1 The concrete and reinforcing required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the Sections of the Specifications detailing the concrete and reinforcing requirements.

.2 Advise the extent of the concrete and reinforcing work required by this Division and supply all information and details as to size and locations within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.38 PAINTING

.1 All equipment shall be supplied with manufacturer's standard finish coat, unless otherwise noted.

.2 All supports, hangers, etc. provided or fabricated by this Division shall be painted with two coats of zinc chromate primer.

.3 Where the finish on any materials or equipment installed by this Division is damaged, it shall be touched-up, completely repainted or replaced to the satisfaction of the Consultant.

1.39 IDENTIFICATIONS

.1 Identify each item of equipment installed by this Division, whether supplied by it or not.

.2 Metal surfaces shall be thoroughly cleaned before application of identification.

.3 Identifications shall be installed after painting has been completed and shall be secured with self-tapping screws or rivets except when installed on the inside of doors when gluing will be acceptable.

.4 Manufacturer's nameplates shall be affixed to each item supplied showing the size, name of equipment, serial number and all information usually provided including voltage, cycle, phase, horsepower, etc., and the name of the Manufacturer and his address. Ensure that all stamped, etched, or engraved lettering on plates is perfectly legible. Do not paint over nameplates and where equipment is to be concealed attach the nameplates in an accessible location.

.5 Panels and all other equipment which have exposed faces in finished areas shall not have any visible trademarks or other identifying symbols. Nameplates shall be mounted on the inside of the doors.

.6 Each lighting panel shall have a directory mounted on the inside of the door behind a protective plastic screen. The directories shall be typewritten and shall identify each branch circuit used. Spares and spaces shall be noted in pencil.

.7 The nameplates for switchboards, distribution panels, power panels, etc. shall be Lamicoid with 13mm high letters with typical identification of e.g., "PP`AA, 600V 3 PH., 4W, fed from Switchboard `A' ".

.8 The nameplates for panel boards shall be Lamicoid with 9.5mm high letters with typical identification of: e.g., "LP`B', 208V, 3Ph, 4W, fed from PP'A"'.

.9 Each breaker, switch, instrument, meter, etc. in switchboards, distribution panels, power panels, etc. shall have a Lamicoid nameplate with 6.4mm high letters with typical identification of: e.g., "Elevator #1" or “Pump-1A”.

.10 The nameplates for disconnect switches, starters, time clocks, dimmers etc. shall be Lamicoid with 6.4mm high letters with typical identification of: e.g., "Supply Fan "S4", 5 HP, 600V, 3Ph., 3W, fed from `PP-1"'.

.11 Each feeder cable and feeder conduit shall be identified with 25mm high letters with typical identification of "208V, 3Ph, 4W to LP'B"'. The identification shall be provided at each access door, each change of direction, each junction box, at each floor or platform for vertically exposed conduits or cables at 2 metres above floor, at not more than 15 metres apart in straight runs, and on both sides of sleeves through walls.

.12 The interior, exterior and lids of all junction boxes and outlet boxes shall be neatly identified with different colours of paint. The colours shall be consistent throughout the project for the following systems:
- .1 347/600 Volt System – Black
- .2 120/208 Volt System – Blue
- .3 120/208 Volt Lighting – Yellow
- .4 120/208 Volt Emergency Lighting System – Orange
- .5 Intrusion Detection System – Purple
- .6 Computer System – Pink
- .7 Fire Detection and Alarm System – Red
- .8 Telephone System – Brown
- .9 P.A./Telephone System – Green
- .10 Cable TV – White (Co-ordinate with the Board)

.13 Provide all signs and marking of equipment as required by the Authorities having jurisdiction.

.14 Outlet boxes for light switch(es) and receptacle(s) and junction boxes provided for lighting or power connections shall be identified on the box cover with circuits contained in the box, the panels from which they are fed, the voltage and the purpose of the outlet.

.15 Each power switch and receptacle shall be complete with permanent printed adhesive label installed on faceplate, identifying panel and circuit from which it is fed.

1.40 MOCK-UP

.1 A mock-up of the ceiling shall be provided by another Division of the Specification.

.2 Provide samples of the lighting fixtures, fire alarm devices and all other items of equipment mounted in or on the ceiling and obtain acceptance for the samples and their installation.

1.41 TEMPORARY AND TRIAL USAGE

.1 When it is claimed that a portion of the work is completed and in accordance with the Drawings and Specifications, the Owner shall have the privilege of temporary and trial usage for a reasonable length of time for making a complete and thorough test of the portion of the work completed.

.2 Temporary or trial usage by the Owner of any electrical device, machinery, apparatus, equipment or any other work or materials supplied under this Contract before final completion and written acceptance, is not to be construed as evidence of acceptance of same.

1.42 RECORD (AS-BUILT) DRAWINGS

.1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version confirmed with consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from consultant by paying $2,500. Drawings may also to be used for preparation of layouts and interference drawings.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes, and deviations from routing of services and locations of equipment shown on Contract Drawings, daily. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep always set up to date, and ensure set is always available for periodic review. As-built set is also to include the following:
   .1 Dimensioned location of inaccessible concealed work.
   .2 Locations of control devices with identification for each.
   .3 Location of all pull boxes and junction boxes.
   .4 Locate, with dimensions to the building grid and datum lines, all buried and concealed services, pull boxes, junction boxes, etc. for all systems.
   .5 Location of all conduits, ducts, wiring, and conductor runs for all systems including sizes, types of components, circuit numbers, etc. exactly as installed.
   .6 Location of concealed services terminated for future extension.
   .7 Room names and numbering, equipment names, etc. shall be in accordance with the Owner's designation and may not necessarily be those shown on the drawings.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to consultant for review. Make necessary revisions to drawings as per Consultant’s comments, to satisfaction of consultant.

.4 Reviews of the record drawings by the Consultant shall be for general conformance only and is not an approval of the accuracy of the drawings. Electrical Division shall be responsible for the accuracy of the record drawings.

.5 Submit final reviewed "as-built" drawing set to consultant to produce final “as-built” CAD drawings for submission to the School Board.

.6 Transfer all recorded information from marked-up set of As-Built condition to AutoCAD.

.7 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of consultant.

1.43 TESTING AND COMMISSIONING

.1 All systems, equipment and installation shall be inspected, tested, adjusted, and commissioned to ensure compliance with the Drawings, Specifications and the Requirements of the Authorities having jurisdiction.

.2 Provide testing equipment, instruments, material and labour for all testing and commissioning.

.3 Submit reports of all testing and commissioning for review by the Consultants.

.4 This Division shall include for the cost of one qualified serviceman, completely familiar with the project, complete with appropriate spare parts and tools, to become part of the commissioning team for the project. The serviceman shall assist the Owner for a total of 60 hours during the commissioning process. This work will be required at or near the substantial completion phase of the project. Each Division and/or trade providing serviceman shall ensure continuity of their function by having only one such person assigned to the commissioning team.

.5 The actual performance of this work will be scheduled and coordinated by the Owner.

1.44 SYSTEM ACCEPTANCES

.1 Prior to requesting final inspection, submit, for review by the Consultant, letters from the manufacturers of equipment and systems indicating that their Technical Service Representatives have inspected and tested the equipment and systems and are satisfied with the methods of installation, connections, and operation.

.2 Acceptance letters shall be submitted for the following, when applicable:
- .1 Switchboard
- .2 Distribution Panels
- .3 Power Panels
- .4 Panel Boards
- .5 Fire Detection and Alarm System
- .6 Emergency Lighting System
- .7 Intrusion Detection System
- .8 Video Surveillance System
- .9 Public Address System
- .10 Lighting Control System

1.45 INSTRUCTIONS AND DEMONSTRATIONS

.1 Instruct the Owner's designated personnel during construction and prior to requesting final inspection so that they are fully familiar with all aspects in the function, installation, operation and maintenance of all systems and equipment.

.2 Arrange for and pay for the services of manufacturer's service technicians, engineers and other personnel required for instruction on specialized systems or installation.

.3 After commissioning of the systems, equipment, and installation they shall be fully demonstrated by this Division and representatives of the manufacturers to the Authorities having jurisdiction.

.4 Prior to requesting final inspection submit, for each system, the following:
- .1 Dates and durations of instructions given to designated personnel and the names of persons instructed.
- .2 Signature of each person instructed stating that they understand and are familiar with the function, installation, operation, and maintenance of the system.
- .3 Dates and durations of demonstrations to Authorities having jurisdiction and names of all persons present.

1.46 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 Supply one hard copy of operating and maintenance (O&M) manuals consolidated in hardcover three "D" ring binders with each binder sized to include approximately 25% spare space for future data. Confirm exact quantity of manuals with consultant. Each binder to include:
- .1 On front cover: project name; wording – "Electrical Systems Operating and Maintenance Manual"; and date.
- .2 Introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.

.3 Equipment manufacturer's authorized contact person name, telephone number and company website.
.4 Table of Contents sheet, and corresponding Index tab sheets for all electrical specification sections.
.5 Copy of each "Reviewed" or clean, updated "Reviewed As Noted" shop drawing or product data sheet, with manufacturer’s/supplier’s name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
.6 Testing and commissioning reports, and certificates issued by governing authorities.
.7 Operating data is to include:

.1 Demonstration and instruction certificate.
.2 Description of each system and its controls.
.3 Control schematics for equipment/systems.
.4 Description of operation of each system.
.5 Operation instruction for each system and each component.
.6 Description of actions to be taken in event of emergencies and/or equipment failure.
.7 Testing procedures.
.8 Trouble finding procedure.

.8 Maintenance data is to include:

.1 Servicing maintenance, operation, and trouble-shooting instructions for each item of equipment and each system.
.2 Schedules of tasks, frequency, tools required, and estimated task time.
.3 Complete spare parts lists with numbers.
.4 Catalogue sheets for all components.
.5 Approved shop drawings.
.6 Wiring diagram.

.9 Copies of warranties.
.10 Items requested specifically in Section Articles.

.2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner’s building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

.4 Provide 1 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with consultant and enhanced with bookmarks and internal document links. Each PDF file name shall be the same as that indicated in the binder. The contents in each PDF file shall be searchable.

1.47 COMMISSIONING

.1 A commissioning Authority will be appointed by the Board/Owner to oversee the commissioning activities of the electrical contract. Cooperate and coordinate with the Authority. Perform all commissioning activities for all aspects of work provided in Electrical Divisions. Perform all corrective work identified by the Authority.

.2 Comply with the requirements of sections 20 05 40 and 25 05 15, prepared by Commissioning consultant.

1.48 WARRANTY

.1 Unless otherwise specified in Divisions 00 and 01, warrant electrical work to be in accordance with Contract Documents and free from defects for a period of one (1) year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.7 Submit signed and dated copies of extended warranties to consultant which clearly states herein specified requirements.

.8 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
.1 once during first month of building operation.
.2 once during third month of building operation.
.3 once between fourth and tenth month in a season opposite to first- and third-month visits.

.9 The following table indicates the warranty period that shall be provided for the following equipment:

EQUIPMENT	ITEMS	WARRANTY
LIGHTING	All types of lighting fixtures including LED lamps, drivers, and other associated components.	5 YEARS
LIGHTING CONTROLS	Lighting controls components including occupancy sensors, power packs, dimming switches, room controllers, control wiring and other associated	5 YEARS

EQUIPMENT	ITEMS	WARRANTY
	components	
DISTRIBUTION	Electrical distribution including switchboard, power panels, panel boards, contactors, transformers, relays, cables, wiring etc.	1 YEAR
FIRE ALARM SYSTEM	Fire alarm system completes with all components, devices etc.	1 YEAR
TELECOMMUNICATIONS NETWORK INSTALLATIONS	Data system completes with all components, devices etc.	1 YEAR WARRANTY COVERING THE INSTALLED CABLING SYSTEM. MINIMUM 15 YEAR MANUFACTURER'S EXTENDED ASSURANCE WARRANTY FOR THE ENTIRE COMMUNICATIONS CABLING SYSTEM.
PUBLIC ADDRESS SYSTEM	Public address system complete with all components, devices etc.	1 YEAR
SECURITY SYSTEM	Security system complete with all components, device etc.	5 YEAR

.10 The Owner/Board reserves the right to initiate a service contract for all equipment with one of the boards approved certified service companies. This shall not affect any of the above extended warranties provided by the manufacturers.

1.49 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

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

1.50 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in electrical work Sections in accordance with following requirements:

.1 Submit a copy of each equipment/system manufacturer's start-up and verification report sheet to consultant for review and incorporate any comments.

.2 Under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit a complete set of start-up and verification documentation sheets signed by manufacturer/supplier and Contractor, to consultant.

1.51 PROJECT CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
.1 Operating and Maintenance Manuals.
.2 As-built record drawings and associated data.
.3 Extended warranties for equipment as specified.
.4 Operating test certificates, i.e., Fire alarm verification Certificate.
.5 Final commissioning report.
.6 Identified keys for equipment and/or panels for which keys are required, and other items required to be submitted.
.7 Other data or products specified.

1.52 INSTRUCTIONS TO OWNER

.1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

.2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations.
.2 Troubleshooting – diagnostic instructions, test, and inspection procedures.
.3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like.
.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.
.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
.6 The training sessions shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Consultant shall video tape the sessions. Refer to Section 20 05 40 for further requirements.

.5 Before instructing Owner's designated personnel, submit to consultant for review a preliminary copy of training manual and a proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.6 Obtain in writing from consultant a list of Owner's representatives to receive instructions. Submit to Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
.1 Date instructions were given to Owner's staff.
.2 Duration of instruction.
.3 Names of persons instructed.
.4 Other parties present (manufacturer's representative, consultants, etc.).

.7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation, and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.8 Submit to Consultant, copy of electronic version of training materials used to train Owner's designated personnel. Include in operating and maintenance manuals submission.

1.53 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
.1 Deficiencies noted during job inspections have been completed.
.2 Field quality control procedures have been completed.
.3 Systems have been tested and verified, adjusted, and are ready for operation.
.4 Maintenance and operating data have been completed and submitted to, reviewed, and accepted by consultant.
.5 Tags and nameplates are in place and equipment identifications have been completed.
.6 Clean-up is complete.
.7 Spare parts and replacement parts specified have been provided and acknowledged by consultant.
.8 As built and record drawings have been completed and submitted to, reviewed, and accepted by consultant.
.9 Owner's staff has been instructed in operation and maintenance of systems.
.10 Commissioning procedures have been completed.

1.54 SUB-CONTRACTORS TO THE ELECTRICAL CONTRACTOR

.1 The Electrical Contractor agrees to employ those sub-contractors proposed in the Electrical Form(s) of Tender and accepted by the Board/Owner at the signing of the Contract with the General Contractor.
.1 The Board/Owner may, for reasonable cause object to the use of a proposed Sub-Contractor and consequently, may require the Electrical Contractor to employ one of the other Sub- Contractors or Bidders.

.2 If the Board/Owner requires a change from a proposed Sub-Contractor originally proposed by the Electrical Contractor, the Contract Price shall be adjusted by the difference in cost.

.3 The Electrical Contractor shall not be required to employ as a Sub-Contractor, a firm to whom he may reasonably object.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.
.2 CSA-C22.2 No. 51 (latest edition), Armoured Cables.
.3 CSA C22.2 No. 38 (latest edition), Thermoset-Insulated Wires and Cables.
.4 CSA C22.2 No. 75 (latest edition), Thermoplastic-Insulated Wires and Cables.
.5 CSA C22.2 No .0.3 (latest edition), Test Methods for Electrical Wires and Cables.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Low voltage wires and cables up to 4/0 shall, unless otherwise noted, have copper conductors with T90 Nylon, 600-volt insulation.

.3 Low Voltages wires and cables 250 MCM and larger shall, unless otherwise noted, have copper conductors with RW90 X-Link minus 40 degrees F, 1000-volt insulation.

.4 Aluminium sheathed feeder cables shall, unless otherwise noted, have a corrugated seamless aluminium sheath, copper conductors, RA90 X-Link minus 40 degrees F, 1000-volt insulation and without P.V.C. jacket.

.5 M.I.C.C. cables shall have solid copper conductors insulated with magnesium oxide and enclosed in a seamless copper sheath with a protective jacket where required.

.6 All outdoor and underground wiring shall have copper conductors with RWU-90, X-Link, minus 40 degrees F, 1000-volt insulation.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Wires and cables shall be selected so that their current carrying capacity conforms to the standards of the Authorities having jurisdiction.

.3 Feeders and branch circuits shall be as indicated on the drawings. Supporting of wires and cables with tie wires, perforated straps, etc., shall not be permitted. Electrical Contractor shall use approved clips.

.4 Unless otherwise indicated on the drawings no wire smaller than #12 AWG shall be used except for internal wiring of lighting fixtures which can be #14.

.5 BX90 aluminium sheathed cable, unless otherwise noted, may be used in accessible ceiling space and where concealed only. Install BX cables with anti-short bushings.

.6 Aluminium sheathed and M.I.C.C. cables shall be installed with horizontal supports at not more than 1220mm intervals and shall be spaced, bonded, and grounded in accordance with the requirements of the Authorities having jurisdiction.

.7 Aluminium sheathed and M.I.C.C. cables shall be terminated with moisture proof connectors.

.8 Where single conductor cables enter a ferrous box, provide the required non-ferrous plates. Slotting between the knockouts shall not be accepted.

.9 Aluminium sheathed and M.I.C.C. cables shall be suitably protected, when installed within 5 feet of the floor and in all locations where they might be subject to mechanical injury.

.10 Joints in feeder cables shall not be permitted.

.11 Joints in branch circuit wiring shall only occur where such circuits divide at a junction box and shall be mechanically and electrically sound and shall be securely fastened by means of "Ideal" 600V special service wire nut connectors.

.12 Conductors shall be colour coded and the colour coding shall be consistent throughout the project.

.13 Conductors shall be identified with self-sticking wire markers, indicating circuit number at all terminations and joints, at panels, pull boxes, junction boxes, etc.

.14 Termination lugs for feeder cables shall be compression type.

.15 All outdoor and underground wiring shall have copper conductors with RWU-90, X-Link, minus 40 degrees F, 1000-volt insulation.

.16 Wiring terminated in an outlet box for future lighting or power shall have 250mm of slack and each cable shall be terminated in a connector.

.17 Exposed cable runs shall be installed parallel to, or horizontally on, the walls of the building.

.18 Loads shall be circuited to provide fully balanced feeders.

.19 Only lubricants approved by the Authorities having jurisdiction shall be used and they shall be suitable for the type of cables installed.

END OF SECTION

1.1 GENERAL

1.2 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 OESC – Latest Edition.
  .2 Electrical Safety Authority – Latest Inspection Bulletins.
  .3 CSA C22.1, Canadian Electrical Code, Part 1 – Latest Edition.
  .4 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The grounding equipment shall be in accordance with CSA C22.2 and the copper grounding conductors in accordance with ASA G7.1.

.3 Provide non corroding accessories necessary for the grounding system.

.4 Building ground system to consist of a grid of copper welded ground rods (minimum 4' to 10' (1.2m to 3m) long spaced minimum of 10' (3m) apart, interconnected with bare minimum No. 3/0 AWG copper loop. Ground rods shall be driven sufficiently to contact permanent water table. Provide minimum No. 3/0 AWG copper ground loop inside electrical room and vaults for grounding of equipment enclosures and connect to ground grid. Connect building water service pipes (both street and building sides), gas service pipes and sprinkler system pipes, supply and return hot water heating pipes to ground system with minimum No. 3/0 AWG copper ground conductor in conduit. Perform resistivity test on soil to determine exact quantity of rods (minimum of 4).

.5 All buried ground connections shall be Thermit welded type.

.6 Provide one (1) No. 3/0 AWG insulated green copper ground conductor in conduit from the main building ground to the main Telephone/LAN Room. Provide a minimum 24" (600mm) long x 2" (50mm) high x 3/8" (10mm) thick copper ground bus and install on wall with standoff isolators and connect to 3/0 cable. Ground bus to have eight drilled taps. Provide one (1) #6 AWG green ground conductor in conduit from this ground bus and extend to each satellite LAN Room and coil for future connection to computer cable termination rack.

.7 Where cable trays are used for the data cabling pathways, ensure that they are grounded and bonded in accordance with the Ontario Electrical Safety Code.

.8 Continuous rows of fluorescent/LED fixtures shall be equipped with No. 12 bare copper ground wire for the full length of fixture row.

.9 The accessories shall be as manufactured by Burndy, Erico, Amp or Caldweld.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide complete permanent and continuous, system and equipment grounding systems including, ground rods, conductors, connectors, accessories, to conform to requirements of the Authorities having jurisdiction.

.3 Install connectors to manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 All non-current carrying metal parts shall be bonded in accordance with ESA, CSA, and provincial inspection department standards.

.6 The neutrals of the dry-type transformer shall be connected by a separate copper ground wire to the ground bus in the switchboard.

.7 A separate copper ground wire to the ground bus in the switchboard shall be provided for each isolation transformer and isolated ground lighting panel.

.8 Separate copper wire shall be installed in all flexible conduits, in all rigid conduits, in wall or below slab conduits, EMT conduits and all non-metallic conduits.

.9 Connect the ground bus in the main switchboard to the main ground and incoming water main ahead of the water meter and provide a water meter shunt.

.10 The grounding system in the main switchboard shall be suitable for use with the ground fault system.

.11 Install separate grounding/bonding systems for telephone system, fire detection and alarm system, public address system, video surveillance system and intrusion detection system, in accordance with the systems suppliers' requirements.

.12 Install grounding system for pad mounted transformer in accordance with ESA and Local Hydro requirements.

.13 All grounding conductors run inside of building, except in electrical and LAN rooms, shall be run in EMT conduit.

.14 Install separate ground conductor for outdoor lighting standards.

.15 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, transformers, switchgear, duct systems, motor frames, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting etc.

.16 Install electrode interconnections where metal parts, circuits, or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

.17 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Type `C', `D', `T' and `E' pull boxes, junction boxes and cabinets shall be made of code gauge steel with corners lapped and welded and shall be painted and identified as noted in this specification.

.3 Cabinets shall provide proper space for conduits, wires and connections and their size shall be in accordance with the requirements of the Authorities having jurisdiction.

.4 The trim and cover shall be as required by the service and location.

.5 Splitters shall be sheet metal enclosure complete with welded corners and formed hinged cover suitable for locking in closed position.

.6 Splitters main and branch lugs/connection bars shall match the required size and number of incoming and outgoing conductors as indicated on drawings.

.7 At least three spare terminals shall be provided on each set of lugs in splitters less than 400A.

.8 The metal cabinets shall be as manufactured by Eaton, Square-D, Siemens, or Hammond.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Pull boxes, junction boxes and cabinets shall be independently supported from the conduit connected to them.

.3 Pull boxes shall be installed in inconspicuous but accessible locations.

.4 The cabinets shall be suitable for the installation and location.

.5 Cabinets shall be mounted with top not higher than 2m above finished floor.

.6 All electrical pull boxes above drywall ceilings shall be accessible via a properly sized access door installed directly below the respective pull box in drywall ceilings. Temporary removal of electrical light fixtures will not be considered safe access to above ceiling electrical boxes and shall not be permitted and acceptable.

.7 Install splitters and mount plumb, true and square to the building lines.

.8 All pull boxes, cabinets, equipment shall be identified in accordance with Section 26 05 01, Electrical Work General Instructions.

.9 Identification labels shall be provided indicating system name voltage and phase.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.1, Canadian Electrical Code, Part 1.
.2 OESC – Latest Edition.
.3 Electrical Safety Authority – Latest Inspection Bulletins.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Size boxes in accordance with latest edition of OESC and/or CSA C22.1.

.3 102 mm square or larger outlet boxes shall be provided as required for special devices.

.4 Blank cover plates shall be provided for all outlet boxes without wiring devices.

.5 347 V outlet boxes shall be provided for 347 V switching devices.

.6 Barriers shall be provided for outlet boxes where more than one system are grouped.

.7 Outlet boxes used with rigid steel conduit shall be `FS' or `FD' Feraloy condulets.

.8 Outlet boxes used with EMT conduit shall be electro-galvanized and made of code gauge steel except when they are surface mounted on walls and then they shall be `FS' or `FD' Feraloy condulets.

.9 Outlet boxes installed outside the building shall be weatherproof type, with neoprene gasket and cast cover.

.10 Electro-galvanized steel masonry single and multi-gang boxes shall be provided for devices flush mounted in exposed block walls.

.11 Electro-galvanized sheet steel concrete type boxes shall be provided for flush mount in concrete with matching extension and plaster rings as required.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 All outlet boxes shall be supported independently of connecting conduits.

.3 Outlet boxes shall have adequate knockouts, but only those knockouts actually required shall be opened.

.4 Outlet boxes shall be securely fastened to the surface on which they are mounted. If the boxes are not mounted on a surface, then adequate and independent supports must be provided.

.5 Outlet boxes shall be provided for each surface mounted lighting fixture.

.6 Outlet boxes shall be provided for each recessed mounted lighting fixture.

.7 Multi-gang outlet boxes with single cover plate shall be used where switches are grouped.

.8 Unused opened knockouts shall be closed with steel knockout plugs.

.9 Correct size of openings shall be provided in boxes for conduit, mineral insulated and armoured cable connections. Installation of reducing washers will not be acceptable and allowed.

.10 All electrical outlet boxes above drywall ceilings shall be accessible via a properly sized access door installed directly below the box in drywall ceilings. Temporary removal of electrical light fixtures will not be considered safe access to above ceiling electrical boxes and shall not be permitted and acceptable.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-C22.2 No. 62 (latest edition), Surface Raceway System.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Supply and install a surface raceway system. The raceway is to be wall mounted or otherwise supported as indicated. It is to be used as a flexible wiring system and for the installation of receptacle outlets and computer in heavily serviced areas, as shown on the drawings.

.3 The raceway is to be two channels with removable cover to provide access to wiring and to permit the easy addition or alteration of circuits and devices at any time. Fabricate raceway and cover shall be from high impact plastic material and homogeneous coloured plastic. Finish Colour to be selected by the Architect.

.4 Multi-channel raceway is to be provided for power circuits and computer wiring as indicated.

.5 The system shall be suitable for 120/208V, 3 phase, 4 wire distribution.

.6 The system shall be Panduit T70 two channel raceways for locations as shown on Drawings.

.7 Provide all fittings and covers necessary for the installation. Fittings and covers shall be tampered resistant to prevent unauthorized access to the wiring. This shall include but not limited to the following items:
.1 Raceway base and cover
.2 Divider wall
.3 Wire retainer
.4 Base coupler fitting
.5 Cover coupler fitting
.6 T70 right angle fitting
.7 T70 end cap fitting
.8 Mounting bracket
.9 Connector clip
.10 2-port screw-on sloped faceplate – data
.11 2-port screw-on sloped faceplate - power
.12 Device box/ bracket for standard data/communication and electrical devices
.13 Cover plates for standard data/communication and electrical outlets

.14 Duplex receptacle outlets

.8 Receptacles shall be as specified in Section 26 27 26.

.9 Computer outlets/ jacks shall be as specified in Section 27 11 19.

.10 Devices shall be flush mounted inside the raceway.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install the raceway and accessories in a neat and orderly manner.

.3 Raceways shall be installed horizontally on millwork, walls above counters, baseboards, and backsplash, fixed to drywall or masonry wall surfaces, at mounting heights indicated on the drawings.

.4 Arrange for the installation of backing in drywall partitions to ensure that the raceway is securely fastened. Horizontal metal studs mounted with sheet metal screws are satisfactory. Fasten raceway base to backing.

.5 Use continuous lengths for standard lengths. For shorter lengths, field cut to suit. Carefully cut all barriers, covers and bases. Make cuts at right angles. Cut edges to be free from burrs, sharp edges, bends, and other distortions. Use a floor mounted power hacksaw or similar device for cuts.

.6 In-feeds are to be conduit run concealed in walls and ceiling space for new walls and vertical raceway for existing walls.

.7 Install wire and devices as required.

.8 Mount Lamacoid nameplates on raceway devices plates, above or below each outlet. Attach with screws. Adhesive fasteners are not acceptable. Engrave with circuit number, including panel designation, and computer outlet number.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 45, Rigid Metal Conduit.
.2 CSA C22.2 No. 83, Electrical Metallic Tubing.
.3 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit.
.4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.5 CAN/CSA C22.2 No. 227.3, Flexible PVC conduit. Non-metallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 Location drawings for all required sleeves and formed openings in poured concrete or precast concrete construction.
.2 Samples of materials and any other items as specified in succeeding Sections of this Division of the Specification.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Rigid metal conduits shall be electro-galvanized and made of standard weight steel pipe and connected with electro-galvanized threaded couplings.

.3 Electrical metallic tubing shall be a metal raceway which has a wall thinner than that of rigid metal conduit and an outside diameter sufficiently different from that of rigid metal conduit to render it impracticable for anyone to thread it with a standard pipe thread.

.4 Rigid PVC conduits shall be a rigid non-metallic conduit of un-plasticized polyvinyl chloride.

.5 Rigid Type I shall be similar to rigid PVC duct, Type EB1, to CSA Standard B196.1 requiring encasement in concrete.

.6 Rigid Type II shall be similar to Type I except of heavier construction and suitable for direct burial.

.7 Flexible conduits shall be liquid-tight flexible metal conduit.

.8 Rigid metal conduits entering boxes in dry locations shall be secured with galvanized steel locknuts and nylon insulated steel bushings.

.9 Rigid metal conduits entering boxes in wet locations shall be secured with steel bullet hub connectors, nylon insulated with neoprene `O' ring.

.10 Connectors for EMT surface mounted conduit shall be steel, set screw and nylon insulated.

.11 Connectors for EMT conduit in concrete shall be steel, raintight, concrete tight and nylon insulated.

.12 Couplings for EMT conduit surface mounted shall be steel set screw type.

.13 Couplings for EMT conduit in concrete shall be steel, rain tight and concrete tight.

.14 Connectors for flexible conduit shall be steel, liquid-tight, nylon insulated with neoprene `O' ring.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change, or violate any part of the installed system components or the CSA/UL certification of these components.

.3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.4 Raceways shall be as shown on the Drawings and as detailed in the Specification.

.5 The size of conduit shall be in accordance with the requirements of the Authorities having jurisdiction.

.6 All conduits inside the building shall, unless otherwise noted, be electrical metallic tubing.

.7 Unless otherwise noted branch circuit conduits shall be concealed in wall and ceilings or exposed in unfinished areas and shall not be installed below or in any concrete slab unless otherwise approved by the owner/consultant. Where it is noted that branch circuit conduits can be installed in a concrete slab that is not on grade the conduit shall be electrical metallic tubing with a copper ground wire.

.8 Conduits exposed to the weather, in wet locations, subject to mechanical injury or in any hazardous locations, shall be rigid metal conduit.

.9 Conduits in plenums shall be rigid metal conduit.

.10 Telephone zone conduits shall be PVC conduit when installed in concrete and EMT in other locations.

.11 Telephone distribution conduits shall be rigid P.V.C. conduit when installed in concrete or underground and EMT conduit in other locations.

.12 Motor feeder drops shall be in rigid conduit with a maximum 910mm of flexible metal conduit. Rigid conduit for the drops shall start at least 910mm ahead of the actual bend and have two additional clips over normal requirements. The minimum conduit size for the drops shall be 19mm.

.13 Liquid tight flexible metal conduit shall be used for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.14 Explosion proof flexible connection shall be used for connection to explosion proof motors.

.15 Conduit sealing fittings shall be installed complete with compound in hazardous areas.

.16 Conduits in finished areas shall be concealed and those in unfinished areas shall be surface mounted unless otherwise noted.

.17 Feeder conduits shall not be installed in or below any concrete slab, unless approved by the Consultant.

.18 Conduits shall be installed so that the conductors can be drawn in without strain or injury.

.19 Expansion fittings shall be installed in conduits crossing expansion joints.

.20 Conduits shall be installed to provide for expansion and expansion fittings shall be provided where required.

.21 Conduits shall not be installed within 75mm of water, sprinkler, drain or waste piping.

.22 Exposed conduits shall run parallel to or horizontally on the walls of the building.

.23 Conduit ends shall be carefully plugged during construction with steel capped bushings.

.24 The use of running threads shall not be permitted. Ericson couplings shall be used where required.

.25 Conduits shall not pass-through structural members without the approval of the Consultants.

.26 Powder activated fastenings can only be used if approved by the Consultant.

.27 Conduits shall be fastened with approved clips. Supporting of conduits with tie wires, perforated straps, etc. shall not be permitted. If a conduit rests on structural steel, etc., this will not be considered as a support. Provide proper supports, hangers, etc. and supports conduits from the top of structural beams/joists.

.28 Conduits shall not be attached or suspended from the metal deck unless approved by the Consultant.

.29 Conduit supports shall be spaced in accordance with the requirements of the Authorities having jurisdiction.

.30 An adequate number and size of pull boxes shall be installed where required in all conduits runs to facilitate the installation of the conductors.

.31 Fish wires shall be installed in all empty conduits, including telephone conduits.

.32 Excessive lengths of flexible conduit shall not be accepted. Maximum 10'-0" of length will be acceptable.

.33 Proper metallic contacts shall be made between conduit, boxes, etc.

.34 Maximum size of conduit on which ground bushings can be used is 32mm.

.35 A separate ground wire shall be installed in all flexible conduits, EMT conduits, underground conduits, in wall or below a concrete slab, underground parking lot lighting and in all non-metallic conduits or ducts.

.36 Installation of conduit in oversize knockouts shall not be accepted.

.37 Joints in conduits installed underground, in concrete slab on grade or in a concrete duct bank shall be pitched on the outside and made completely watertight.

.38 Minimum concrete thickness over a conduit in a concrete slab where applicable shall be 50mm.

.39 Spare or unused conduits that terminate in an enclosure shall be capped.

.40 Conduits passing through concrete and/or masonry floors, walls, roof and any other such construction shall be provided with sleeves.

.41 Electrical conduit roof flashing shall be similar to National Roofing supply product code# ECP-PVCH (electrical conduit post PVCH), Gooseneck S.S.A ARPGN2 (2")/ ARPGN3 (3").

.42 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit manufacturer's instructions, printed product literature and data sheets. Include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Provide dual hanger system as described below and as shown on drawings.

.3 Hangers where noted are to be complete with the following features:
.1 4" J-Hook; Legrand cat. # CJ64H.
.2 Approximately 150 mm (6") high by 50 mm (2") wide.
.3 Constructed from steel.
.4 Pre-galvanized finish.
.5 Suitable for wall or suspended mounting.
.6 J-Hooks shall be installed as per details as shown on drawings.
.7 Mono systems; J-Hook/Steel Cat. #H-433-S shall be considered equivalent.

.4 As an alternate to the hanger system detailed, the contractor may use as an equal, one run of 50 mm (2") x 150 mm (6") wire mesh cable management system equal to Cablofil Cat. #CF 54/150 EZ complete with Cat. #FAS L 150 universal wall bracket where, noted shall be wall mounted and Cat. #FAS C 200 where, noted shall be hung. The hangers shall be installed at intervals as recommended by the manufacturer but not greater than 2.4 m (8'-0") on centre.

.5 Cable Tray/ Management System:
.1 The system, where noted, shall be a continuous, rigid, welded steel wire mesh cable management system with the following features:

.1 Permits continuous ventilation of cable and maximum dissipation of heat.
.2 Continuous safety edge T-welded wire lip.
.3 Welded at all intersections.
.4 Straight sections 4" x 12" (100 mm x 300 mm) in configurations noted on the drawings.
.5 Constructed of carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent and surface treated after manufacture.
.6 Post fabrication finish of electro-plated zinc galvanizing:

.1 ASTM B 633, Type III, SC-1.

.7 Fittings:

.1 Field fabricated in accordance with manufacturer's instructions for straight sections.

.2 The support system shall be Cablofil FAS CH hanger.
.3 The necessary hardware, including splice connectors and support components furnished by manufacturer.
.4 The product shall be Cablofil Cat. #CF105/300 EZ complete with Cat. #FAS P300 CH at intervals as recommended by the manufacturer.
.5 The manufacturer shall be Cablofil Inc.
.6 Flextray, Cat. #FT4x12x10 complete with 12 CTR HGR shall be considered equivalent.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical

.2 Cable Management Hangers:
.1 Install hangers as per details in configuration noted.
.2 Prior to installation co-ordinate location with other services within the ceiling space.
.3 Co-ordinate with noted sub-contractors to install cables noted to be utilizing these hangers. Cables are to be installed such that the maximum sag between hangers does not exceed 25 mm (1”). This electrical contractor is to coordinate.
.4 Attaching cable to any T-bar support rods is not acceptable.

.3 Cable Tray/ Management System:
.1 Install cable management system at locations indicated on the drawings and in accordance with manufacturer’s instructions.
.2 Support system every 2.4 m (8’-0”) unless system is used within a telecommunication room. In that situation, support every 1.5 m (5-0”).
.3 Cut wires in accordance with manufacturer’s instructions.
.4 Cut wires with side action bolt cutters to ensure integrity of galvanic protective layer. Cut using side action bolt cutters (Cablofil Cat. #Coupfil).
.5 Cut each wire with 1 clean cut to eliminate grinding or tough-up.
.6 Install cable management system using hardware, splice connectors, support components, and accessories furnished by manufacturer.
.7 Suspend from structure or intermediate Unistrut channel spanning across the corridor where access to structure is not available due to the concentration of mechanical ductwork and/or piping.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Access panels for walls and ceiling shall be of the flush type with concealed flanges constructed from 12 gauge minimum bonderized steel and shall be complete with anchor straps, rust resistant concealed hinges and positive locking, self-opening screwdriver operated lock. Coordinate with Division 23.

.3 Access panels in tiled walls shall be stainless steel with recessed door panel to accept wall finish and shall be of a size to suit tile pattern.

.4 Access panels installed in fire rated walls, partitions or ceilings shall have a fire resistance rating equal to the materials in which they are installed.

.5 Access panels shall be as manufactured by LeHage, SMS, Pedlar or approved equal.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 All parts of the installation including, but not limited to, pull-in, junction and outlet boxes, cabinets, gutters, etc. shall be accessible.

.3 Supply access panels as required to provide complete access to all equipment and connections. The access panels shall be installed by other Sections of the specification.

.4 Provide drawings showing size, type and location of all access panels and submit for review by the Consultant.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Electric supplementary heaters and controls shall, unless otherwise noted, be supplied by Division 23.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all electric heaters and remote electric thermostats supplied by Division 23.

.3 Electric duct heaters shall be installed by another Division of Specification.

.4 Provide all conduit, wiring, etc. and connect to the electric heaters, electric duct heaters and remote electric thermostats to provide a complete Electric Heating System.

.5 Install filler pieces as shown on the drawings between baseboard heaters to form a continuous length.

.6 All L.V. control wiring shall be by Division 23.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The pipe tracing cables, and controls shall, unless otherwise noted, be provided by Division 23.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduit, wiring, pipe tracing cables, etc., and connect to the pipe tracing cables and controls to provide a complete pipe tracing system.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 This Section is for provisions for Building Automation System only.

.3 Divisions 23 will supply and install a Computerized Building Automation System complete with the distribution boxes, control sequencing and all interfacing.

.4 Division 26 shall provide individual lighting relays and/or contactors for each individual circuit and associated relay boxes and connect to load side of relays, as shown on the drawings. All control wiring by Division 23.

.5 Contactors used in conjunction with building automation system shall be electrically operated, electrically held type. Refer to Section 26 29 01.

.6 Coordinate all work with Division 23.

Execution: NOT USED

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of disconnect switch, type, quantity, voltage, ampacity, and dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The hand dryers shall be:
.1 Nova 4 by World Dryer or approved alternative by Bobrick or Saniflow. Surface mounted one-piece cast iron automatic hand dryer equipped with 15 air intake slots, fan protected by an aluminum die cast grating fixed into housing fitted with 360-degree revolving die cast aluminum nozzle, tamper resistant bolts and steel wall plates. Motor shall be 1/10hp, 3200rpm, thermally protected and 4400LFM of air volume. Nickel finish and 120v input voltage.
.2 Electrical supply: 110-120v, 15A, 1800watts.
.3 Finish: Cast iron finished in white acid-resistant porcelain enamel.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide backboxes complete with conduit and wiring and connect to circuits as shown on the drawings. Coordinate all associated work with Architectural drawings.

.3 Hand dryers shall be installed in accordance with manufacturer's recommendations.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 Drawings to include electrical detail of lighting control devices including occupancy sensor complete with associated power pack etc., quantity, control schematic wiring diagram and coverage area etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Provide lighting control device(s) including occupancy sensors, room controllers, daylight sensors, dimmers, etc. as specified on the drawings:
.1 Provide associated power and relay packs.
.2 Provide all associated mounting accessories.

.3 Electrical Contractor shall include in tender price for installation, testing, time adjustment, functional testing and commissioning of occupancy sensors, room controllers, daylight sensors, and programming of Auto-On sequence of all lighting control devices for light fixtures on a room-by-room basis in entire building by manufacturer. Submit verification/commissioning report after completion of work.

.4 Lighting Control Devices Commissioning:
.1 Functional testing: Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. Where occupancy sensors, time switches, programmable schedule controls, or photo sensors are installed, the following procedures shall be performed.

Occupancy sensors:

.1 Certify that the sensor has been located and aimed in accordance with manufacturer recommendations.
.2 For each sensor to be tested, verify the following:

.1 Status indicator (as applicable) operates correctly.
.2 Controlled lights turn `off' or down to the permitted level within the required time.
.3 For auto-on occupancy sensors, the lights turn `on' to the permitted level when someone enters the space.
.4 For manual-on sensors, the lights turn `on' only when manually activated.
.5 The lights are not incorrectly turned `on' by movement in nearby areas or by HVAC operation.

.6 Simulate occupied condition. Verify and document the following:

.1 All lights can be turned `on' and `off' by their respective area control switch.
.2 The switch only operates lighting in the enclosed space in which the switch is located.

.7 Simulate unoccupied condition. Verify and document the following:

.1 All non-exempt lighting turns `off'.
.2 Manual override switch (where applicable) allows only the lights in enclosed space where the override switch is located to turn `on' or remain `on' until the next scheduled shut off occurs.

.8 Daylight controls

.1 All control devices (photocontrols) have been properly located, field-calibrated, and set for appropriate setpoints and threshold light levels.
.2 Daylight controlled lighting loads adjust to appropriate light levels in response to available daylight.
.3 The location where calibration adjustments are made is readily accessible only to authorized personnel.

.2 Functional testing report/documentation shall certify that the installed lighting control of each respective space in entire building meets all requirements as specified in the contract documents.

.5 All occupancy sensors must be installed as per manufacturer’s recommended location and wiring diagram.

.6 Occupancy sensors time delay settings must be adjusted and co-ordinated to suit the Owner requirements.

.7 Acceptable Manufacture: Cooper, Current, Crestron shall be considered equivalent for the lighting control system.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all lighting control devices as shown on electrical drawings. Provide all components to suit.

.3 Exact location of occupancy sensors shall be co-ordinated on site and shall comply with the manufacturer’s recommendations.

.4 Occupancy sensors shall turn off the corresponding light fixture when light switches are in the “On” position and the space is not occupied.

.5 Adjust occupancy detection sensitivity to match the level of activity for each space.

.6 Install power packs and associated relays to suit the number of circuits in the respective spaces. Installation shall comply with the manufacturer’s recommendations. Coordinate all work with manufacturer.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 29, Panel boards and enclosed Panel boards.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of panel board, branch breaker type, quantity, ampacity, KAIC rating and enclosure dimensions etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Panel boards shall be of the size, capacity and type as shown on the drawings. Series or integrated ratings shall not be an acceptable method of achieving specified interrupting levels for breakers, panels, or electrical equipment in general. Where an interrupting rating is specified, it shall be on a breaker, panel, or switchboard. Each breaker associated shall be fully rated to interrupt that magnitude of current. If there is a conflict between drawings and specifications, the higher rated value associated with that equipment shall be deemed to be correct.

.3 Panel boards shall be of the sprinkler-proof, dead front type enclosed in code gauge steel equipped with door, gasket, lock, and directory and shall be suitable for surface or flush mounting as required.

.4 Bussing in each panel shall be copper and shall extend the full length of the panel. Multi-section panels shall have full capacity rated horizontal bussing between each section.

.5 Breakers shall be ambient compensated type, calibrated at 40 degrees C and be of the bolt-on type. Multi-pole breakers shall have common trip.

.6 Panel boards for use on 240-volt or 208-volt system shall, unless otherwise noted be of the "NQ" panel or I-line panel as indicated on drawings.

.7 Panel boards for use on 600-volt system shall, unless otherwise noted be of the "NF" panel as indicated on drawings.

.8 Panels, including tubs, shall have two coats of primer paint and two coats of ASA 61 grey paint.

.9 Panel boards shall be of the same manufacturer as the switchboard.

.10 All circuit breakers shall be installed in panel boards before shipment.

.11 Panel boards shall be provided with mains, number of circuits, KAIC rating and branch circuit breaker sizes as indicated in contract documents.

.12 Lock-on devices shall be provided for fire alarm, emergency and exit lighting circuits and other circuits as indicated in contract documents.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Locate panel boards where indicated; and mount securely and plumb true and square to adjoining surfaces.

.3 Panels are to be mounted so that the top of the panels are 1800mm above finished floor.

.4 Provide 2 - 32mm empty conduits from each flush mounted panel to the ceiling spaces above and below for future installation.

.5 Provide wire-ways above multi-section panels to avoid cross-wiring.

.6 Numbering of breakers in multi-panel assemblies shall be consecutive. If necessary, provide narrow Dymomite strips with the required numberings.

.7 Prior to energizing or commissioning the panels, they shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
.1 Grounding.
.2 Breaker settings.
.3 Breaker operation.
.4 Continuity of feeder cables.
.5 Phase resistance of feeder cables.
.6 Insulation resistance of feeder cables.
.7 Proper phasing of incoming and feeder cables.
.8 Equal division of load between parallel conductors.
.9 Bus torque, supports, clearance, general mechanical conditions, and insulation resistance.

.8 30% of all breakers in panels shall be equipped with locking devices. These locking devices shall be installed as directed by the Consultant on completion of work and the unused units shall be handed over to the Owners.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 29, Panel boards and enclosed Panel boards.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of power panel, branch breaker type, quantity, ampacity, KAIC rating and enclosure dimensions etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Power panels shall be factory assembled, sprinkler proof, free standing, dead front type, complete with door and gasket suitable for use on the system as specified and shown on the drawings.

.3 Power panels shall be of the size, capacity and type as shown on the drawings. Series or integrated ratings shall not be an acceptable method of achieving specified interrupting levels for breakers, panels, or electrical equipment in general. Where an interrupting rating is specified, it shall be on a breaker, panel, or switchboard. Each breaker associated shall be fully rated to interrupt that magnitude of current. If there is a conflict between drawings and specifications, the higher rated value associated with that equipment shall be deemed to be correct.

.4 Fusible panels shall be of the "QMQB" type consisting of a fully convertible chassis to permit assembly of units in any desired arrangement. The fusible units shall have visible blades, integral handle mechanism, cover interlock, quick-make, quick-break mechanism, front operation, high pressure fuse holders and recessed live parts. The units shall be floor mounted and shall, unless otherwise noted, be 92" in height.

.5 Breaker panels shall be switchboard QED distribution section type with the sizes and type of breakers as shown on the drawings. The branch devices/ breakers rated 400A and above shall be breaker(s) with electronic trip(s) (LSI).

.6 Splitter troughs shall be complete with copper bus bars the length of the trough. The covers shall be bottom hinged with retained securing screws at the top.

.7 Bussing in each panel shall be copper and shall extend the full length of the panel. Multi-section panels shall have full capacity rated horizontal bussing between each section.

.8 Panels shall be provided with the non-ferrous plates for aluminium sheathed cables.

.9 Panels, including tubs, shall have two coats of primer paint and two finish coats of ASA 61 grey paint.

.10 Power panels shall be of the same manufacturer as the main switchboard.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Locate panel boards where indicated; and mount securely and plumb true and square to adjoining surfaces.

.3 All panels less than 1520mm are to be wall mounted so that the top of the panel is 1980mm above finished floor.

.4 Connect loads to the circuits as shown on the drawings.

.5 Openings in panels shall be cut or punched. Burning of holes shall not be permitted.

.6 Each panel and switches or breakers mounted in them, shall be identified.

.7 Prior to energizing or commissioning the panels, they shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
.1 Grounding.
.2 Continuity of feeder cables.
.3 Breaker settings and fuses.
.4 Ground fault system operation.
.5 Breaker and switches operation.
.6 Phase resistance of feeder cables.
.7 Insulation resistance of feeder cables.
.8 Proper phasing of incoming and feeder cables.
.9 Equal division of load between parallel conductors.
.10 Trip units tested and calibrated to the settings provided by the Co-ordination Study.
.11 Bus torque, supports, clearance, general mechanical conditions, and insulation resistance.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA-C22.2 No.55, Special Use Switches.
.2 CSA-C22.2 No.111, General-Use Snap Switches.
.3 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
.4 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Supply and install classroom control panel modules as specified below for the locations as shown on drawings.

.3 Classroom control panel modules shall be wall mounted or otherwise supported as indicated.

.4 Classroom control panel module shall be as follows:
.1 Materials:

.1 Frame:

.1 Aluminum extrusions extruded shapes CSA HA.5, 6063 T5 alloy satin anodized aluminum frame.
.2 Sheet aluminum, plate sheet anodizing quality CSA HA.4 990C, Alcan D25, condition H14.

.2 Laminate Panel:

.1 0.08mm thick with high pressure plastic laminate faced panels of lightweight MDF core and a 0.5mm plastic laminate backing sheet. Plastic laminate–CAN3-A172.
.2 Allow minimum four (4) colours selections.
.3 Colours to be selected at later date by architect from Wilsonart, Arborite, Formica or Pionite.

.3 Finish: Clear anodized aluminum AA-M12.C32.M31.

.2 Manufacturer:

.1 Classroom control panel module shall be manufactured by:

.1 Swift Path Solutions
.2 Control Hub Solutions or approved equal.

.5 Receptacles shall be as specified in Section 26 27 26.

.6 Computer outlets/ jacks shall be as per specified Section 27 11 19.

.7 PA system outlets/jacks shall be as per specified Section 27 51 16.

.8 Devices shall be flush mounted inside the classroom control panel module.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Fabricate classroom control panel modules in accordance with reviewed shop drawings with extruded aluminum frames and solid plastic laminate face panels.

.3 Solid plastic laminate face panels shall be removable from aluminum frames and shall be vandal resistant.

.4 Classroom control panel modules shall have factory fabricated cutouts, mounting flanges, blank-off plates, etc. to mount all mechanical and electrical equipment and devices.

.5 Make, model and dimensions of switches, duplex and computer cable outlets, thermostats and temperature sensors, clocks, speakers, intercom devices, including switches, keypads and handsets will be supplied and installed by mechanical and electrical divisions.

.6 Classroom control panel modules shall be factory fabricated to include all drilled or cut holes and speaker mountings to allow installation of all devices by mechanical and electrical divisions.

.7 All cabling and wiring will be supplied and installed by mechanical and electrical divisions as indicated on drawings and specified in contract documents.

.8 Classroom control panel modules shall have all contacts for services as required for installation of mechanical and electrical services by mechanical and electrical divisions.

.9 Classroom control panel modules shall be full height from 6" (152mm) off floor to underside of ceiling panels.

.10 Install classroom control panel modules in accordance with manufacturers' recommendations and reviewed shop drawings complete with all frames, cutouts, face panels etc.

.11 Symbols on drawings shows approximate locations on classroom control panel module. Care shall be taken to locate each device to ensure that it is in the appropriate location to suit the classroom control panel module detail as shown on drawing.

.12 Mounting heights of equipment/devices are referred to finished floor or finished ceiling unless otherwise noted.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA-C22.2 No.55, Special Use Switches.
.2 CSA-C22.2 No.111, General-Use Snap Switches.
.3 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
.4 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer’s printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Light switches on 120-volt circuits under 1200 watts shall be 15 amp. and above 1800 watts shall be 20 amp.

.3 Light switches shall be premium specification grade, A.C., Toggle type switches.

.4 Receptacles shall be of the type shown on the drawings with the standard C.S.A. configurations and shall be specification grade. Hubbell #5262.

.5 Light switches and receptacles on normal power shall be white unless noted otherwise.

.6 Isolated ground receptacles shall be orange. Hubbell #1G-5262.

.7 Wall plates for flush mounted devices shall be multiple gangs super stainless-steel type 302.

.8 Wall plates for surface mounted devices in unfinished areas shall be metal covers for F.S. type boxes.

.9 The weatherproof plates shall be cast aluminium with lift cover for F.S. type boxes.

.10 For T.V. and computer outlets provide blank cover plates unless work is complete.

.11 For telephone outlets provide blank cover plates unless work is complete.

.12 Receptacle mounted on the exterior walls of the building shall be with ground fault protection mounted in an F.S. type box with a Hubbell #5206WO and MX3200 weatherproof in-use cover plate.

.13 50A/208V 1 phase 3W receptacle, range receptacle Smith & Stone #1-8450 complete with plug and cord set.

.14 30A, 120/208V receptacle Smith & Stone #1-8430 dryer receptacle complete with plug and cord set.

.15 Wiring devices shall, unless otherwise noted, be of Pass & Seymour, Hubbell, Leviton, or Cooper manufacture.

.16 All service receptacles on roof shall be 15/20A combination GFI type receptacles complete with weatherproof in-use cover (Similar to Hubbell Cat. #MX3200).

.17 Receptacle controlled by occupancy sensor shall be Similar to Hubbell Cat. #BR15C2GRY.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Symbols on drawings show approximate locations. Care shall be taken to locate each device to ensure that it is in the appropriate location to suit the Architectural finishes.

.3 Mounting heights are referred to finished floor or finished ceiling unless related to benchmark elevations.

.4 Provide cover plates for flush mounted manual starters.

.5 Receptacle, telephone, etc. outlets shall, unless otherwise noted, be mounted vertically 400mm above finished floor in the finished areas and 1200mm in all unfinished areas. Thermostats shall be mounted 1400mm, unless otherwise noted.

.6 Telephone, P.A., etc. wall outlets shall be spaced 100mm from power outlet.

.7 All wiring devices cover plates shall be labelled using clear adhesive strips with black type identifying, panel and circuit number(s) for each device.

.8 Single throw switch(es) shall be installed with handle in "UP" position when switch closed.

.9 Switches shall be installed in gang type outlet box(es) when more than one switch is required in one location.

.10 Receptacles shall be installed in gang type outlet box(es) when more than one receptacle is required in one location.

.11 Suitable common cover plates shall be installed where wiring devices are grouped.

.12 Cover plates meant for flush mount outlet boxes shall not be use for surface mounted outlet boxes.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 248.12, Low Voltage Fuses

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of fuse type, quantity, ampacity, voltage rating and dimension etc.

.3 Submit fuse performance data characteristics for each fuse type and size. Performance data to include average melting time-current characteristics.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Fuses protecting motor circuits shall be Form I Class `J' time delay.

.3 Other fuses up to 600A shall be Form I Class `J'.

.4 Other fuses above 600A shall be Form I Class `L'.

.5 All fuses shall be of Ferraz, Shawmut or Bussman.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide fuses for the complete electrical installation.

.3 Supply six (6) spare fuses of each size and type installed.

.4 Provide in the main electrical room a wall mounted metal cabinet complete with doors and lock, and an adequate quantity of pigeonholes to accommodate the spare fuses.

.5 To avoid confusion and possible loss the fuses shall not be stored in the cabinets until they are physically counted by the Owner's representative and a written receipt obtained for them. A copy of the receipt shall be included in the manuals.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of disconnect switch, type, quantity, voltage, ampacity, and dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Disconnect switch(es) shall have the operating handle interlocked with the switch cover so that it can only be opened when the switch is in the "Off" position, and the handle cannot be put in the "On" position unless the cover is closed.

.3 Fused disconnect switch(es) shall have steel reinforced clips and fuses shall be easily removable when the switch is in the "Off" position.

.4 Switches shall have ample gutter space for top or bottom wiring and shall have fully visible blades when in the "Off" position, quick-make, quick-break mechanism and be horsepower rated.

.5 Disconnect switch(es) shall be provided with ON-OFF switch position indication on switch enclosure cover.

.6 Switches used outdoors shall be in a weatherproof enclosure.

.7 Switches shall have provision for padlocking in the "Off" position and interlock defeat.

.8 All motors shall be provided with a disconnect switch by this Division unless otherwise noted.

.9 The disconnect switches shall be as manufactured by Eaton, Siemens, or Square `D'.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Disconnect switch(es) shall be installed complete with fuses as indicated on drawings and in contract documents.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No.14, Industrial Control Equipment.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of contactor, quantity, ampacity, voltage, control schematic wiring diagram and enclosure dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Contactors controlling panel boards or branch circuits shall be tungsten rated, electrically operated, electrically held of the size and rating specified, complete with control transformer, control circuit fuses, pilot light warning label, NO/NC contacts and On/Off/Auto selector switch.

.3 Contactors shall be in sprinkler proof enclosure unless otherwise noted.

.4 The contactors ampere rating shown on the drawings is the minimum continuous enclosed de-rated rating of the contactors. Contactors shall be designed and manufactured in accordance with NEMA Standards.

.5 Contactors controlling branch circuits shall be mounted above the panel board from which they are fed, unless otherwise noted.

.6 Contactors shall be of Allen-Bradley, Eaton, Siemens or Square `D' manufacture.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Field designed and assembled contactor assemblies will not be acceptable.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC).
.1 IEC 947-4-1, Part 4: Contactors and Motor-Starters.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The motors shall be provided and adjusted by Division 23, Mechanical.

.3 The starters shall be supplied by Division 23, Mechanical.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide and connect conduit and power wiring to the motors.

.3 Conduit and wiring for low voltage thermostats shall, unless otherwise noted, be provided by another Division of the Specification.

.4 Wiring and conduit for line voltage thermostats shall be by this Division. Coordinate with Division 23, Mechanical drawings.

.5 Take delivery of and install the starters and provide and connect conduit and power wiring to the starters. Control wiring and conduit shall, unless otherwise noted, be provided by Division 23, Mechanical.

.6 Fuses for the fused combination magnetic starters shall be supplied and installed by Division 23, Mechanical.

.7 Prepare schedule of each motor connected which shall include the following:
.1 Phase
.2 Voltage
.3 Horsepower
.4 Full load current
.5 Motor Purpose
.6 Fuse size and type
.7 Overload heater size and type

.8 Submit the motor schedule for review by the Consultant and include the schedule in the manuals.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Light fixtures finish and construction shall meet ULC listings and CSA certifications related to intended installation.

.3 Light Emitting Diodes (LED) shall comply with the following:
.1 Light emitting diodes shall be manufactured by “Cree” or equal.
.2 Junction temperature at 25°C ambient shall not exceed 60°-70°C.
.3 LED light fixture(s) shall follow LM-79 and LM-80 Standards. Luminaire photometric shall be performed by an independent company.
.4 Lumens per watt output (LPW) shall be not less than 100 LPW.
.5 The lifetime rating of driver, LEDs and all electrical components of complete fixture shall be 60,000 hours (minimum) at full load.
.6 Colour temperature shall range from 3500K to 5100k as called for in the Lighting Fixtures Schedule.
.7 All electrical components shall have a 5-year replacement (parts and labour) warranty.
.8 LED light fixture(s) shall be DLC certified.
.9 LED light fixture(s) shall be complete with 0-10V dimming driver.

.4 The louvres for light coves in washrooms and display cases and where shown shall be 1/2"x1/2"x1/2" (13x13x13mm) continuous aluminium and shall be of American Louvre manufacture.

.5 Lenses shall be acrylic (minimum of 0.175mm) with a maximum flame spread rating of 250 and smoke development classification of 600 and shall be of KSH, American Louvre manufacture.

.6 Acceptable Manufacture: Cooper, Omnilumen, TPL shall be considered equivalent.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Remove from the site all empty cartons, crates, etc. in which the fixtures and associated components are delivered.

.3 Install lighting fixtures at locations as indicated on drawings and in contract documents.

.4 The chain supports required for mounting and installation of recessed lighting fixtures shall be supplied and installed by this Division. The supports shall be attached to the structure with minimum 2 supports per fixture. The ceiling system shall not be used as a supporting means. Prior to installation of lighting fixtures, Electrical Contractor shall coordinate with consultant and get approval.

.5 Surface mounted fixtures shall be independently supported from the structure above.

.6 Fixtures connected to the circuits exceeding 150 volts to ground shall be mounted at least 8 feet above floor level.

.7 Fixtures mounted in continuous rows shall be equipped with aligning clips to form straight uninterrupted line.

.8 Align light fixtures mounted individually parallel or perpendicular to building grid lines.

.9 The location of lighting fixtures in Service Areas, Electrical and Mechanical Rooms, etc. shall be determined after the equipment is installed.

.10 Refer to the Architectural reflected ceiling drawings for the exact location of the lighting fixtures.

.11 Cooperate with the other Divisions to establish proper clearances from sprinkler heads, diffusers, ducts, etc.

.12 Surface mounted fixtures shall have minimum clearance of 2'-0" (600mm) from adjacent sprinkler heads.

.13 Provide additional supports, hangers etc. required to support fixtures mounted under ductwork and the fixture supports shall not be attached to either the ductwork or the ductwork supports.

.14 Provide and connect all branch circuit conduit and wiring to the signs (if required).

.15 Angles required for support of 1/2"x1/2"x1/2" (13x13x13mm) louvre shall be by Ceiling Division.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 PURPOSE OF DOCUMENT

.1 This document is to provide a standard defining the structured communications cabling systems to be installed within Simcoe Muskoka Catholic District School Board facilities. It is geared toward leveraging school board legacy cabling infrastructure while upgrading to more recent technologies in new installations. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards, and industry best practices.

.2 Within this document, the facilities owner is the ICT Services department, and shall be referred to as such, or as Simcoe Muskoka Catholic District School Board. Bidding low-voltage installers shall be referred to as “Installer” or “Contractor”.

.3 It is the responsibility of the installing Contractor to evaluate these general recommendations and adapt them effectively to actual projects. Contractor is responsible for identifying and bringing to the attention of ICT Services any design directions that may be improved. All such changes shall be approved in writing from Simcoe Muskoka Catholic District School Board.

.4 This specification defines quality standards and practices common to all School’s and network cabling upgrades and Greenfield (new), and Brownfield (existing) projects. The system offered and quoted, shall incorporate all features and facilities listed in this specification.

.5 In addition to this cabling standard, individual projects will also have associated documentation such Requests for Proposals (RFP), facility drawings, and project schedules pertaining to that job. Such collateral will be referred to in this document as “Project-specific Documentation”, “Project Documentation”, or simply “Construction Documents”. Many of the requirements described herein may be detailed or expanded upon by such project-specific documents.

.6 Any conflict between this general specification and any project-specific documentation shall be brought to the attention of ICT Services and will be resolved by ICT Services in writing.

.7 Note that while many portions of this specification are addressed to "The Contractor", these requirements apply equally to architects, engineers, project managers, planning, or anyone doing network cabling and infrastructure work within ICT Services facilities, whether those persons are outside contractors or persons directly employed by ICT Services.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include equipment and material detail including dimensions.

.3 Submit drawings for jacks, cables, faceplates, patch panels, patch cords, wall brackets, etc.

1.4 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-C22.2 No.214 (Latest Edition), Communication Cables.
.2 CSA-C22.2 No.232, (Latest Edition), Optical Fiber Cables.
.3 CSA-C22.1, (Latest Edition), Canadian Electric Code Part 1
.4 OESC – Latest Edition
.5 OBC – Latest Edition

.2 Telecommunications Industry Association (TIA)/ Electronic Industries Alliance (EIA)
.1 TIA/EIA-568-B.1 (latest edition), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
.2 TIA/EIA-568-B.2 (latest edition), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
.3 TIA/EIA-568-B.3 (latest edition), Optical Fiber Cabling Components Standard.
.4 ANSI/TIA-569: (latest edition), Telecommunications Pathways and Spaces.
.5 TIA/EIA-606-A: (latest edition), Administration Standard for the Commercial Telecommunications Infrastructure.
.6 ANSI/TIA-607: (latest edition), Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
.7 TIA-TSB-162: (latest edition), Telecommunications Cabling Guidelines for Wireless Access Points.
.8 ANSI/TIA-4966: (latest edition), Telecommunications Infrastructure Standard for Educational Facilities.
.9 ANSI/TIA/EIA-526-14 - Optical Power Loss Measurements.
.10 ISO-11801 - Generic Cabling for Customer Premises.
.11 BICSI – Building Industry Consultative Services International – Manuals

.1 Telecommunications Distribution Methods Manual, most recent edition.
.2 Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition.

.12 Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the CEC and any applicable local codes or ordinances, or default to the most current and stringent requirements listed by either.
.13 Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor’s expense.

1.5 SUBMISSION POLICY

.1 This is a performance-based specification developed from the experience of the ICT Services, Simcoe Muskoka Catholic District School Board in providing exceptional solutions for all SMCDSB facilities and departments. As such, substitution of specified products or systems named in this document is highly discouraged.

.2 Any Contractor wishing to offer substitutions for any part of the systems specified herein shall be responsible for proving equivalency and shall follow the procedure below:
.1 Contractor shall submit a request for product substitution to ICT Services of SCDSB in writing no less than one week in advance of bid.
.2 Contractor shall provide three (3) each sample of the product being offered for evaluation by ICT Services.
.3 Samples of products offered for substitution shall be accompanied by product drawings, specification sheets and engineering documents proving equivalency in transmission performance (where applicable) and mechanical function.
.4 Category Cat 6A cable and components offered in substitution to those specified shall be accompanied by third party test reports proving equal or better channel performance. Such test reports shall name exact products by part number and state channel results in worst-case connector links of maximum length that include both cross-connect and consolidation points.

.3 Equivalent product acceptance must be received from ICT Services in writing.

.4 Contractor shall be responsible for and assume all costs for removal and replacement of any substituted product installed without prior written approval from ICT Services. Such costs shall include but not be limited to labour, materials as well as any penalties, fees or costs incurred for late completion.

1.6 NETWORK INSTALLATIONS DESCRIPTION

.1 Reference the following documents detailing the completion of the network installation:
- .1 Attached drawings showing data drop locations.
- .2 Contractor will contact ICT Services to retrieve current matrix spreadsheet documenting the routing of all panel ports to switch ports in all LAN rooms.
- .3 Contractor will contact ICT Services to retrieve rack topology showing all inter-switch media, fibre trunk locations etc.

.2 In areas where data network is being upgraded, all existing cable is to be removed from existing infrastructure. This includes all cable found above and below ceiling, in cable tray, raceway, wiremold etc.

.3 Supply and install a complete end-to-end Category 6 and Category 6a structured data cabling system. Network cabling component manufacturer and the cable and patch cord manufacturer must have contractual relationships to ensure that the system warranty is a true “end to end” structured cabling system warranty.

.4 When installing & terminating copper cables, jacks shall follow colour designation below:
- .1 Data: Blue
- .2 Voice: Green
- .3 Cameras & security: Purple
- .4 WIFI: Yellow
- .5 Special: Black
- .6 Audio-Visual: Red

.5 WIFI structured cabling shall consist of minimum, two Category 6a cables per wireless access point (WAP), as per TIA-TSB-162 guidelines for WAP installations.

.6 Each classroom and/or office space will have the following volume of data drops:
- .1 Classroom: Two for a Wi-Fi access point. One for a Printer. One for a VOIP Phone.
- .2 Office: Two for a Wi-Fi access point. One for a Printer. One for a VOIP Phone. One for a Workstation.
- .3 Gym: Eight (2 X each WAP capacity of 4) for Wi-Fi access points. One for a phone. One for a Workstation.
- .4 Library: Four (2 for each WAP) for Wi-Fi access points. One for a Printer. One for a VOIP Phone, One for a Workstation.

.7 All work must be installed by system manufacturer’s certified system installers who are certified and experienced in implementing the selected data cabling system, and to perform relating testing programs.

.8 All cablings shall be installed in conduit or run-in cable tray.

.9 In locations without conduit and/or cable trays, cables must be supported to the building structure independent of other systems, using a wire management system. Board or Electrical Consultant must approve this type of installation.

.10 In LAN Rooms, where specified, supply and install EIA Standard 19" floor mount equipment racks in accordance with ANSI/TIA/EIA-607 (CSA T527), complete with patch panels, switches, bonding, and horizontal/vertical wire management.

.11 Data cabling shall be terminated in Category 6 or 6A where specified jacks at the workstation end and in Category 6 or 6A patch panels at the communication closet end.

.12 Data cabling contractor shall supply to the Owner, two (2) Category 6 or 6A where specified patch cables for every data drop installed. One from patch panel-to-switch, and another from the data jack faceplate. The lengths of the cables shall be as follows: 50 percent 4 feet and 50 percent 6 feet.

.13 All panel-to-switch patch cabling will be installed by the contractor as per details documented in the data cable matrix, provided by the ICT Services (detailed in section 1.5.1).

1.7 SPECIAL COORDINATION MEETINGS

.1 Attendance at the Division 25/26/27 Start-Up meeting is mandatory.

.2 M&E Rough-In Inspection:

.1 Inspect locations of all drops above and below ceiling, and placement of racks in LAN Rooms. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.3 Above Ceiling Inspection:

.1 Verify placement of Wireless Access Point Drop and review installation of Access Point. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.4 Cabling & LAN Room Inspection:

.1 Verify the installation and routing of cable, panel and cable management in racks, and review final cable matrix prior to installation of switches and patching down drops. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.5 Final Installation Review:

.1 Prior to occupancy, review installation of switches, patch cables, and the functioning of wireless access points and data drops. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

1.8 PROJECT DOCUMENTATION

.1 Shop Drawings

.1 The contractor shall always maintain an updated copy of as-built drawings on site.

.2 Submit shop drawings in accordance with General Electrical Requirements or Submittals section as applicable.

.3 Shop drawings of this system must be submitted and reviewed prior to release of all orders.

.2 Cabling Matrix and Rack Topology

.1 Prior to shop drawing process, the data cabling Contractor to request from the Board a soft copy of up-to-date Data matrix. Contractor will update Matrix with new information prior to installation. The pre-installation matrix information will be used to provision and program network switches and finalize rack topology for the new data drops.

.2 During the project, this Data matrix document is to be kept up to date, with any changes made for the duration of the installation, by the contractor, including the length of all cables while also documenting the location of all racks, panels, and drops along with respective room locations.
.3 Rack topology provided by the ICT Services will be delivered to the contractor to ensure that all network equipment is mounted properly at time of installation.
.4 One week prior to occupancy, Data Cabling Contractor shall provide digital floor plans in PDF format indicating drop locations within the room with drop numbers indicated.
.5 One week prior to occupancy, Data Cabling Contractor shall provide digital up-to-date data matrix in Excel format indicating drop number (in A/1/2/03 format), drop room number, drop length, drop use, and any relevant drop notes. This information will be used to configure the network switches.
.6 One week prior to occupancy, Data Cabling Contractor shall perform testing on all data drops.

.3 Submittals (Prior to issuance of final payment by the Owner)
.1 Submit shop drawings in accordance with General Electrical Requirements. One digital AutoCAD copy, one PDF format and three sets of hard copy as-built drawings prior to final payment.
.2 Testing data and certificates per the “TESTING” section of this document, and all equipment manuals and warranty information.
.3 Final copy of included Data Matrix document, including all cable length and location information populated within.
.4 The following fields MUST be completed by the contractor for new drops:

.1 **Rack ID**: AAA-RX, where AAA is school code, and X is rack letter (if second rack in room, then AAA-RA2, otherwise "1" is assumed and AAA-RA is sufficient).
.2 **Panel ID**: AAA-X-PN, where AAA is school code, X is rack letter (add number if second rack in room), N is panel number from top of rack (verify numbering with ICT if installing a new patch panel).
.3 **Drop ID**: MUST follow A/1/2/03 format in spec (rack room/rack number/patch panel/drop number).
.4 **Alt Drop Nº**: (Deprecated) this is for existing drops only - all new drops should conform to A/1/2/03 format specified in spec, and this field should therefore be blank for new installs.
.5 **Length ft**: cable length in feet.
.6 **Cable:** CAT5e, CAT6, CAT6e, CAT7, etc.
.7 **Room Nº**: Room number on door, or generally accepted room number, or room number on floor plans.
.8 **Room Type**: (Optional, but helps to figure out obscure room numbers) Generic room description (classroom, gym, principal's office, etc.).
.9 **Drop Use**: Purpose for drop (student, teacher, admin, printer, projector, WAP, etc.).
.10 **Asset ID**: (Optional) ID from asset tag attached to drop.
.11 **Notes**: General notes if the above fields don't suffice.

.5 The following fields will be completed by ICT once contractor returns the final cable matrix showing newly installed drops. This can then be used by contractor to patch down the new drops to the switch:

.1 **Stack**: (ICT use) Switch stack name.
.2 **Rack U**: (ICT use) U where switch is installed.
.3 **Switch ID**: (ICT use) Asset ID of switch drop is patched to.
.4 **Port:** (ICT use) switch port where drop is patched to.
.5 ***:** (ICT use) Asterisk indicates non-contiguous patching where switch port number doesn't match patch panel drop number.
.6 **VLAN:** (ICT use) VLAN for switch port.

1.9 SYSTEM OPERATION

.1 The local area network system must be "protocol neutral". The wiring configuration is based on a "physical star" topology in which cabling and/or backbone runs emanate in a radial pattern from the main data communications closet. Six strand multimode fibre installations will connect all LAN Rooms, with the exception of the WAN fibre demarcation point which will be “extended” to uplink directly to the main data communications closet using single mode fibre. If a LAN Room exceeds 192 installed ports, an additional six strand fibre installation is required.

1.10 QUALITY ASSURANCE

.1 The Owner accepts products from the following manufacturers: BELDEN CDT, COMMSCOPE, PANDUIT. No alternatives will be accepted. If an installation involves moving, adding, or changing an existing install, the contractor will match the current product unless an alternate solution is proposed by the Owner.

.2 The data cabling contractor will have only tradesmen who are fully qualified and experienced in the installation of a certified communications cabling system and wireless network system.

.3 The successful data cabling contractor shall:
.1 Provide current training and certification status including certification number by the specified cabling system manufacturer.
.2 Have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
.3 Have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Fibre Optic Cable
.1 The Fiber Structured Cabling System shall be capable of supporting and/or integrating the following:

.1 Data applications
.2 Local area network services
.3 Wide area network services
.4 Storage Network applications and services

.2 The applications that shall be supported include, but are not limited to:

.1 Data Communications

.1 Ethernet (10GBASE-SR/SW, 10GBASE-LRM, 10GBASE-LX4, 1000BASE-SX and 1000BASE-LX).
.2 Fibre Channel (100-M5E-SN-I thru 1600-M5F-SN-I).
.3 FCOE (ANSI T11 FC-BB-6 Fibre Channel Backbone 6).
.4 Any other application designed to run on a generic structured cabling system designed and installed to TIA or ISO structured cabling standards.

.2 Data Processing

.1 Mainframe access client server, enterprise server, messaging systems and electronic mail, client database, etc.

.3 Video

.1 Analogue video, digital video, and video conferencing.

.4 Multiple Services

.1 The structured cabling system shall also support backward and forward migration of applications with minimal disruption to existing services or personnel, allowing for quick moves, adds, and changes.

.3 Installation Guidelines (Applies to all Fiber Trunks)

.1 Fiber terminations shall be done according to recommendations of TIA, manufacturer's requirements, and accepted industry best practices.
.2 Fiber optic cabling system additions and upgrades to existing facilities (Brownfield) shall match the Fiber type (OM/OS designation) of the system to which it is being installed. Contractor shall under no circumstances mix different OM/OS classes of cable or termination devices (connectors) within the same channel unless specifically instructed to do so within the project specific documentation.
.3 When installing Fiber cable, Contractor shall maintain a minimum bend radius of 20 times the outer diameter of the cable when it is under load (being pulled).
.4 Fiber service loops shall be stored to maintain a minimum bend radius of 10 times the outer diameter of the cable.
.5 Optical Fiber shall only be pulled using its internal strength member in conjunction with a properly rated multi-weave mesh grip and swivel pulling eye.
.6 All unjacketed Fiber shall be contained within appropriate Fiber enclosures. Exposed tight-buffered, fan-out or loose-tube strands will not be tolerated and shall be remedied at Contractor's expense.
.7 Direct connection of terminated Fiber backbone links to equipment is not allowed. All Fiber connections shall go through a Fiber enclosure interconnect and connect to active equipment via Fiber jumpers.
.8 Contractor shall perform Fiber testing of all strands according to guidelines in the "Testing and Acceptance" section of this document.
.9 Service loop (slack) in telecommunications rooms shall be at least 3 meters. Consult project documentation for length of service loops and storage method within a specific telecom room or space.
.10 Slack shall be stored per manufacturer instructions inside the enclosure or stored outside the enclosure using appliances built for that purpose. Consult project documentation for details on storage of service loops.
.11 Fiber pulls using multiple pull points shall use the "figure-8" technique any time excess cabling is piled on the floor as slack to supply the next pull-point.
.12 Cable shall be rolled off the spinning cable reel, not pulled off the end.
.13 During all Fiber cable pulls Contractor shall have one person at each end of the pull to ensure proper cable pay out and pile up without damage to the Fiber.
.14 Fiber backbone cables shall be installed separately from horizontal distribution cables. Under no circumstances may copper and Fiber cables be pulled in common bundles.
.15 In pathways containing both Fiber and copper cables, the Fiber cable must either be of armoured construction or segregated in innerduct.
.16 Where cables are housed in sleeves or conduits, the backbone and horizontal cables shall be installed in separate conduits or the Fiber segregated in separate innerduct within the conduits.
.17 Fiber shall be segregated within racks and patching systems unless instructed otherwise in the project documentation.
.18 Where possible Fiber enclosures shall be mounted at the top of equipment racks and the Fiber cable kept separate from copper cable.

.19 Contractor shall inspect Fiber end faces with a Fiber scope and clean the connectors (if needed) whenever plugging in a Fiber connector.

.4 Fiber Optic Cable (Indoor Applications)

.1 The inter-LAN room fibre optic cable plant shall be type OM3 OR OM4 where required, 6 strand, 50 Micron Multi-Mode cabling, using laser optimized (OM3 or OM4) fibre in a cable with aqua coloured jacket, terminated with LC type connectors and mating adapters.
.2 The mechanical room to central LAN room fibre optic cable plant shall be 6 strand, 9/125 Micron Single-Mode cabling, with yellow coloured jacket, terminated with LC type connectors and mating adapters.
.3 The jacket shall be OFNP (FT6 / CMP) rated outer sheath.
.4 Shall be suitable for plenum and horizontal applications.
.5 Cable shall be part of the “end to end” structured cabling system warranty.
.6 Terminations and mating adapters shall be enclosed in a rack mount housing.
.7 Plenum rated 1” innerduct shall be supplied and installed by Data Network contractor if a dedicated conduit has not been provided.
.8 Fibre Optic patch cords, 50/125, shall be consistent with the grade and manufacturer of the fibre cable that is being warranted.
.9 Supply enough 6’ fibre optic patch cords to activate all strands. Confirm connector type with owner prior to ordering.

.5 Fiber Optic Cable (Indoor/ Outdoor Applications, including Portables)

.1 The inter-LAN room fibre optic cable plant shall be 6 strand, 50/125µm OM3 multi-Mode cabling with an attenuation of 3.5dB/km @ 850nm, an operating temperature of -40°C to 158°F (-40°C to 70°C), terminated with LC type connectors and mating adapters.
.2 The cable sheathing shall be UV resistant, meet light absorption requirement defined by standards and withstand harsh outdoor environmental demands.
.3 The cable sheathing shall provide superior crush resistance for aerial mounting applications.
.4 The cable sheathing shall be water resistant for underground conduit applications.
.5 The cable sheathing shall be rated OFNP (FT6 or CMP), and suitable for plenum and horizontal applications.
.6 The fibre used in the production of cords, cables and pigtails must be from the same source of manufacture (ex. - mixing of Bend Tolerant and Non-Bend intolerant fibres is not permitted).
.7 Bend radius should be maintained at 10x cable outside diameter, no less.
.8 Avoid excessive slack in the frames and cable tray, and abrupt bends.
.9 Dust plugs will be provided and should be maintained on all fibre outlets and patch panel ports to protect the connection from contamination when not in use.
.10 Mechanical splices and fibre adapter products shall not be used for joining fibres mid- span of any fibre link.
.11 Terminations and mating adapters shall be enclosed in a rack mount housing.
.12 Plenum rated 1” innerduct shall be supplied and installed by Data Network contractor if a dedicated conduit has not been provided.
.13 Fibre backbone should be the topmost cable in all cable routing solutions. Fibre should never be buried under any other cables.
.14 Fibre Optic patch cords, 50/125, shall be consistent with the grade and manufacturer of the fibre cable that is being warranted.
.15 Supply enough 6’ fibre optic patch cords to activate all strands. Confirm connector type with owner prior to ordering.
.16 Cable shall be part of the “end to end” structured cabling system warranty.

.3 Category 6 Cable

.1 Category 6 Cable (Indoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 The jacket shall be printed with sequential length markings1000' to 0' marking system, CMP (FT6) rated blue outer sheath.
.3 The category marking shall appear every foot.
.4 Shall be suitable for plenum and horizontal applications.
.5 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.6 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.7 CAT 6 cable is good for distances up to 90 meters / 295 feet. The horizontal cable from the patch panel to the RJ-45 jack in the faceplate shall not exceed a maximum of 90 meters / 295 feet.
.8 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 requirements as per the TIA/EIA-568-B.2-1 standard.

.2 Category 6 Cable (Indoor/ Outdoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 Cable sheath shall be CMX (outdoor) rated, for use where exposed to the elements.
.3 Cable sheath shall be CMR (riser) rated, suitable for vertical shaft applications.
.4 Cable sheath shall be UV rated, resistant to cracking after long-term UV exposure.
.5 Shall be suitable for plenum and horizontal applications.
.6 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.7 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.8 The horizontal cable from the patch panel to the RJ-45 jack in the termination box shall not exceed a maximum of 90 meters / 295 feet.
.9 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 requirements as per the TIA/EIA-568-B.2-1 standard.
.10 Bridged taps and splices are not permitted as part of the copper cabling.
.11 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
.12 Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.
.13 A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
.14 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
.15 All horizontal cables shall be supported at a maximum of 48-to-60-inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
.16 Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities more than 25 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
.17 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.3 Category 6A Cable (Indoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 The jacket shall be printed with sequential length markings 1000' to 0' marking system, CMP (FT6) rated blue outer sheath.
.3 The category marking shall appear every foot.

.4 Shall be suitable for plenum and horizontal applications.
.5 Certified channel performance to ANSI/TIA 568.2 D Category 6A and ISO 11801 Class EA in a four connector configuration up to 100 m.

.4 Category 6A Cable (Indoor/ Outdoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 Cable sheath shall be CMX (outdoor) rated, for use where exposed to the elements.
.3 Cable sheath shall be CMR (riser) rated, suitable for vertical shaft applications.
.4 Cable sheath shall be UV rated, resistant to cracking after long-term UV exposure.
.5 Shall be suitable for plenum and horizontal applications.
.6 Exceeds ISO 11801 Class Ea and ANSI/TIA568-C.2 Category 6A standards; Standards compliance: ISO 11801 Class Ea, IEC 61156-5 Category 6A, ANSI/TIA-568-C.2 Category 6A, IEC 60794-1-2F5 Method B Water Penetration Requirement Poe Compliance: Meets IEEE 802.3af, IEEE 802.3at, and IEEE 802.3bt for PoE applications; RoHS Compliant Cable.
.7 Bridged taps and splices are not permitted as part of the copper cabling.
.8 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
.9 Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.
.10 A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
.11 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
.12 All horizontal cables shall be supported at a maximum of 48-to-60-inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
.13 Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities more than 25 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
.14 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.4 Wireless Access Point Ceiling Drops
.1 All Wireless Access Point locations to be cabled with Category 6A cable, jacks, and patch cords or use of approved Field-terminable Plug. Cable to be CMP rated and terminated with colour jack in patch panel end to designate 6A. Contractor must have tester able to certify performance to 6A standards. You must install an additional 15 foot of "service loop" to ensure the cable can be placed optimally.

.5 Faceplates
.1 Faceplates shall be ULC Listed and CSA Certified.
.2 Faceplates shall be stainless steel, compatible with industry standard keystone modules.
.3 Faceplates shall be 2.75" W x 4.4" H (69.8mm x114.3 mm) for a single gang.
.4 Faceplates shall be available to mount one, two, three, four, or six jacks in a single gang.
.5 Two and three port faceplates shall have thermal ink transfer stencilled port indicators.
.6 All horizontal data cable installed in noted surface raceway shall be terminated with jacks as specified in a 3-port "furniture" faceplate on the raceway outlet location. Faceplates must be of the same manufacturer as the raceway. Surface faceplates on top of the raceway will not be permitted. Provide blank cover plates in ports not used. All faceplates to match raceway colour.

.6 Category 6 Modular Jacks

.1 Shall be 8 positions unkeyed.
.2 Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening.
.3 Jack Housing shall be constructed of high impact 94 V-0 rated thermoplastics.
.4 Modular jack contacts shall accept a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
.5 Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in 2 staggered arrays of 4 to maximize contact spacing and minimize crosstalk.
.6 Modular jack shall be constructed of beryllium copper for maximum spring force and resilience.
.7 Contact plating shall be a minimum of 50 micro inches of gold in the contact area.
.8 Jack termination shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
.9 Jacks should be colour-coded as per their function:

.1 Wireless Access Points – Green
.2 CCTV Cameras – Purple
.3 Building Automation – Black
.4 Voice/Telephone - Red
.5 Main Office Data – White
.6 1st Floor Data – Blue
.7 2nd Floor Data – Orange
.8 3rd Floor Data - Yellow

.7 Category 6 Patch Panels
.1 Panels shall only be 48-port high density, 2U or 1U when required, and be made of black anodized aluminum in 2 rows of 24 ports. First row numbered 1-24 on upper portion of panel, and second row numbered 25-48 on lower portion of panel.
.2 Contractor to use existing empty ports on rack prior to adding additional ports.
.3 Contractor will populate, with modules, all ports of a newly installed patch panel frame.
.4 Panels shall be labelled on the front and rear of the panel to minimize obstruction by patch cables.
.5 Separate panels shall be used for data cable installations provisioned for voice and wireless access points. These panels shall be installed below other panels on the rack as the modules in these panels have to be connected to POE switches.
.6 One Rack Unit space should be maintained between Patch Panels of differing function (i.e., RU38 = Wireless Access Point Panel, RU37 empty, RU36 = CCTV Panel, RU35 empty, RU34 = 1st Floor Data, etc.)

.8 Racks
.1 Supply and install EIA Standard 19" floor mount equipment racks in accordance with ANSI/TIA/EIA-607 (CSA T527), complete with patch panels, switches, and horizontal/vertical wire management. Racks shall be bonded and bolted to the floor.
.2 All EIA Standard racks will be laid out to match Diagram 1-A. In addition, 4U must be made available for UPS, and another 3U made available for a rack mount server.
.3 Racks shall be securely attached to the concrete floor using appropriate mounting hardware.
.4 All racks shall be grounded to the telecommunications ground bus bar in accordance with cited standards the bonding and grounding section of this document.
.5 Rack mount screws (#12-24) not used for installing Fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation
.6 In telecommunications rooms with multi-bay rack rows, Contractor is responsible to include in design Interbay routing pathways at the top, middle, and bottom of each rack to provide efficient and neat patch routing between any two points within rack rows.

.9 Routers/ Switches/ Wireless Access Points/ UPS
.1 Supplied by Board with installation completed by the contractor. All Network Equipment software configuration will be completed by Board Staff.

.10 Portables
.1 The portable to LAN room fibre optic cable plant shall be 6 strand, 9/125 Micron Single-Mode cabling, with yellow coloured jacket, terminated in a 1U fibre patch panel (in LAN Room and portable) with LC type connectors and mating adapters.
.2 All fibre from the portables to the school shall be run within loom tubing in the cable support tray system, or in dedicated EMT conduit system, between the LAN Room and the point where it leaves the school building. All fibre shall be run in conduit and sealed when it runs through walls.
.3 A single wall mount 11U rack shall be securely installed in the Hub portable, with the bottom of the rack positioned at least 5 feet above the portable floor, and the rack located as close as possible to the point where the fibre enters the portable. The rack shall be configured as follows (top to bottom):

.1 1U Fibre Patch Panel
.2 2U 2-row 48-port patch panel
.3 2U Horizontal Management
.4 HPE Aruba Networking 2930F 12G PoE+ 2G/2SFP+ Switch (JL693A) and HPE Aruba Networking 10G SFP+ LC SR 300m OM3 MMF Transceiver (part number J9150D)

.4 All Ethernet cabling from the rack to a wireless access point drop located in the ceiling of each portable shall be CAT6 outdoor-rated and run-in conduit and sealed when it runs through portable walls.
.5 Supply one 3-foot CAT6 patch cable for each drop installed in the rack.
.6 Supply one 7-foot CAT6 patch cable for each wireless access point drop installed in the ceiling.
.7 Supply one 3 foot single-mode fibre patch cable with LC connectors for the portable rack.
.8 Supply one 6 foot single-mode fibre patch cable with LC connectors for the LAN Room rack.
.9 Patch down portable rack panel: drop 1 to port 1 on switch, drop 2 to port 2, etc.

.11 Patch Cables
.1 All LAN room Category 6 patch cables connecting panels to network equipment will be labelled at both ends of the cable following the naming convention detailed in the “LABELS” section of this document.
.2 All panel to switch patch cabling to be connected as per details provided in topology and matrix documents.

.12 Labels
.1 Supply and install the following mechanically printed labels:

.1 Face Plate Labels

.1 Labels shall adhere to the following convention:

.1 "LAN Closet<Letter>/Rack#/PATCH PANEL#/port#". ** Note that the LAN Closet Letter follows A, B, C...
.2 Labels shall be affixed to the faceplate on the space provided by the manufacturer.

.2 Cable Labels

.1 Shall be labelled in an identical manner as Faceplates.

.2 Supply and install self-laminated labels at both ends of each cable.

.1 End denotes 2-6” behind modular jack at both the faceplate and patch panel ends.
.2 All LAN Room panel-switch patch cables labelled within 3” of both ends of the cable.

.3 Rack Labels

.1 Labels shall adhere to the following convention:

.1 “LAN Closet<Letter>/Rack#”.

.2 Labels shall be affixed to the top centre of the rack.
.3 Shall be labelled consecutively from left to right.

.4 Patch Panel Labels

.1 Labels shall adhere to the following convention:

.1 ” Patch Panel#”.

.2 Labels shall be affixed to top left corner of patch panel.
.3 Shall be labelled consecutively from top to bottom.

.5 In-ceiling drops (access points, projectors, building equipment, etc.) shall have drop label (A/1/2/03 format) attached to the underside of the T-Bar below ceiling to indicate the location of the drop.

.13 Testing Copper

.1 The Data Cabling Contractor shall perform a full Category 6 or 6A test for every data drop installed in order to verify a 1000Mb/s solution or 10Gbs solution. Tester shall be a Level IIIe (or higher) field certification device capable of validating Category 6A channels per ANSI/TIA 1152 A.
.2 Upon completion of the testing, the Consultant or Owner may ask the contractor to perform random tests of up to 30% of the cables. This test will be completed with Consultant or Owner present. A penalty of $50.00 will be deducted from the contract amount for each cable that fails the test.
.3 All cables shall be tested in accordance with this document, the ANSI/TIA Standards, the manufacture warranty guidelines, and industry best practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
.4 All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is more stringent.
.5 Contractor shall set references according to manufacturer’s recommendation prior to each day’s testing and reset references anytime the tester unit shuts down due to inactivity.
.6 Resetting references shall also be done whenever test results become sporadic, or the tester demonstrates a consistent deterioration of test measurement performance.
.7 Category 6 test parameters shall be:

.1 Wire map
.2 Insertion loss
.3 Equal-level far end crosstalk (ELFEXT)
.4 Power sum Equal level far end cross talk (PSELFEXT)
.5 Propagation delay
.6 Length
.7 Near end cross talk (NEXT)

.8 Power sum near end cross talk (PSNEXT)
.9 Return loss
.10 Delay Skew

.8 Jacks shall be tested as part of the horizontal cabling system.
.9 Category 6 or 6a jacks shall be tested as part of the channel Length, DC continuity, NEXT, PSNEXT, Attenuation, return loss, ELFEXT, and PSELFEXT using a level III tester for category 6 channel compliance.
.10 A "PASS" indication shall be obtained for all link or channel tests when tested using the appropriate level tester for the appropriate category.
.11 Testers shall be correctly set to test the type and manufacture of the horizontal cable used in the link or channel being tested, including the correct NVP.
.12 Link attenuation shall be calculated as: Link attenuation = cable attenuation + connection insertion loss + splice loss.
.13 Splicing of any cable shall not be permitted for any reason.
.14 Test results shall be submitted in hard and electronic format. Electronic reports shall be submitted in digital format in Microsoft Excel (.xls, .xlsx). All electronic reports must be accompanied by a certificate signed by the authorized representative of the Company warranting the truth and accuracy of the report. The hard copy of the report is to be submitted in triplicate in three individual binders.
.15 The test results documentation will reference each data outlet with the specified labelling scheme, while also appending the data outlet's room number location. This will provide the Board with a completed matrix that maps the data outlet's locations to the room numbers throughout the school. Each data outlet tested will appear as follows:

.1 "LAN Closet<Letter>/Rack#/PATCH PANEL#/Port#/Room#"

.16 Final room numbers should be used in this documentation.

.14 Final Inspection
.1 The cabling contractor, Consultant, and Owner must together perform a job walkthrough upon completion of testing, to verify that network cabling is properly installed and performs to acceptable Owner standards.

.15 Warranty
.1 The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-up support after the project for a period of one year. All costs for these warranties must be included in the tender/bid amount.
.2 The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance by the Owner. The warranty shall cover all labour and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after the repairs are accomplished. This warranty shall be provided at no cost to the Owner.
.3 The performance warranty shall warrant properly installed 250 MHz or 500 MHz horizontal copper portion of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568A and TSB-67.
.4 The Contractor shall provide a 24-hour response time to any warranty claim.
.5 The Data Cabling Contractor will be required to provide a minimum 15-year manufacturer's extended assurance warranty for the entire communications cabling system. Warranty shall be in effect from the date of substantial completion.
.6 The Data Cabling Contractor shall provide a letter of certification within two weeks of the substantial completion. This document will include:

.1 Verification number
.2 Manufacturer's certification number
.3 Identification of the installation by location and project number.

.7 The system manufacturer shall provide in writing to the Owner that in the event of the demise or failure of the installing certified system installer/Vendor, the manufacturer shall be responsible for providing another certified system installer/vendor to fulfil the remainder of the warranty conditions.
.8 Contractor must ensure that the selected network cabling components manufacturer and the wiring manufacturer have contractual relationships to ensure that the system warranty is a true "end to end" structured cabling system warranty.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 General
.1 Conform to the requirements of the authorities having jurisdiction.

.3 Cable Installation
.1 All cables shall be installed in the following manner:

.1 Cables shall be housed in conduit raceways or placed in the cable support tray system.
.2 All cables shall be plenum rated to provide fire protection to prevent smoke spread.
.3 Cable raceways shall not be filled greater than the Ontario Electrical Safety code maximum fill for the particular raceway type.
.4 Cables shall be installed in continuous lengths from origin to destination (no splices).
.5 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
.6 If a J-hook or Cable Tray support system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals - at no point shall cable(s) rest on acoustic ceiling grids or panels.
.7 Horizontal distribution cables shall be bundled in groups of not greater than 40 cables.
.8 The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
.9 Cables shall not be attached to ceiling grid or lighting support wires.

.10 Cables shall be identified by a self-adhesive label in accordance with the Section “Labels” of this specification.
.11 Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
.12 Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
.13 Where the cables in an air return plenum are not in conduit or placed in a wire management system, they shall be neatly installed following building lines and attached to the structure with Cable supports in plenums shall be UL listed, plenum rated, non metallic ties that maintain a minimum 1 inch bend radius, or metal clips mechanically fastened at maximum 1000mm centers. Do not attach to ductwork, piping, threaded rods, equipment, or other conduits.
.14 Backbone cables shall be installed separately from horizontal distribution cables.
.15 Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

.16 Backbone cables will be installed to a separate patch panel on each rack as per Diagram 1-A.
.17 The category marking shall appear every foot.
.18 Shall be suitable for plenum and horizontal applications.
.19 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.20 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.21 CAT 6 cable is good for distances up to 90 meters / 295 feet. The horizontal cable from the patch panel to the RJ-45 jack in the faceplate shall not exceed a maximum of 90 meters / 295 feet.
.22 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 or 6A requirements as per the TIA/EIA-568-B.2-1 standard.
.23 Cable shall include sequential length markings and be CMP (FT6) rated with blue outer sheath.
.24 Shall be suitable for plenum and horizontal applications.

.4 Outlet Installations
.1 All outlets shall be installed in the following manner:

.1 No more than appropriate lengths of slack shall be stored in an in-outlet box or modular furniture raceway.
.2 Each cable type shall be terminated as indicated below:

.1 Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
.2 Pair untwist at the termination shall not exceed 0.5 inch for Enhanced Category 6 connecting hardware.
.3 Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
.4 The cable jacket shall be maintained as close as possible to the termination point.

.5 Horizontal Cross-Connect Installation
.1 Copper termination and management hardware shall be installed in the following manner:

.1 Cables shall be dressed and terminated in accordance with ANSI/TIA/EIA-568B, manufacturer's recommendations and best industry practices.
.2 Pair untwist at the termination shall not exceed 0.5 inches for Enhanced Category 6 or 6A connecting hardware.

.3 Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
.4 Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
.5 The cable jacket shall be maintained as close as possible to the termination point.
.6 Each cable shall be clearly labelled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.
.7 Cable labels shall not be obscured from view within bundles.

.6 Fibre Optic Termination Hardware Installation
.1 Fibre optic termination hardware shall be installed in the following manner:

.1 Fibre slack shall be neatly coiled within the fibre termination panel. No slack loops shall be allowed external to the fibre panel(s).

.2 Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
.3 Each fibre cable shall be stripped upon entering the termination panel and the individual fibres routed in the termination panel.
.4 Each cable shall be clearly labelled at the entrance to the termination panel. Cables labelled within the bundle shall not be acceptable.
.5 Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

.7 Rack Installation
.1 The racks and cable routing hardware shall be in Local Area Network (LAN) closets. Racks shall be placed in a manner as follows; for the Central (Main) LAN closet allow a minimum of 5 feet clearance from the rear mounting surfaces and 3 feet of clearance from the front and on one side and for the racks in the Branch LAN closets allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6” to the wall to allow room for vertical management. The racks shall be equipped with perimeter horizontal and vertical management to provide Interbay management. Ganged rack frames will be placed in a manner that will allow a minimum of 5 feet of clearance from the rear and 3 feet from the mounting surfaces and on one side of the ganged assembly.
.2 Where racks and voice telecommunication networks are located in the same closet the racks shall be on the opposite side of the room from the voice termination fields. Conduits for data backbone shall be located adjacent to the racks and conduits for voice shall be located adjacent to the voice termination fields.
.3 Racks shall be installed in the following manner:

.1 Racks shall be securely attached to the concrete floor using 3/8” hardware anchor bolts.
.2 All racks shall be grounded in accordance with ANSI/TIA/EIA-607 “Grounding and Bonding Requirements”.
.3 Rack mount screws (#12-24) not used for installing fibre panels and other hardware shall be bagged and left with the rack upon completion of the installation.

.8 Fire and Smoke Stop Systems
.1 Must match General Contractor’s Specification for Firestop Systems.
.2 All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through wall penetrations and through floor penetrations. Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

.3 A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
.4 Firestop systems shall meet CAN4-S101M, Fire Tests of Building Construction & Materials, CAN4-S102M, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies and CAN4-S115M, Standard Method of Fire Tests of Fire Stopping Systems.

.9 Fibre Optic Testing
.1 Each fibre strand shall be tested for attenuation with an optical power meter and light source. Cable length and splice attenuation shall be verified using an OTDR.
.2 Attenuation:

.1 Horizontal distribution multimode optical fibre attenuation shall be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. This measurement is consistent with the loss which network equipment will see under normal installation and use. Backbone multimode fibre shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14. Test results evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1.

.2 Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables shall be evaluated based on the following formula: manufacturer's maximum attenuation per kilometer divided by 1000 and then multiplied by the installed cable length in meters.

.3 The adjusted cable attenuation value shall be added to the manufacturers mean loss per mated pair of connectors multiplied by the number of mated pairs under test (the testing for this project measures the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors - subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test).

.4 The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor's test matrix. Each strand of fibre in the respective cable shall be evaluated against this target number. Any fibres that exceed this value shall be repaired or replaced at no cost to the Owner.

.5 Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.

.10 Cleaning

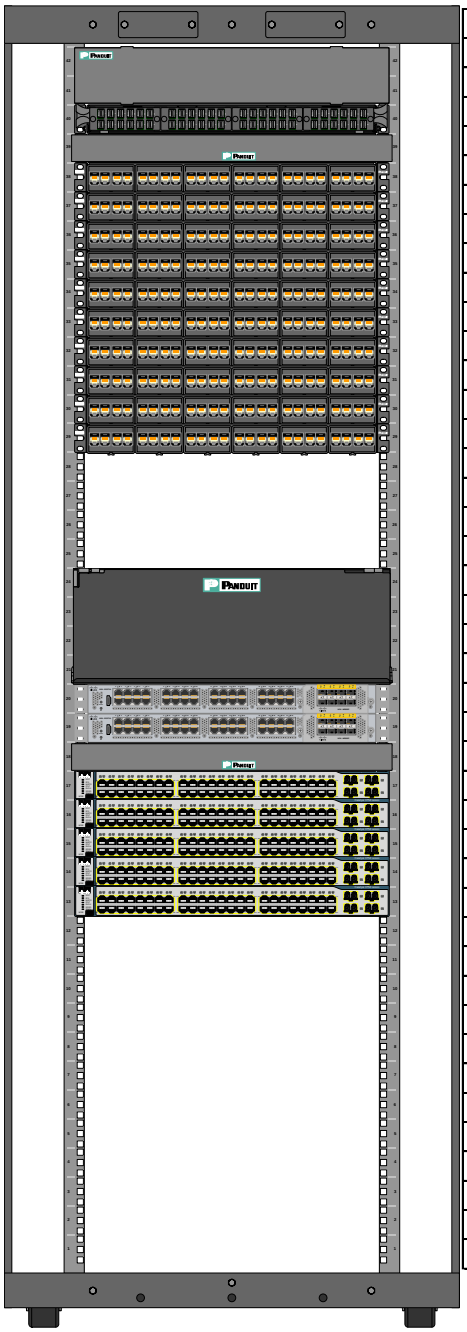
.1 The Owner's facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

.2 All Equipment will be stored appropriately at the end of each workday

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after fire stopping materials have set.

DIAGRAM 1-A



RU	DESCRIPTION
42	CBL MNGT
41	
40	FIBRE
39	CBL MNGT
38	PATCH PANEL COPPER
37	PATCH PANEL COPPER
36	PATCH PANEL COPPER
35	PATCH PANEL COPPER
34	PATCH PANEL COPPER
33	PATCH PANEL COPPER
32	PATCH PANEL COPPER
31	PATCH PANEL COPPER
30	PATCH PANEL COPPER
29	PATCH PANEL COPPER
28	OPEN
27	OPEN
26	OPEN
25	OPEN
24	CBL MNGT
23	
22	
21	
20	L3 SWITCH
19	L3 SWITCH
18	CBL MNGT
17	SWITCH
16	SWITCH
15	SWITCH
14	SWITCH
13	SWITCH
12	OPEN
11	OPEN
10	OPEN
9	OPEN
8	OPEN
7	OPEN
6	OPEN
5	OPEN
4	OPEN
3	OPEN
2	UPS
1	

END OF SECTION

APPENDIX A -MATERIALS LIST

Product Category	Part Description
Copper Cabling Products	
Category 6	Copper Cable, Cat6, 4-pair, 23AWG, U/UTP, CMP, Blue, 1000 feet in a carton
	Patch Panel ; 24 Port ; Angled ; Black
	Patch Panel ; 48 Port ; Angled ; Black
	Cat 6, UTP, 8 pos 8 wire, Universal, Blue, TG Style
	Stainless Steel Faceplate, 2 Port
	Faceplate that accepts two modular keystone-style Cat 6/6A jacks.
	Blank Module, 1 Port, Black
	The block-out device works with most standard RJ45 openings to prevent unauthorized access and to protect from dust and debris or foreign objects.
	Copper Patch Cord; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 3 Ft
	Copper Patch Cord; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 7 Ft
	Copper Patch Cord ; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 10 Ft
	Standard RJ45 plug lock-in device with extended hood, 10 devices (black) and 1 key
Category 6a	Copper Cable, Cat 6A, 4-Pair, 23 AWG, UTP, CMP, Blue, 1000ft/305m
	Cat 6A, UTP, 8 pos 8 wire, Universal, Blue, TG Style
	Category 6A UTP Field Terminable RJ45 Plug
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 3ft
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 7ft
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 10ft
Fiber Cabling Products	
	50um OM4 6 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers

Product Category	Part Description
	LC Fiber Optic Connector that is a multimode 50/125µm OM3/OM4/OM5 duplex fiber connector, intended for 900-micron tight-buffered fiber installation.
	Angled fiber tray that is designed to organize fiber distribution cabling. When used with the CFAPPBL1A patch panel, it accommodates up to 4 QuickNet cassettes or FAP adapter panels.
	Angled fiber patch panel is used with FMT1A and FMT2A trays and holds up to four Cassettes or FAP adapter panels. It is compatible with all 19" wide EIA rack mount installations, is black powder coated steel, and fits in a 1 RU footprint.
	Wall Mount Fiber Enclosure designed to manage and organize fiber distribution when space is limited.
Racks, Cabinets, and Cable Management	
	The 2-post rack that provides a reliable foundation for mounting telecommunications and data center equipment.
	Vertical Cable Manager that is a single-sided cable manager that provides a cost-effective solution to organize, manage, and protect network cabling in telecommunication rooms and data centers.
	Horizontal Cable Manager that provides a neat and efficient way to manage patch cables on any standard EIA 19 inch (483mm) rack or cabinet. It manages copper, fiber optic, and coax cables.
	Horizontal Cable Manager that provides a neat and efficient way to manage patch cables on any standard EIA 19 inch (483mm) rack or cabinet.
	The 2-post rack mount shelf mounts test gear, computer equipment, and small networking devices on 3 inch (76mm) or 6 inch (152mm) channel 2 post racks.
Bonding and Grounding	
	Grounding and labeling shall follow CSA T527 and ANSI/TIA-606-C; bidders may use any manufacturer's components that meet these standards.
Network Labeling	
	Labeling shall comply with ANSI/TIA-606-C and CSA T527; bidders may reference any publicly available documentation that demonstrates compliance with these standards.
Other Accessories	
	Provide basic 15 A, single-phase, 120 V rack-mount PDU with a minimum of twelve NEMA 5-20R outlets and 3 m cord.

Product Category	Part Description
	Hook and Loop Cable Roll is constructed of soft, premium material that is safe to use on high performance cables to protect against over-tensioning.
	J-Hook for wall mount application have a patented design, featuring complete horizontal and vertical 1" bend radius control, which prevents pinch points and degradation of cable performance.

END OF APPENDIX A

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The existing P.A. system (Multicom-2000) shall remain and shall be operational at all times.

.3 Provide associated outlet boxes, back boxes, P.A. system wiring, P.A. system devices, testing, conduits terminated in corridor and provide extension to the existing system as shown on drawings and indicated in specification and in accordance with manufacturer recommendation. Provide all associated components to suit.

.4 New P.A. system speaker, VoIP phone handset (Mitel/ Shoretel) shall match existing unit.

.5 All new P.A. system devices i.e., P.A. system speaker(s), VoIP handset etc. shall match existing and shall be compatible with existing P.A. system panel.

.6 Provide VoIP-to-analog gateway that supports FXS ports complete with required conduit/wiring from new LAN room to existing PA rack located in existing electrical room. Provide all associated components for fully functional VoIP integration phone system to match existing to suit.

.7 Relocate existing P.A. system devices as shown on drawings. Extend associated conduit, wiring and adjust all components to suit.

.8 New P.A. system wiring shall be plenum rate FT-6 type, 24 AWG, two (2) twisted pair to match existing wiring. Install new wiring in new outlet/back boxes, conduits, and "free run" in corridor ceiling space. Provide associated "J-hooks" as required for proper support.

.9 Install wiring in new conduits/outlet boxes.

.10 Terminate new wiring in existing P.A. system panel.

.11 Terminate all conduits in corridor ceiling.

.12 The fish wire shall be installed in each conduit.

.13 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.14 Installations of equipment and wiring shall be done in accordance with manufacturer’s recommendations and school board requirements.

.15 After completion of the system provides verification report by system manufacturer/installer.

.16 Pre-Qualified Contractor: Barrie Communications, High Tech Communications Inc., Eclipse Technology Solutions.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide conduits, outlet boxes and other materials as required and/or shown on the drawings for installation of P.A. system devices and equipment.

.3 Conduits for P.A. devices shall be terminated as shown on the drawings. Coordinate all work with the P.A. system supplier/installer.

.4 The installation shall be in accordance with the Board's requirements.

.5 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The main existing telephone panel shall remain and shall be operational at all times.

.3 Provide associated outlet boxes, back boxes, jacks, cover plates, telephone system wiring, connection, conduits terminated in corridor and provide extension to the existing system as shown on drawings, indicated in specification and in accordance with manufacturer's recommendation. Provide all associated components to suit.

.4 Install wiring in new conduits/outlet boxes, and "free run" in corridor ceiling space. Provide associated "J-Hooks" (as required) for proper support.

.5 Terminate new wiring in existing telephone system BIXS panel.

.6 For each telephone outlet provide separate dedicated run of telephone system wiring and connect to existing telephone system BIXS panel/existing telephone system switch.

.7 New telephone system wiring shall be four (4) pair, solid copper, 22 AWG cable, unshielded twisted pair (U.T.P.), category 3, FT-6 rated and shall match existing wiring.

.8 Terminate all conduits in corridor ceiling. Provide J-Hook if required for proper support.

.9 The fish wire shall be installed in each conduit.

.10 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.11 Installation shall be in accordance with manufacturer's recommendations and school board requirements.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduits, outlets and other materials as required and/or shown on the drawings for a complete system.

.3 A fish wire shall be installed in each telephone conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Clocks shall be surface mounted, battery operated, Simplex #6310 (1-12/00 23-hour dial), complete with batteries and hangers.

.3 Clocks in general purpose room shall be 14” diameter and shall be complete with wire guard.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide hangers for all clocks.

.3 Supply and install clock in each rom containing a classroom control panel and as shown on drawings. Include in contract 8-additional clocks which will be installed in rooms as designated by the school board representative and on site.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The existing intrusion system shall be upgraded as part of Cash allowance work.

.3 Coordinate all work with intrusion detection system installer/contractor and on site.

.4 Pre-Qualified Contractor:
.1 Huronia Alarms
233 Midland Ave.
Midland, Ontario
L4R 3K1
Telephone (705) 526-9311

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section, refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduits, outlets and other materials for the installation of intrusion detection system devices and equipment as part of the cash allowance.

.3 Conduits for intrusion detection system devices shall be terminated per the intrusion installer's direction on site. Coordinate all work with the intrusion detection system supplier/installer and on-site.

.4 A fish wire shall be installed in each intrusion detection system conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
  .2 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.
  .3 CAN/ULC-561-03 (latest edition) - Standard for Installation and Services for Fire Signal Receiving Centres and Systems.

1.3 SUBMITTALS

.1 Fire alarm system ULC remote monitoring and certificate in accordance with CAN/ULC-561(Latest Edition) - Standard for Installation and Services for Fire Signal Receiving Centres and Systems.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical

.2 Provide ULC remote monitoring for fire alarm system complete with all required components in accordance with CAN/ULC-S561-03 (Latest Edition) - Standard for Installation and Services for Fire Signal Receiving Centres and Systems.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Fire alarm system control panel interconnection shall include but not limited to the following:
  .1 Wiring connection must be provided between the ULC monitoring system panel and the fire alarm system panel.
  .2 Wiring connection must be in conduit and installed to CAN/ULC-S561-03 (latest edition) requirements.
  .3 The connection must be an independent zone to all other security system devices.
  .4 Two (2) zones of the remote monitoring control panel shall be assigned as follows:

    .1 Fire Zone 1: 'Fire' – building fire system activated.
    .2 Fire Zone 2: 'Fire Trouble' – building fire system is in trouble.
    .3 Fire zones shall be designated twenty-four (24) hour zones and shall not be armed/disarmed by the digital keypad.
    .4 Exact zone designations shall be confirmed and coordinated with fire alarm remote monitoring agency/contractor.

  .5 Provide 21mm conduit from ULC remote monitoring control panel to main telephone equipment backboard for fire alarm system monitoring to a ULC Listed Central Monitoring Station and another 21mm conduit from ULC remote monitoring control panel to GSM-GS3060 cellular module.

.6 Provide 21mm conduit from fire alarm panel to the new ULC monitoring control panel and another 21mm conduit from fire alarm panel to GSM-GS3060 Cellular module for connection of the fire alarm/trouble outputs.

.3 ULC remote monitoring of fire alarm system shall be in accordance with CAN/ULC-561-03 (latest edition) and shall include but not limited to the following:

.1 Provide all required ULC remote monitoring equipment for complete system including but not limited to the following:

.1 DSC-PC1616 Control Panel.
.2 DSC-PK5500 LCD Icon Keypad.
.3 DSC-PC4050CR Red Fire ULC Cabinet.
.4 DSC-ATC-FTC3716 pre-mounted 16v Transformer.
.5 DSC-T1 Tamper Switch.
.6 DSC Cabinet Lock.
.7 2-12V Batteries.
.8 DSC-PC4701 Dual line dialler module
.9 GSM-GS3060 Cellular module.

.2 Keypad shall not be mounted in or on the remote monitoring control panel. It must be mounted below or beside the panel. No holes shall be drilled in the cabinet.
.3 Dedicated circuit shall be provided for power. Control panel shall not be tied into the fire alarm panel circuit breaker.
.4 A telephone line must be installed for the ULC remote monitoring control panel.
.5 Wiring between the fire alarm panel and the ULC remote monitoring panel must be in conduit.
.6 ULC certificate shall be installed near ULC remote monitoring control panel.
.7 Install all components for CAN/ULC-516-03 (latest edition) compliance for Fire Alarm remote monitoring through DSC monitoring panel controller and adjust all components to suit.
.8 All costs for testing, verification, connection to the designated ULC Central Monitoring Station, attendance of the designated alarm monitoring company technician and demonstration of the system shall be included in the tender price.
.9 Contractor shall also include for final connections to central monitoring station, in accordance with the latest requirements of CAN/ULC-S561-03 (latest edition).
.10 All work shall be performed by ULC listed suppliers/installers.

.4 A phone connection will be required for fire alarm system remote monitoring. Electrical contractor shall coordinate all associated work with the owner.

.5 Adequate power supplies shall be provided to power all equipment and devices for complete monitoring system.

.6 2-12V batteries for minimum of 24-hour period operation shall be provided. All batteries shall be labelled with date of installation.

.7 Plug-in transformers shall NOT be used. Primary side of transfer must be directly connected to electrical panel. Primary side electrical connection must be terminated junction box. Secondary side shall be wired straight into remote monitoring panel.

.8 GSM-GS3060 cellular module shall be fed from the same circuit through separate power supply DSC-PC4204CX (ULC Labelled) and connected to the remote monitoring panel.

.9 GSM tamper shall be connected in series with cabinet tamper “CAB/GSM Tamper”.

.10 CA38A jacks shall be installed at main telephone backboard Bell demarcation point.

.11 GSM-GS3060 cellular module Installation/Programming requirements shall include but not limited to the following:
- .1 Line to Bell Demarcation.
- .2 Relays for GSM shall be DSC RM1C ULC listed relays (ULC labelled).
- .3 A programmable output from remote monitoring panel shall be connected through RM1C ULC relay to Input 1 on GSM for fire alarm system monitoring.
- .4 Wiring from GSM to remote monitoring panel must be in conduit and mechanically protected.

.12 Three (3) FT6 4/22 cables must be installed in 21mm conduit between the fire alarm system panel and remote monitoring panel. Fire alarm system panel shall be connected for ‘Fire Alarm’, ‘Fire Supervisory’ and ‘Fire Trouble’ monitoring. Remote monitoring company will verify and inspect. All fire alarm zone cables must be clearly labelled.

.13 Provide 120-volt dedicated circuit compete with conduit/wiring at location of remote monitoring control panel /communication unit for connection to control cabinet and communication devices.

.14 All wiring shall be FT6 plenum rated to conform to requirements of the Canadian Electrical Code and Provincial Codes. Only FT6 rated #22 AWG cable will be acceptable. All system wiring/cables shall be installed as per all applicable codes and regulations.

.15 All work must be, clean, neat, and with high standard of workmanship. System wiring leading into the control panel must be neat and in raceway/conduit.

.16 Wherever conduit/ wires cross building expansion joints, install the conduit/wires in such a manner to permit free movement without imposing additional stress or load upon the support system, and to prevent excessive movement at joints and connections.

.17 All work shall be completed in accordance with CAN/ULC-561-03 (latest edition) requirements and manufacturer’s recommendations. Work that is unsatisfactory to the authorities having jurisdiction shall be replaced at no extra cost.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
.2 CAN/ULC-S525 - Audible Signal Device for Fire Alarm Systems.
.3 CAN/ULC-S526 - Visual Signal Devices for Fire Alarm Systems.
.4 CAN/ULC-S527 - Control Units.
.5 CAN/ULC-S528 - Manual Pull Stations for Fire Alarm Systems.
.6 CAN/ULC-S529 - Smoke Detectors for Fire Alarm Systems.
.7 CAN/ULC-S530 - Heat Actuated Fire Detectors for Fire Alarm Systems.
.8 CAN/ULC-S531 - Standard for Smoke Alarms.
.9 CAN/ULC-S536-S537 - Burglar and Fire Alarm Systems and Components.
.10 CAN/ULC-S548 - Water flow Indicators for Fire Protective Signalling Systems.

.2 National Fire Protection Agency (NFPA)
.1 NFPA 72 - National Fire Alarm Code.
.2 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit manufacturer's printed product literature, specifications and data sheets as required and specified in specification.

.3 Submit equipment and zoning layout complete with wiring diagram.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical

.2 The fire alarm system shall be an Addressable Analog, Single Stage, Zoned, Non-coded, indicating, fully integrated system completes with F.A devices, modules, auxiliary contacts, conduits, wires etc. as specified below.

.3 The Fire Alarm System shall be a Multi-Processor Based System designed specifically for Fire, Model EST3, and shall be ULC listed under CAN/ULC-S527 standard. Fire alarm system manufactured by Simplex/Grinnell-4100ES, Mircom-FX4000 shall be considered equal provided it meets the specifications. The Fire Alarm System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:
.1 Modular systems design, with a layered application design concept, including an Operational Layer and Human Interface Layer, to allow maximum flexibility of the system with a minimum physical size requirement.

.2 All System operational software is to be stored in FLASH memory. Control Panel disassembly, and replacement of electronic components of any kind shall not be required to upgrade the operations of the installed system to conform to future application code and operating system changes.
.3 Up to 128 Service Groups must be definable within the system program to allow the testing of the installed system based on the physical layout of the system, not on the wiring of the field circuits connected to the Fire Alarm Control Panel.
.4 Advanced Windows-based System Definition Utility with Program Version Reporting to document all changes made during system start-up or system commissioning. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data.
.5 System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.
.6 System Common Control Functions shall be automatically routed to any node of the system as a function of the time of day and date.

.4 The Fire Alarm System shall include the following features and shall support the following operations in each installed cabinet or node of the system:
.1 Up to 10 Signature Series Intelligent Device loops.
.2 Up to 125 Intelligent Smoke Detectors and 125 Intelligent Modules per Signature Data Circuit.
.3 Up to 144 Hardwired input/output Circuits.
.4 Up to 228 Manual Control (Input) Switches.
.5 Up to 456 LED Annunciation Points.
.6 Up to 63 Remote Display Units.
.7 Peer-To-Peer network connection of up to 64 system nodes wired as Class A.
.8 Ground fault detection by panel, by Signature Data Circuit and by device module.
.9 Ability to download all system applications programs and "firmware" from a computer through a single point in the system.
.10 True Distributed Intelligence, including microprocessor-based Detectors and Modules.
.11 A.C. Power Trouble Delay adjustable from 4 Hours to 10 Hours.
.12 Removable, Interlocked terminal blocks for the connection of the field wiring to the Fire Alarm Control Panel.
.13 Electronic Addressing of Field Devices.
.14 Advanced Power Management.
.15 Dead Front Construction.

.5 Fire Alarm System Sequence of operation:
.1 Activation of any alarm initiating device shall cause the following to occur:

.1 All audible signals to sound continuously for the mandatory period before they can be manually or automatically silenced.
.2 The type and location of the alarm to be indicated on the control panel and the remote annunciator.
.3 Transmit an alarm to the central station and Fire Department with indication on the annunciator.
.4 Operation of auxiliary contacts for control of auxiliary functions.
.5 Release fire doors held open by electric door hold open devices.
.6 De-energize electric maglock devices.
.7 Fan shut down.

.2 Activation of any supervisory device shall cause the following to occur:

.1 The common trouble alarm signal shall sound in the control panel and the annunciator.
.2 The type and location for the alarm to be indicated on the control panel and the annunciator.

.3 Any malfunction on the system shall sound a trouble alarm signal and illuminate a trouble indicator on the control panel and the annunciator.

.1 The trouble alarm signal shall be suppressed during an alarm.

.6 Fire Alarm System shall include an Emergency Operators' Interface Panel which shall include the following system annunciation and control functions:

.1 System Annunciation and Control Functions:

.1 Hands free Emergency Operation. The first and last highest priority event on the system shall be displayed automatically and simultaneously.

.2 Control Panel Internal Audible Signal shall have four programmable signal patterns to allow for the easy differentiation between Alarm, Supervisory, Trouble and Monitor conditions within the installed system.

.2 Five Discreet System Status LEDs:

.1 Power Status LED:

.1 Green LED shall illuminate when AC power is present.

.2 Test Status LED:

.1 Yellow LED shall illuminate when any portion of the system is in the test mode. A programmable timer shall cause the system to automatically exit the test mode after a period of system inactivity. Alarm operation in the rest of the building shall not be affected by the test area. The Test LED shall function in a local or in a group mode.

.3 CPU Fail Status LED:

.1 Yellow LED shall illuminate when the panel controller has an internal failure.

.4 Ground Fault Status LED:

.1 Yellow LED shall illuminate when un-grounded wiring connected to the cabinets' power supply has continuity to ground. This feature shall function in either a local or group mode.

.5 Disable Status LED:

.1 Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.

.3 Four Discreet Common Control Switches with associated Status LEDs:

.1 Reset:

.1 Depression of the ‘Reset’ Switch starts the system reset operation. The associated Yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to normal mode. Each phase, as well the overall reset cycle shall be programmable to perform other functions.

.2 Alarm Silence:

.1 Depression of the ‘Alarm Silence’ Switch shall turn off all (audible and/or visible) Notification Appliance Circuits. The associated yellow LED illuminates when the Alarm Silence function is active, whether by the Alarm Silence Switch, or by an integral software timer. Subsequent activation of the Alarm Silence Switch shall resound the signals. Activation of the Alarm Silence switch shall be programmable to perform other functions.

.3 Panel Silence:

.1 Depression of the ‘Panel Silence’ Switch shall turn off the systems' internal audible signal when configured as a 'local' system. The associated yellow LED illuminates when the panel silence feature is activated.

.4 Drill Switch / LED:

.1 Depressing the ‘Drill’ switch activates the fire drill function. Yellow LED indicates that the fire drill function is active. The Drill Switch shall also be programmable to perform system functions other than the Drill Function.

.4 Other Operator Control Switches:

.1 Previous Message Switch:

.1 Pressing the ‘Previous Message Switch’ shall scroll the display to show the preceding message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the top of the respective queue event list. The operator may do scrolling through event messages at any time.

.2 Next Message Switch:

.1 Pressing the ‘Next Message Switch’ shall scroll the display to show the following message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the bottom of the respective queue event list. The operator may do scrolling through event messages at any time.

.3 More Details Switch:

.1 Pressing the ‘More Details Switch’ shall show the address and 42-character location message of the active device on display. If a zone is active, pressing the switch displays the address and message of active devices within the zone. When multiple devices are active, the "Previous/Next" message switch may be used to scroll through the messages.

.7 The Liquid Crystal display shall provide the means to inform the System Operator with detailed information about the off-normal status of the installed Fire Alarm System. The Main Display shall automatically respond to the status of the system and shall display that status on an 8 line by 21-character backlit alphanumeric Graphic Liquid Crystal Display. Provide displays in main panel and annunciator(s).

.8 When the Fire alarm system is in the Normal Mode; the following status functions shall be annunciated by the Main LCD (Liquid Crystal Display):
.1 The current Date and Time.
.2 A Custom System Title (2 lines X 21 characters).
.3 A summary total of the Alarm History of the system.

.9 When the Fire Alarm System is in the Alarm Mode; the LCD shall automatically reconfigure into four logical windows:
.1 System Status Window:

.1 The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD Display.

.2 Current Event Window:

.1 The LCD shall show the first active event of the highest priority in reverse text to highlight the condition to the Emergency Operator. The top line of the reversed text shall show the sequence number in which the displayed event was received, as well as its event type. The second and third lines of reversed text shall display an identification message related to the displayed event.

.3 Last Event Window:

.1 The LCD shall show the most recent, highest priority event received by the system.

.4 Type Status Window:

.1 The LCD shall show the total number of active events in the system, by event type. There shall be four different System Event Types, which shall be displayed:

.1 Alarm Events.
.2 Supervisory Events.
.3 Active Trouble Events.
.4 Active Monitor Events.

.10 To simplify, and to clarify the System Status information, which is given to the Emergency Operator, the Main LCD shall include queues for each of the System Event Types. The Main LCD shall allow the Emergency operator access to the System Status information contained within those queues by pressing an associated queue select switch. Whenever there is an unacknowledged event in any of the System Event queues, the associated Status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue and shall cause the associated LED to illuminate steady.

.11 All messages contained in any of the System Event queues shall be accessible for review by the Emergency Operator using the "Previous/Next" message switch. It shall be possible to route additional event information to a printer.

.12 The Main LCD shall also allow the System Operator to access system maintenance functions through a four-level password system. The authorized System Operator shall be able to access the following functions:
.1 System Status:

.1 The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.

.2 Enable:

.1 The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any group function, guard patrol function, Panel, system module, "software - defined zone", operator control, or time control function.

.3 Disable:

.1 The system shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system. Additionally, the system shall allow the operator to disable any group function, guard patrol function, Panel, system module, "software - defined zone", operator control, or time control function within the system.

.4 Activate:

.1 The system shall allow the operator to manually turn on any system output point, or system function. Alternate Smoke Detector sensitivity, message routing within the system, guard patrol timing, and check-in group timings shall be modifiable with this simple command from the control panel.

.5 Restore:

.1 The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the message routing functions with this simple command from the control panel.

.6 Control Output:

.1 The system shall allow the operator to manually command and control relays and LEDs.

.1 Relays shall be able to be commanded to Latch, to energize as:

.1 High Priority,
.2 Low Priority, or
.3 De-Energize.

.2 LEDs shall be able to be commanded to Latch, to energize as:

.1 High Priority,
.2 Low Priority,
.3 Turn ON,
.4 Turn OFF,
.5 Slow Blink or
.6 Fast Blink.

.7 Reports:

.1 The system shall provide the operator with system reports, which give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD and shall be capable of being printed on any of the connected system printers.

.1 The system shall provide a report, which gives a sensitivity listing of all detectors, which have less than 75% environmental compensation remaining.
.2 The system shall provide a report, which provides a sensitivity listing of any detector.
.3 The system shall provide a report, which gives a listing of the sensitivity of all the detectors any given panel in the system, or any given SDC loop within any given panel.
.4 The system shall provide a report, which gives a chronological listing of up to the last 1740 system events.

.5 The system shall provide a listing of all the firmware revision listings for all the installed network components in the system.

.13 The system shall allow the authorized operator to perform all the following system functions:
.1 Set the System Time.
.2 Set the System Date.
.3 Set (Change) the System Passwords.
.4 Restart the System.
.5 Set the Dates for the System Holiday Schedule.
.6 Clear the Chronological System History File.

.14 The system shall allow the authorized operator to perform test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per cabinet, circuit, or service group basis.

.15 Each panel in the installed system shall include local Control and Display Annunciators. These annunciators shall have integral membrane style, tactile push-button control switches, for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events. The Local Control Display Annunciators shall provide the system with individual zone and / or device annunciation.

.16 Each remote annunciator panel in the installed system shall include remote Control and Display Annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events. The Remote-Control Display Annunciators shall provide the system with individual zone and / or device annunciation.

.17 Fire Alarm System Operations Interface:
.1 The Signature Device Card (SDC) shall be the interface between the Fire Alarm Control Panel and the Signature Series Detectors and Modules.
.2 The communications format between the SDC and the Signature Series Devices shall be 100% digital. Communications to devices must incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.
.3 It shall be possible to wire the SDC as Class A or Class B without twisted or shielded wire. It must be possible to wire branch circuits (T-Taps) from Class B Circuits.

.18 Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 24Vdc EST Integrity Series Signalling Appliances. The NAC shall be Class B and shall control up to 3.5 amps of power to the circuit.

.19 The Fire Alarm System shall allow Network Routing to be configured to any or all nodes (cabinets) in the network.

.20 All the system Printer ports can be configured to display any or all the following functions:
.1 Alarm
.2 Supervisory
.3 Trouble
.4 Monitor
.5 Service Group

.21 Each LCD Display on each node (cabinet) in the system shall be configurable to show the status of any or all the following functions anywhere in the system:
.1 Alarm
.2 Supervisory
.3 Trouble
.4 Monitor

.22 Fire Alarm Components:

.1 Intelligent Detectors - General Operation:

.1 The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns, and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Digital filters shall eliminate signal patterns that are not typical of fires. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

.2 Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and Analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total Analog loop response time for detectors changing state shall be 0.5 seconds.

.3 Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the Analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.

.4 The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

.5 Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.

.6 Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, and other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24-hour long term and 4-hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

.7 The intelligent Analog device and the Analog loop controller shall provide increased reliability and inherent survivability through intelligent Analog standalone operation. The device shall automatically change to standalone conventional device operation in the event of a loop controller polling communications failure. In the Analog standalone detector mode, the Analog detector shall continue to operate using sensitivity and environmental compensation information stored in its microprocessor at the time of communications failure. The Analog loop controller shall monitor the loop and activate a loop alarm if any detector reaches its alarm sensitivity threshold.

.8 Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.

.9 The intelligent Analog detectors shall be suitable for mounting on any Signature Series detector mounting base.

.2 Fixed Temperature Heat Detector, SIGA-HFS:

.1 Provide intelligent fixed temperature heat detectors, SIGA-HFS. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centres and be suitable for wall mount applications.

.3 Fixed Temperature/Rate of Rise Heat Detector, SIGA-HRS:

.1 Provide intelligent combination fixed temperature/rate-of-rise heat detectors SIGA-HRS. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centres and be suitable for wall mount applications.

.4 Ionization Smoke Detector, SIGA-IS:

.1 Provide intelligent ionization smoke detectors, SIGA-IS. The Analog ionization detector shall be complete with dual unipolar detector chamber to sense the presence of smoke particles provided by fast combustion as well as slow smouldering fires. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable.

.2 The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the Analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. The ionization detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centres and be suitable for wall mount applications. The ionization smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes. The detector shall be protected by a ULC Listed protective guard in areas where subjected to mechanical damage or abuse. The guard shall be suitable for flush or surface mounted detector installation.

.3 The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The ionization detector shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C).
.2 Humidity: 0-93% RH, non-condensing.
.3 Elevation: No limit.

.5 Standard Detector Mounting Bases, SIGA-SB:

.1 Provide standard detector mounting bases SIGA-SB suitable for mounting on North American 1-gang, 31/2" or 4" octagon box and 4" square box. The base shall, contain no electronics, support all Signature Series detector types, and have the following minimum requirements:

.1 Removal of the respective detector shall not affect communications with other detectors.
.2 Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.
.3 The base shall be capable of supporting one (1) Signature Series SIGA-LED Remote Alarm LED Indicator. Provide remote LED alarm indicators as required to suit detector installation location and code requirements.

.6 Relay Detector Mounting Bases, SIGA-RB:

.1 Provide relay detector mounting bases SIGA-RB suitable for mounting on North American 1 gang, 3 1/2 " or 4" octagon box and 4" square box. The relay base shall support all Signature Series detector types and have the following minimum requirements:

.1 The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
.2 The position of the contact shall be supervised.
.3 The detector processor upon power shall exercise the relay operation up.
.4 The relay shall automatically de-energize when a detector is removed.
.5 The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
.6 Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for "pilot duty".
.7 Removal of the respective detector shall not affect communications with other detectors.
.8 Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.

.7 Duct Detector Housing, SIGA-DH:

.1 Provide smoke detector duct housing assemblies, SIGA-DH, to facilitate mounting an intelligent Analog photoelectric detector, SIGA-PS, or 3D multi-sensor detector, SIGA-PHS, or 4D multi-sensor detector, SIGA-IPHS along with a standard, relay or isolator detector mounting base. Provide for variations in duct air velocity between 300 and 4000 feet per minute (300 to 1000 feet per minute for ion- photo-heat detector). Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Provide five one gang knockouts for mounting optional Signature Series modules. Finish the housing in baked red enamel. Provide remote alarm LED's, SIGA-LED, and Remote Test Stations, SIGA-DTS as required to suit detector installation location and code requirements.

.8 Single Input Module, SIGA-CT1:

.1 Provide intelligent single input modules, SIGA-CT1. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:

.1 Normally Open Alarm Latching (Manual Stations, Heat Detectors, etc.).
.2 Normally Open Alarm Delayed Latching (Waterflow Switches).
.3 Normally Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.).
.4 Normally Open Active Latching (Supervisory, Tamper Switches).

.9 Dual Input Module, SIGA-CT2:

.1 Provide intelligent dual input modules, SIGA-CT2. The Dual Input Module shall provide two (2) supervised Class B (Style 4) input circuits, each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers or may be panel mounted. The dual input module shall support the following circuit types:

.1 Normally Open Alarm Latching (Manual Stations, Heat Detectors, etc.).
.2 Normally Open Alarm Delayed Latching (Waterflow Switches).
.3 Normally Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.).
.4 Normally Open Active Latching (Supervisory, Tamper Switches).

.10 Single Input Signal Module, SIGA-CC1:

.1 Provide intelligent single input signal modules, SIGA-CC1. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers, 100mm European square boxes or may be panel mounted. The single input signal module shall support the following operations:

.1 Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms at 50W or 70Vrms @ 35 Watts of Audio).

.11 Control Relay Module, SIGA-CR:

.1 Provide intelligent control relay modules, SIGA-CR or intelligent polarity reversing control relay modules, SIGA-CRR. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The Polarity Reversing Relay Module will be used to power an activate groups of detectors sounder bases installed on the system. The control relay and polarity reversing modules shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers or may be panel mounted.

.12 Isolator Module, SIGA-IM:

.1 Provide intelligent class A Isolator modules, SIGA-IM. The Class A Isolator Module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. Following a short circuit condition, each isolator module shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator modules not capable of performing independent self-tests shall not be acceptable. The isolator base shall have the following minimum requirements:

.1 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.
.2 When connected in Class A configuration the Signature Loop Controller shall identify an isolated circuit condition and provide communications to all non-isolated Analog devices.

.13 Intelligent Manual Pull Stations - General Operation:

.1 It shall be possible to address each Signature Series fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input modules. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes that can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C).
.2 Humidity: 0-93% RH, non-condensing.

.14 Manual Pull Station, SIGA-270, SIGC-270F, SIGC-270B:

.1 Provide intelligent single action, single stage fire alarm pull station. The fire alarm pull station shall be of metal construction with an internal push button switch. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers. Manual pull stations shall be provided with auxiliary contacts mounted at door(s) having maglock devices (to de-energize in case of activation of fire alarm in building) as shown on drawings.

.15 Self-Synchronized Strobes (Type 'QC'):

.1 Provide strobes manufactured by EST. In-Out screw terminals shall be provided for wiring. The strobes shall have a red plastic faceplate. They shall provide 15 cd synchronized flash outputs. Strobes shall mount in a North American 1-gang box. The strobe shall have lens markings oriented for wall or ceiling mounting, as shown on drawings. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. Ceiling mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed strobe to change the lens markings shall not be acceptable.

.16 Fire Alarm Horn

.1 Provide electronic F.A. cone Horn. In-Out screw terminals shall be provided for wiring. The horn shall have a red plastic housing. A steady tone sound output level of 93 dBA peak shall be provided. Horn shall mount to a North American 4" electrical box with extension ring using the 2 screws provided with ring. It shall not be necessary to completely remove the screws to facilitate mounting.

.17 Horn/Strobes:

.1 Provide electronic cone horn/strobes. In-Out screw terminals shall be provided for wiring. The horn shall have a red plastic housing. A steady tone sound output level of 93 dBA peak shall be provided. The strobe shall provide 15 cd synchronized flash outputs. The strobe shall have lens markings oriented for wall or ceiling mounting, as per drawings. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. Ceiling mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed cone horn/strobe to change the lens markings shall not be acceptable. Cone horn/strobes shall mount in a 4" electrical box with extension ring using the 2 screws provided with ring. It must not be necessary to completely remove the screws to facilitate mounting.

.23 Provide amplifiers to suit quantities of F.A. horn as shown on drawings plus 20% spares for future use.

.24 Supervisory switches shall be alarm devices, which shall have normally open contacts that close on alarm. These devices will be supplied by another Division of this Specification but shall be installed and connected by this Division.

.25 The loss of power devices shall be provided by this Division.

.26 End of line resistors shall be provided by this Division for the complete system.

.27 Provide framed multi-colour fire alarm passive graphic display board consisting of electronically stored building outline, with floor(s) and zone(s) outline, printed on dimensionally stabilized clear film under UV protective clear acrylic shield. Different colours as approved by the Owner shall depict floor outline, zone areas and egress corridors. Every zone of fire alarm system shall be shown including alarm zones, elevators zones, mechanical ventilation system duct detector zones, fire pump zones, sprinkler and standpipe system zones, emergency generator zones, gas shut off valve zones, smoke control fans zones, etc. Symbol of legend, project name, true north and "YOU ARE HERE" notation shall be included.

.28 Simplex and Mircom, manufacturer shall be considered equal if they meet the specification.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 The equipment shall be installed strictly in accordance with the manufacturer's requirements and recommendations and the requirements of the Authorities having jurisdiction.
.1 Canadian Electrical Code.
.2 Canadian, Provincial and Local Building codes.
.3 Local Authorities Having Jurisdiction.
.4 Underwriters Laboratories Canada Inc.
.5 ULC, BSA.

.3 Install wiring to conform with the requirements of the Canadian Electrical Code. Size wiring in accordance with Class 2 requirements, except for A.C. Signal Circuits where the wiring shall be sized in accordance with Class 1 requirements but be protected from mechanical injury or other injurious conditions such as moisture, excessive heat, or corrosive action in conduit. Connect wiring to the screw terminals in the devices.

.4 Install fire alarm systems in accordance with the latest Standards as identified in Section 1.2.1 above.

.5 Install end-of-line resistors in a separate outlet box with grille.

.6 Provide a complete system of relays for the auxiliary functions.

.7 Mechanical connectors are not acceptable. Solder and insulate all joints if wire cannot be continuous.

.8 Wire with colour coded conductors.

.9 Supervise all wiring.

.10 All wiring shall have copper conductors.

.11 Prior to energizing or commissioning the system, the F.A. system shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
- .1 That the type of equipment installed is that designated by the specifications.
- .2 That the wiring connections to all equipment components show that the installer has complied with ULC and CSA requirements.
- .3 That the equipment has been installed in accordance with the manufacturer's recommendations and that all devices have been operated and tested to verify their operation, and that the system operates in accordance with the requirements of the Specification.
- .4 That the supervisory wiring of those items of equipment connected to a supervisory circuit is operated as specified.
- .5 That Governmental regulations will be met to the satisfaction of inspection office.

.12 The inspection and testing reports and certification of fire alarm system prepared by the fire alarm vendor shall be submitted for review by the Consultant. This work shall be complete 3 weeks prior to occupancy date.

.13 The "dB" readings shall be provided by the fire alarm system vendor in each area/room where audible devices are installed (part of this Contract). The testing report shall be prepared and submitted for review by the Consultant. This work shall be complete 3 weeks prior to occupancy.

.14 System installation and operations shall be verified by the manufacturer's representative, and a verification certificate presented upon completion. The manufacturer's representative shall be responsible for an on-site demonstration of the system operation and initial staff training as required by the Owner and/or Consulting Engineer.

.15 System changes shall be verified by the manufacturer's representative, and a verification certificate presented upon completion.

.16 When the fire alarm system has been commissioned and verified it shall be fully demonstrated by this Division to the authorities having jurisdiction.

.17 The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week.

.18 Warranties all installation, and workmanship for one (1) year from date of acceptance, unless otherwise specified.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
.2 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.

.2 National Fire Protection Agency (NFPA)
.1 NFPA 72 - National Fire Alarm Code.

1.3 SUBMITTALS

.1 Fire alarm verification report and verification certificate in accordance with CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical

.2 Verify Fire Alarm System complete with all fire alarm zones in accordance with CAN/ULC-S537 (Latest Edition) - Standard for Verification of Fire Alarm Systems..

.3 Refer to Architectural Division Section 01 91 29 – Integrated System Testing of Fire Protection and Life Safety Systems, and include any cost associated with this work in the tender price.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section, refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide a letter addressed to the Consultant confirming that the fire alarm system verification and integrated testing have been satisfactorily completed.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 31 22 13 - Rough Grading.

.2 Section 31 23 16 - Excavation.

.3 Section 32 93 00 - Planting.

1.2 REFERENCES

.1 OPSS.MUNI 201 (April 2019): Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders.

.2 OPSS.MUNI 801 (Nov. 2019): Construction Specification for the Protection of Trees.

1.3 EXISTING CONDITIONS

.1 Prevent damage to items scheduled to remain.

.2 Protect trees designated to remain to OPSS.MUNI 801.

.3 Provide protective temporary fencing as required, placed at dripline of trees to protect root systems against passage of heavy equipment.

.4 Where excavation must occur through root system, excavate by hand, cut roots with sharp axe and seal cuts.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Conform to applicable regulatory requirements for disposal of debris in accordance with authorities having jurisdiction.

3 Execution

3.1 CLEARING

.1 Conform to OPSS.MUNI 201.

.2 Clear Place of the Work of debris and vegetation.

.3 Remove trees and shrubs within marked areas.

.4 Cut off trees, shrubs, stumps and other vegetation to within 100 mm of original ground surface.

.5 Perform close-cut clearing so that existing insulative layer of fibrous material is not damaged.

.6 Cut off unsound branches and cut down dangerous trees overhanging area cleared.

.7 Cut off isolated trees designated for removal at a height of 300 mm above ground.

.8 Grub out isolated tree stumps.

.9 Grub out stumps and roots to not less than 300 mm below original grade.

.10 Grub out visible rock fragments and boulders greater than 200 mm in greatest dimension, but less than 0.25 m^3 in volume.

3.2 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials from Place of the Work.

.2 Useable timber and rocks become property of Contractor.

.3 Leave ground surface in condition suitable for immediate earthwork operations, as specified in Sections 31 22 13 and 31 23 16.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 31 11 00 - Clearing and Grubbing.

.2 Section 31 22 13 - Rough Grading.

.3 Section 31 23 16 - Excavation.

.4 Section 31 23 33 - Trenching and Backfilling.

1.2 EXISTING CONDITIONS

.1 Protect rock outcropping, trees, shrubs, lawns, and other features remaining as part of completed Project.

.2 Protect bench marks, existing structures, fences, roads, sidewalks, paving, and curbs.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Conduct chemical analyses of top soil and subsoil being exported from Place of the Work to determine disposal site requirements, as required by authorities having jurisdiction.

3 Execution

3.1 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 Identify known below grade utility services. Stake and flag locations.

.3 Notify utility company to remove and relocate affected utility services.

3.2 TOPSOIL STRIPPING

.1 Strip topsoil from designated locations.

.2 Stockpile topsoil in area designated at Place of the Work, to depth not exceeding 2 500 mm.

.3 Do not bury excess topsoil.

.4 Remove excess topsoil from Place of the Work and dispose of in accordance with authority having jurisdiction.

3.3 SUBSOIL STRIPPING

.1 Strip subsoil from areas to be re-landscaped or regraded.

.2 Stockpile subsoil in area designated at Place of the Work, to depth not exceeding 2 500 mm.

.3 Remove excess subsoil from Place of the Work and dispose of in accordance with authority having jurisdiction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 31 14 00 - Earth Stripping and Stockpiling.

.2 Section 31 23 16 - Excavation.

.3 Section 31 23 23 - Fill.

.4 Section 31 23 33 - Trenching and Backfilling.

.5 Section 32 11 23 - Aggregate Base Courses.

.6 Section 32 92 23 - Sodding and Topsoil.

1.2 REFERENCES

.1 ASTM D6461/D6461M-18: Standard Specification for Silt Fence Materials.

.2 OPSS.MUNI 206 (April 2019): Construction Specifications for Grading.

.3 OPSS.MUNI 805 (Nov. 2021): Construction Specification for Temporary Erosion and Sediment Control Measures.

1.3 EXISTING CONDITIONS

.1 Protect rock outcropping, trees, shrubs, lawns, and other features remaining as portion of final landscaping.

.2 Protect bench marks, existing structures, fences, roads, sidewalks, paving, and curbs.

2 Products

2.1 MATERIALS

.1 Subsoil: Native stripped and excavated soil or similar imported soil; graded free of lumps larger than 150 mm OD, rocks larger than 75 mm OD, and debris.

.2 Erosion Control Blanket: To OPSS.MUNI 805.

.3 Silt and Sediment Fence: To ASTM D6461/D6461M; 915 mm high, woven polypropylene fibre geotextile fabric secured to support posts; having 67 percent filter efficiency; eg. Terrafence by Terrafix Geosynthetics Inc.

3 Execution

3.1 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 Provide temporary erosion and sediment control measures to OPSS.MUNI 805.

.3 Provide silt and sediment fencing as indicated on Drawings. Space support posts at 2 440 mm OC.

3.2 ROUGH GRADING

.1 Conform to OPSS.MUNI 206.

.2 Cut and fill to levels required.

.3 Establish and maintain line and grade stakes for duration of grading operations.

.4 Conform to grades indicated on Drawings.

.5 Unless otherwise noted, uniformly slope grades between elevations indicated.

.6 Do not exceed slopes of 4:1 unless indicated otherwise on Drawings.

.7 Contour lines indicated on Drawings are approximate only and may require minor adjustments at Place of the Work.

.8 Smoothly contour tops and toes of slopes and banks.

.9 Establish contours parallel to finished grades.

.10 Shape contours to ensure adequate drainage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 31 22 13 - Rough Grading.

.2 Section 31 23 23 - Fill.

.3 Section 31 23 33 - Trenching and Backfilling.

1.2 DEFINITIONS

.1 Rock: Defined as a solid rock formation, wherever found, that can be removed only by drilling and blasting; is more than one cubic metre in volume; and does not include glacial till, hardpan or layered rock in its original location that, in Consultant's opinion, can be ripped by a single rear-mounted tooth on D-8 crawler type tractor or similar equipment.

1.3 REFERENCES

.1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Geotechnical Investigation Report: As described in Section 00 31 00.

1.4 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit field quality control reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Soil bearing capacity test reports, indicating specified and actual results for compaction, moisture content, suitability, and other required standards for sub-surface material.

1.5 EXISTING CONDITIONS

.1 Protect trees, shrubs and lawns remaining as portion of final landscaping.

.2 Protect above and below grade utilities which are to remain.

.3 For excavation purposes, determine classification of existing soils as defined by Occupational Health and Safety Regulations for Construction Projects.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Conduct chemical analyses of subsoil being exported from Place of the Work to determine disposal site requirements, as required by authorities having jurisdiction.

3 Execution

3.1 PREPARATION

.1 Identify required lines, levels, contours, and datum.

3.2 EXCAVATION

.1 Excavate to lines, grades, elevations, and dimensions indicated on Drawings, or in absence of such information, in accordance with recommendations of geotechnical investigation report.

.2 Remove concrete, masonry, paving, walks, demolished foundations, lumped subsoil, boulders, rubble, and other obstructions encountered during excavation.

.3 In the event Rock is encountered within limits of excavation, notify Consultant and await instructions before proceeding with its removal.

.4 Existing field drains from previous farming operations may be encountered during excavation. Notify Consultant if drains are encountered.

.5 Machine slope banks to angle of repose or less until shored. Refer to geotechnical investigation report for recommended slope of excavations.

.6 Excavation cut not to interfere with normal 45 degree bearing splay of foundation.

.7 Stockpile excavated material in area designated at Place of the Work. Remove and dispose of surplus and unsuitable excavated material in accordance with O. Reg. 406/19.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Hand trim, make firm, and remove loose material and debris from excavations.

.10 Ensure bottoms of excavations are undisturbed soil, level, free from loose, soft, or organic matter.

.11 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with lean concrete as specified in Section 31 23 23.

.12 Grade top perimeter of excavation to prevent surface water from draining into excavation.

.13 Correct areas over excavated by error. Refer to Section 31 23 23.

3.3 TRENCHING

.1 Perform trenching as specified in Section 31 23 33.

.2 Do not excavate more than 30 metres of trench in advance of installation operations.

.3 Do not leave open more than 15 metres of trench at end of each Working Day.

.4 Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.

3.4 ABANDONED EXISTING ITEMS

.1 Cut off and cap abandoned piping.

.2 Cut off and seal ends of tree roots encountered during excavation.

.3 Fill in old drains, wells, and cisterns encountered and not affecting the bearing of any footing. Use only clean earth from excavation, well tamped, and consolidated.

3.5 UNDERPINNING

.1 Excavation for underpinning or any other excavation likely to undermine existing footings is to be carried out with caution.

.2 Install adequate shoring prior to such excavation.

.3 Use tapes or similar devices to monitor any movement in existing walls.

.4 Excavate in sections not exceeding 1 830 mm in length.

.5 Do not use heavy equipment for underpinning.

3.6 PUMPING AND DE-WATERING

.1 Refer to Section 01 50 00 and geotechnical investigation report.

.2 Keep excavations free from accumulation of water.

.3 Conduct de-watering when required so as to avoid damage to the Work and adjacent property. Prevent weakening of bearing soil and stability of embankments and slopes.

3.7 UNSUITABLE SOILS

.1 Excavate to design elevations.

.2 Arrange for independent inspection and testing company to be present at Place of the Work full-time, documenting excavation operations, and confirming excavation is at design depth.

.3 Where unacceptable bearing or other subsurface conditions are encountered, do not excavate beyond design elevations, or extent of Contract, or to depths of existing fill, as determined by geotechnical investigation report.

.4 Additional excavation may proceed only as follows:
- .1 Notify both independent testing and inspection company and Consultant when soil at bottom of excavation at design elevation appears unsuitable.
- .2 Arrange for independent inspection and testing company to be present at Place of the Work full-time, documenting presence of unacceptable subsurface conditions, and confirming excavation is at design elevation.
- .3 Testing and inspection company to oversee any and all required additional excavations.
- .4 Removal of additional material to be reviewed and quantified by testing and inspection company designated by Owner.
- .5 Testing and inspection company to outline extent of required additional excavation, and confirm and document all new elevations and quantities of removed and replaced materials. Testing and inspection company to ensure any additional excavation is minimized. When an acceptable founding elevation has been achieved, the revised founding elevation is to be confirmed and documented by testing and inspection company. Remove unsuitable material from bottom of excavation to extent and depth as directed by testing and inspection company.
- .6 Testing and inspection company to verify additional quantities submitted by Contractor.
- .7 Where required due to unauthorized over-excavation, fill under bearing surface and footings with coarse aggregate fill, compacted to 100 percent Standard Proctor maximum dry density. Conform to recommendations of geotechnical investigation report.
- .8 Testing and inspection company to document all site information necessary for verification of additional costs submitted Contractor. Claims submitted for additional subsurface work must include verification documentation from testing and inspection company. If supported, a claim shall follow processes outlined in GC 6.1 - Owner's Right to Make Changes.

.5 Claims submitted by Contractor that have not followed the above requirements will not be considered by Owner.

3.8 HAULING AND DISPOSING OF EXCAVATED SOILS FROM PLACE OF THE WORK

.1 Be fully and solely responsible for hauling and disposing of excavated soils from Place of the Work, including but not limited to:
- .1 Conduct additional sampling and testing needed to verify environmental quality of soil designated to be removed from Place of the Work. Confirm applicable handling and disposal options.

.2 Disclose available analytical results and environmental site assessment reports to disposal site authority. Submit confirmation disposal site authority agrees to receive designated soils.
.3 Satisfy requirements of disposal site authority, including additional testing they may request.
.4 Select a disposal site having site condition standards that are compatible with environmental quality of soil originating from Place of the Work.
.5 Supply equipment suitable for handling and transporting excavated soils, including licensed haulage companies.
.6 Prepare and submit manifests and documents necessary for hauling and disposing of excavated soils.
.7 Comply with applicable regulatory requirements of authorities having jurisdiction, and with requirements of disposal site authority.

3.9 FIELD QUALITY CONTROL

.1 Notify Consultant when bottom of excavation is reached. Obtain Consultant review of completed excavation.

.2 Conduct field inspection and testing as specified in Section 01 40 00.
.1 Confirm suitable subsurface conditions when acceptable founding elevations are achieved.
.2 Document site information necessary for verification of additional costs resulting from additional work required by unsuitable conditions.
.3 Inspect, analyse, and confirm soil bearing capacities.

3.10 PROTECTION

.1 Refer to Section 01 70 00.

.2 Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

.3 Protect bottom of excavations and soil adjacent to and beneath foundation from frost, freezing, softening and other disturbances.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 07 13 26 - Self-Adhering Sheet Waterproofing.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 31 23 16 - Excavation.

.5 Section 31 23 33 - Trenching and Backfilling.

.6 Section 32 11 23 - Aggregate Base Courses.

.7 Section 33 46 00 - Subdrain.

1.2 REFERENCES

.1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 OPSS.MUNI 501 (Nov. 2017): Construction Specification for Compacting.

.3 OPSS.MUNI 1010 (Apr. 2025): Material Specification for Aggregates - Base, Subbase, Select Subgrade, Granular Surface, Shouldering, Bedding and Backfill Material.

.4 OPSS.MUNI 1860 (Nov. 2018): Material Specification for Geotextiles.

.5 Geotechnical Investigation Report: As described in Section 00 31 00.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 40 00.

.2 Verification Samples: A 4.5 kg sample of each type of fill material, delivered to testing laboratory in air-tight containers.

1.4 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control reports as specified in Section 01 40 00.

.2 Source Quality Control Reports: Include moisture content, suitability, and other required standards for fill materials.

1.5 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit field quality control reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Include specified and actual results for compaction, moisture content, and other required standards for fill.

2 Products

2.1 MATERIALS

.1 Fine Granular Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.

.2 Coarse Granular Fill: To OPSS.MUNI 1010, Granular Class B, Type II; moisture content within plus or minus two percent of requirements in ASTM D698.

.3 Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter.

.4 Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded as follows:
.1 Minimum Size: 6 mm.
.2 Maximum Size: 16 mm.

.5 Clear Crushed Stone Fill: Pit run, washed natural stone; free of shale, clay, friable material, sand, debris; graded as follows:
.1 Minimum Size: 16 mm.
.2 Maximum Size: 19 mm.

.6 Structural Fill: Clean granular compactable material, approved for use by geotechnical engineer.

.7 Subsoil: Re-used or imported subsoil, free of debris and gravel larger than 75 mm OD.

.8 Concrete: Lean concrete, with minimum compressive strength of 7 MPa at 28 days.

2.2 ACCESSORIES

.1 Geotextile Fabric: To OPSS.MUNI 1860, non-woven type.

.2 Below-Grade Thermal Insulation: As specified in Section 07 21 00, as follows:
.1 Vertical Applications: Extruded polystyrene rigid board insulation, Type INS-RB-1.
.2 Horizontal Applications: Extruded polystyrene rigid board insulation, Type INS-RB-2.

2.3 SOURCE QUALITY CONTROL

.1 Inspect and test proposed backfill materials as specified in Section 01 40 00.

.2 Conduct tests on submitted verification samples described above.

.3 Do not proceed with backfill operations until verification samples have been accepted.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify foundation perimeter drainage installation has been inspected.

3.2 PREPARATION

.1 Generally, compact subgrade to density requirements for subsequent backfill materials.

.2 Cut out soft areas of subgrade not capable of insitu compaction and compact.

.3 Install below-grade insulation in locations indicated on Drawings, and as specified in Section 07 21 00.

.4 Proof roll subgrade prior to placement of backfill in presence of Owner's geotechnical engineer.

.5 Correct soft areas and obtain geotechnical engineer's acceptance of existing conditions prior to placing backfill.

3.3 BACKFILL

.1 Backfill to contours and elevations as indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.

.2 Do not use frozen material.

.3 Systematically backfill to allow maximum time for natural settlement.

.4 Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

.5 Place geotextile fabric where indicated on Drawings prior to placing next lift of fill.

.6 Granular Fill: Place and compact granular fill materials in continuous layers not exceeding 150 mm compacted depth.

.7 Native Soil Fill: Place and compact native soiul fill materials in continuous layers not exceeding 200 mm compacted depth.

.8 Employ placement method that does not disturb or damage adjacent construction.

.9 Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

.10 Slope grade away from building minimum 150 mm in 3 000 mm, unless noted otherwise.

.11 Make grade changes gradual. Blend slope into level areas.

3.4 ENGINEERED STRUCTURAL FILL

.1 Provide engineered structural fill to raise founding elevations below building footings, foundations, and slabs-on fill to levels indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.

.2 Place and compact materials in continuous layers not exceeding 250 mm loose lift thickness.

.3 Unless indicated otherwise on Drawings, extend area of engineered fill horizontally 1 000 mm beyond outside edge of exterior footings and extend downward at 1:1 slope to sound bedrock or stiff, compact native soil surface.

3.5 COMPACTING

.1 Compact fill to OPSS.MUNI 501, and as described in geotechnical investigation report.

.2 Do not use heavy equipment within 1 830 mm of basement walls. Compact with hand controlled equipment in such areas.

3.6 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Conduct tests and analysis of fill materials to ASTM D698.

.3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products, and retest at no cost to Owner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 31 23 16 - Excavation.

.2 Section 31 23 23 - Fill.

.3 Section 32 11 23 - Aggregate Base Courses.

.4 Section 33 46 00 - Subdrain.

1.2 REFERENCES

.1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 OPSS.MUNI 401 (Nov. 2024): Construction Specification for Trenching, Backfilling and Compacting.

.3 OPSS.MUNI 1001 (Nov. 2021): Material Specification for Aggregates - General.

.4 OPSS.MUNI 1010 (Apr. 2025): Material Specification for Aggregates - Base, Subbase, Select Subgrade, Granular Surface, Shouldering, Bedding and Backfill Material.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating shoring, bracing, and underpinning, complete with design calculations and supporting data.

.3 Prepare Shop Drawings under direct supervision of a professional engineer licenced to practice at Place of the Work.

.4 Shop Drawings must be stamped, signed, and dated by Submittal engineer.

1.4 EXISTING CONDITIONS

.1 Size, depth, and location of existing utilities and structures indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Temporary Shoring, Bracing, and Underpinning: As specified in Section 01 50 00 and in accordance with applicable regulatory requirements. Protect existing features.

.3 Existing Soil: For excavation purposes, verify classification of existing soils as defined by Occupational Health and Safety Regulations for Construction Projects.

2 Products

2.1 MATERIALS

.1 Fine Granular Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.

.2 Sand: To OPSS.MUNI 1001, natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

.3 Select Subsoil: Re-used and imported subsoil; free of debris, gravel larger than 75 mm OD, and having moisture content less than optimum.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify foundation perimeter drainage installation has been inspected.

.3 Confirm locations of buried utilities by careful test excavations.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 When necessary, compact subgrade surfaces to density requirements for backfill material.

.3 Maintain and protect existing underground utilities and structures encountered. Obtain direction of Consultant before moving or otherwise disturbing existing utilities or structures.

.4 Conduct condition survey of existing buildings, trees, plants, lawns, fencing, service poles, wires, paving, survey bench marks, and monuments which may be affected by Work.

3.3 EXCAVATION

.1 Conform to OPSS.MUNI 401.

.2 Excavate subsoil required for underground site services to lines, grades, elevations, and dimensions indicated on Drawings. In the absence of such information, conform to recommendations of geotechnical investigation report.

.3 Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

.4 Remove lumped subsoil, boulders and rock up to 0.25 m^3, measured by volume. Remove larger material as specified in Section 31 23 16.

.5 Excavation shall not interfere with normal 45 degree bearing splay of foundations.

.6 Fill over-excavated areas under pipe bearing surfaces as directed by Consultant.

.7 Stockpile excavated material in area designated at Place of the Work.

.8 Remove excess and unsuitable materials from Place of the Work.

3.4 BEDDING AND BACKFILLING

.1 Conform to OPSS.MUNI 401.

.2 Provide bedding materials as indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.

.3 Support pipe and conduit during placement and compaction of bedding fill.

.4 Backfill trenches to final contours and elevations.

.5 Place and compact granular and other select fill materials in continuous layers not exceeding 150 mm loose depth.

.6 Place and compact subsoil and other common fill material in continuous layers not exceeding 200 mm loose depth.

.7 Maintain optimum moisture content of backfill materials to attain required compaction density.

.8 Remove surplus backfill materials from Place of the Work.

3.5 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Conduct tests and analysis of fill material to ASTM D698.

.3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products, and retest at no cost to Owner.

3.6 RESTORATION

.1 Upon completion, remove surplus materials and debris, trim slopes, and correct defects noted by Consultant.

.2 Replace topsoil as indicated on Drawings.

.3 Reinstate existing pavement and lawns designated to remain to condition and elevation which existed before excavation.

.4 Clean and reinstate affected areas.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 31 23 16 - Excavation.

.3 Section 31 23 23 - Fill.

.4 Section 31 23 33 - Trenching and Backfilling.

.5 Section 32 12 16 - Asphalt Paving.

.6 Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

.1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 OPSS.MUNI 501 (Nov. 2017): Construction Specification for Compacting.

.3 OPSS.MUNI 1004 (Nov. 2021): Material Specification for Aggregates - Miscellaneous.

.4 OPSS.MUNI 1010 (Apr. 2025): Material Specification for Aggregates - Base, Subbase, Select Subgrade, Granular Surface, Shouldering, Bedding and Backfill Material.

.5 Geotechnical Investigation Report: As described in Section 00 31 00.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 40 00.

.2 Verification Samples: A 4.5 kg sample of each type of fill, delivered to testing laboratory in air-tight containers.

1.4 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control reports as specified in Section 01 40 00.

.2 Source Quality Control Reports: Include moisture content, suitability, and other required standards for aggregates.

1.5 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit field quality control reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Include specified and actual results for compaction, moisture content, and other required standards for aggregate base courses.

2 Products

2.1 MATERIALS

.1 Fine Aggregate Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.

.2 Fine Crushed Stone Fill: To OPSS.MUNI 1004, Open Graded 19.0 mm Crushed Rock.

.3 Coarse Aggregate Fill: To OPSS.MUNI 1010, Granular Class B, Type II; moisture content within plus or minus two percent of requirements in ASTM D698.

.4 Coarse Crushed Stone Fill: Pit run, washed natural limestone; free of shale, clay, friable material, sand, and debris; graded as follows:
.1 Minimum Size: 38 mm.
.2 Maximum Size: 50 mm.

3 Execution

3.1 PREPARATION

.1 Prepare subgrade as described in geotechnical investigation report.

.2 Cut out soft areas of subgrade not capable of insitu compaction and compact.

.3 Proof roll subgrade prior to placement of backfill in presence of Owner's geotechnical engineer.

.4 Correct soft areas and obtain geotechnical engineer's acceptance of existing conditions prior to placing aggregate base courses.

3.2 PLACEMENT

.1 Provide aggregate sub-base and base courses to compacted thicknesses and in locations as indicated on Drawings, including below:
.1 Concrete slabs-on-fill.
.2 Asphalt paving.
.3 Concrete paving, sidewalks, curbs, and gutters.

.2 Where sub-base and base course thicknesses are not identified on Drawings, conform to recommendations of geotechnical investigation report.

.3 Backfill areas to contours and elevations with unfrozen materials.

.4 Systematically backfill to allow maximum time for natural settlement.

.5 Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

.6 Place and compact materials in continuous layers not exceeding 150 mm compacted depth.

.7 Employ placement method that does not disturb or damage adjacent Work.

.8 Make grade changes gradual. Blend slope into level areas.

.9 Compact aggregate sub-base and base courses to OPSS.MUNI 501; at compaction rates recommended by geotechnical investigation report.

3.3 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Conduct tests and analysis of fill material to ASTM D698.

.3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products, and retest at no cost to Owner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 11 23 - Aggregate Base Courses.

.2 Section 32 13 13 - Concrete Paving.

.3 Section 32 17 23 - Pavement Markings.

1.2 REFERENCES

.1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 OPSS.MUNI 310 (Nov. 2017): Construction Specification for Hot Mix Asphalt.

.3 OPSS.MUNI 341 (Nov. 2021): Construction Specification for Routing and Sealing Cracks in Hot Mix Asphalt Pavement.

.4 OPSS.MUNI 1003 (Nov. 2013): Material Specification for Aggregates - Hot Mix Asphalt.

.5 OPSS.MUNI 1101 (Nov. 2016): Material Specification for Performance Graded Asphalt Cement.

.6 OPSS.MUNI 1103 (Nov. 2025): Material Specification for Emulsified Asphalt.

.7 OPSS.MUNI 1150 (Nov. 2020): Material Specification for Hot Mix Asphalt.

.8 OPSS.MUNI 1212 (Nov. 2022): Material Specification for Hot Poured Rubberized Asphalt Joint Sealing Compound.

.9 Geotechnical Investigation Report: As described in Section 00 31 00.

1.3 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control reports as specified in Section 01 40 00.

.2 Source Quality Control Reports: Two weeks prior to asphalt placement commencing, submit mix design data for each type of specified asphaltic concrete, in accordance with OPSS.MUNI 310.

1.4 FIELD QUALITY CONTROL SUBMITTALS

.1 Submit field quality control reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Include specified and actual results for compaction, suitability, and other required standards for asphaltic material.

1.5 AMBIENT CONDITIONS

.1 Conform to OPSS.MUNI 310.

.2 Do not install Products during rainy or inclement weather.

2 Products

2.1 MATERIALS

.1 Asphalt Cement: To OPSS.MUNI 1101.

.2 Aggregate for Asphaltic Concrete Mix: To OPSS.MUNI 1003; graded as follows:
.1 Binder Course Mix: 100 percent passing a 26.5 mm sieve.
.2 Surface Course Mix: 100 percent passing a 16 mm sieve.

.3 Primer, Tack, and Sealer Coats: To OPSS.MUNI 1103; SS-1 asphaltic emulsion.

.4 Patching Compound: Asphalt-based mix, maximum 10 mm OD aggregate size, Elsro Road Repair #1170 by W. R. Meadows of Canada Ltd.

.5 Crack Sealant: To OPSS.MUNI 1212; hot poured rubberized asphalt sealant.

2.2 MIXES

.1 Asphaltic Concrete Mixes: To OPSS.MUNI 1150; ready-mixed, hot laid asphaltic concrete, as follows:
.1 Binder Course: Type HL 8.
.2 Surface Course: Type HL 3.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify aggregate base course is compacted, dry, and ready to support paving and imposed loads.

.3 Verify aggregate base course gradients and elevations are correct.

3.2 PREPARATION

.1 Shape finished subgrade parallel to proposed finished grades.

.2 Proof roll aggregate base course, and compact to 100 percent Standard Proctor maximum dry density.

.3 Where existing asphalt pavements are designated to be removed, replaced, or extended, saw cut existing edges to form a neat joint between existing and new construction. Remove and dispose of abandoned materials in accordance with authorities having jurisdiction.

3.3 PLACEMENT

.1 Lay asphalt paving to OPSS.MUNI 310, rolled to firm compaction.

.2 Apply asphalt courses to compacted thicknesses as indicated on Drawings. In the absence of such information, conform to recommendations of geotechnical investigation report.

.3 Lay mixture on dry aggregate base course, free of standing water.

.4 Spread mixture with mechanical self-propelled power spreader capable of spreading mixture to a line and grade.

.5 Before roller compaction is started, check surface for inequalities and flat spots, and adjust.

.6 Unless surface course is placed on same day as binder course, apply tack coat to binder course before proceeding with surface course application.

.7 Finished Surface: Smooth and true to established crown, free from depressions.

.8 Make Good designated areas of damaged asphalt pavement using patching compound.

.9 Route and seal cracks in asphalt pavement to OPSS.MUNI 341.

3.4 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Obtain samples of asphalt during placement, and submit to independent inspection and testing agency for laboratory tests intended to verify conformance to OPSS.MUNI 310 job mix formula tolerances.

.3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products, and retest at no cost to Owner.

3.5 ADJUSTING

.1 Repair low or defective areas by cutting out affected course and replace it with fresh, hot mixture. Immediately compact to conform to surrounding area.

.2 Ensure 100 percent bond to existing adjacent paving.

END OF SECTION

PART I - GENERAL

1.1. DESCRIPTION

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the inspection and construction of concrete paving, concrete seat and curbing as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with the requirements of the Tender Document and General Conditions.

1.2. QUALITY ASSURANCE

.1 The contractor must have a minimum of 5 years experience in concrete work.

.2 All materials must conform to CSA A23.1-94. A copy must be kept on site at all times during construction.

.3 Furnish the Landscape Architect with a certificate prepared by the Ready-Mix concrete suppliers stating that all requirements regarding strength, slump, air entrainment, mix, materials and ratio have been met and maintained.

.4 Prior to pouring concrete, obtain the approval of the Landscape Architect of all form work, placement of reinforcing steel, consolidation of subgrade and placement and consolidated of granular base.

.5 When required by the Landscape Architect, have all concrete tested for compressive strength, slump and air content, in accordance with CSA A23.2-94. Submit test reports in duplicate and pay all costs incurred.

.6 Ensure work complies with the Ontario Building Code and all pertinent local by-laws and regulations. These shall govern in case of conflict with the specification. Obtain and pay for all necessary permits before starting work.

1.3. PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store all materials in accordance with CSA A23.1-94 latest edition.

.2 Store reinforcing steel on racks or skids. Protect from contamination by dirt or other materials.

.3 Store forms off the ground and sufficiently supported to prevent warping or distortion. Protect from contaminations by oil, grease, water, earth, etc.

.4 All concrete is to be ready mixed at plant and transported to the site by truck in accordance with CSA A23.1-94. Hand mixed concrete is not allowed unless approved in writing by the Landscape Architect prior to the start of work.

.5 Convey concrete from the mixer to the place of final deposit as rapidly as possible, with as little rehandling as is practical. Avoid segregation and/or loss of material.

.6 Place concrete in final position and at such a rate that it remains plastic at all times and flows readily between reinforcement, into all corners and crevices and around all embedded fixtures. Pour in a continuous operation between expansion joints.

.7 Thoroughly clean all equipment, used for mixing or transporting of concrete, of all hardened concrete and foreign material prior to placing concrete.

.8 Do not allow concrete to be contaminated by foreign materials. Do not use retempered concrete unless approved in writing, by the Landscape Architect.

.9 Obtain the approval of the Landscape Architect of the type, number and method of use of mechanical vibrators. Do not operate a vibrator for longer than 10 seconds in any one location.

.10 Maintain constant control to ensure that finished concrete is dense, uniform, free of air holes or honeycombs and that no segregation of aggregates and cement paste occurs.

1.4. JOB CONDITIONS

.1 Protect all concrete surfaces from damage or harmful effects of weather, water, mechanical shock or trespassers until concrete is properly cured.

.2 If temperature is expected to drop below 5°C, place and protect concrete in accordance with AC1.605.

1.5. INSPECTION

.1 Obtain the approval of the Landscape Architect of the layout, compacted sub-grade, compacted granular base, formwork and reinforcing before proceeding with subsequent work.

1.6 WARRANTIES

.1 Each warranty must show:

a) Name and address of project
b) Name of owner
c) Section Number and Title

.2 All work shall be warrantied for 1 year from date of Final Completion.

PART II – PRODUCTS

2.1. MATERIALS

.1 Granular A and Granular B: granular material conforming in all respects to OPSS 1010, latest edition.

.2 Portland cement: standard grey portland cement, conforming to CAN/CSA-A5/A8/A362-93 type 10 normal.

.3 Aggregates: nominal size as specified and conforming to CSA A23.1-94.

.4 Water: clear and free of deleterious substances or efflorescing salts.

.5 Air entraining admixtures: conforming to ASTM C 260-94 and of approved manufacturer.

.6 Reinforcing steel: conforming to CSA G-30.12-M77 for bars, CSA G30.5-M83 for welded steel wire mesh and OPSS 1440.

.7 Expansion joint filler: premoulded bituminous impregnated fibre board conforming to ASTM D1751-73 of thickness and depth specified.

.8 Curing Compounds: clear liquid chlorinated rubber to ASTM C309 and OPSS 1315.

.9 Formwork: conforming to CSA A23.1-94 and AC1- 347 and of sound wood, in good condition and equal or better than No. 2 grade construction spruce and/or 19mm Douglas Fir plywood, with the surface treated to produce a smooth concrete finish. Plywood to be CSA 0/2/.

2.2. MIXES

.1 Mix concrete materials in accordance with CSA CAN3-A23.1M-77, in the proper proportions and ratios to provide a finished product as specified. Concrete mix shall meet the following requirements: Compressive strength 32 MPa at 28 days; 100mm slump at point of deposit; air entrainment 5 to 8%. Unless noted otherwise on the drawings or details, all concrete is to be 32 MPa strength.

.2 With the exception of air entraining agents, other mixtures may only be used with the written approval of the Landscape Architect. The use of agents to lower the freezing point of the mix will not be permitted.

PART III – EXECUTION

3.1 PREPARATION

.1 Excavate to the minimum specified depths, after compaction, as shown on the drawings. Maintain sub-grade parallel to finished grade in all cases.

.2 Fine grade subgrade eliminating uneven areas and filling low spots. Remove all debris. Excavate all soft and unstable areas in subgrade and backfill with Granular “B”.

.3 Compact subgrade uniformly to minimum ninety-eight percent (98%) Standard Proctor Density. Arrange for testing of fill materials and compaction. When required and as directed by the Landscape Architect, the Contractor shall, at his own expense, sprinkle water to assist in compaction.

.4 The Granular “B” base shall be applied in maximum 74mm (3 inches) layers, graded, rolled and compacted in accordance with OPSS Division 3.

.5 In the event of delay between completion of subgrade and commencement of application of stone base, the Contractor shall re-grade and re-compact subgrade at his own expense if so ordered.

.6 Keep materials clean and free of deleterious materials at all times.

.7 Maintain final grade of granular base course parallel to finished grade.

.8 Submit written test reports.

.9 Contractor to ensure that all concrete columns are vibrated to eliminated all voids.

3.2. GRANULAR BASE

.1 Spread the specified granular materials in horizontal layers not exceeding 100mm loose depth and compact to 95% Standard Proctor Dry Density. In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.

.2 Build up thickness of each material to the minimum compacted thickness as specified on the

drawings.

.3 Ensure that granular does not become contaminated by deleterious material.

.4 Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform and true to line and grade.

.5 When required by the Landscape Architect, have the compaction of the granular materials tested by an approved, independent testing firm. Submit 2 copies of the test results to the Landscape Architect and obtain his approval prior to pouring concrete. Pay testing costs incurred.

3.3. FORM WORK

.1 Erect forms in such a manner as to facilitate dismantling and removal without damaging concrete.

.2 Erect forms true to line and level in accordance with the drawings, and sufficiently braced to maintain their form and alignment when concrete is placed.

.3 Prior to each pouring operation, coat affected form surfaces with an approved form separating material.

.4 Provide for all openings, sleeves, hangers, anchors and ties to be cast into the concrete.

.5 Do not use treated plywood for exposed surfaces more than 5 times. Do not use plywood if surface is damaged.

.6 Obtain the approval of the Landscape Architect of all form work before proceeding

3.4. REINFORCEMENT

.1 Before placing reinforcement, clean all loose scale, dirt and any other coating that would destroy or reduce bonding to concrete.

.2 Place all reinforcement accurately in accordance with the drawings and/or approved shop drawings. Use approved chairs, spacers, hangers or ties to secure the reinforcing in position.

.3 Unless directed otherwise, provide the following minimum concrete cover over reinforcing:

a) 75mm where concrete is deposited against soil.

b) 50mm for bars larger than 10m and 40mm for bars smaller than 10m where concrete is exposed to weather.

.4 Obtain the approval of the Landscape Architect of all reinforcing before proceeding.

3.5. JOINTS

.1 Locate expansion joints as shown on the drawings or at max. intervals of 6.0m, between new concrete and all new or existing rigid structures, and either side of all driveway sections. Joints must be cast in place.

.2 Execute construction joints in accordance with AC1-301 and as detailed on the drawings. Thoroughly clean the joint surface of all laitance and wet thoroughly and slush with a coat of cement grout immediately before placing new concrete.

.3 Except for expansion joints, continue reinforcing uninterrupted through joints, unless shown otherwise on the drawings or directed by the Landscape Architect.

.4 Stop reinforcing on each side of expansion joints. Where dowels are indicated, cast one half into one side of the joints. The exposed half shall be machined smooth and heavily greased before placing adjoining sections.

.5 Locate control joints as shown on the drawings or at a max. spacing of 2.0m. Ensure joints are to a minimum depth of 1/4 the thickness of the concrete. Make joints by one of the following methods:

a) Sawed joints

b) Hand formed and hand tooled

c) Inset joints placed in plastic concrete

.6 No offsets will be allowed between adjacent sections of joint fillers and no plugs of concrete will be permitted anywhere within an expansion joint.

.7 Apply joint sealant in accordance with the manufacturer's directions. Ensure joints are clean and free of any foreign substances before sealing. Clean any sealant spilled on concrete surface immediately.

3.6. PLACING OF CONCRETE

.1 Place concrete by approved means and using approved equipment.

.2 Do not place concrete until formwork and grades have been inspected by the Owner or Landscape Architect.

.3 Transport concrete from mixer to point of deposit, and place in final position as quickly as possible to prevent separation and loss of materials.

.4 While placing concrete, compact thoroughly and uniformly by approved means to ensure a dense homogeneous structure free of air pockets, and honeycombs and closely bonded with reinforcement.

3.7. FINISHING

.1 Treat and finish all surfaces as directed or specified and in accordance with CSA CAN3-A23-1-M77.

.2 Strike off and float all exposed paving surfaces as soon as possible after consolidation and in accordance with recommendations of the Portland Cement Association. Execute final finishing as specified on the drawings or as directed by the Landscape Architect.

.3 Ensure finished surface is true to line and level as shown on the drawings. Walks are to be sloped as per grading plans.

.4 All irregularities greater than 6mm under a 3000mm straight edge, operated parallel to the centre line, must be repaired.

.5 Obtain the approval of the Landscape Architect of finished surfaces before starting curing operations.

.6 Immediately after stripping formwork, obtain the approval of the Landscape Architect before commencing patching, finishing or curing operations.

.7 The extent, method and type of mix for patching shall have the approval of the Landscape Architect before commencing work. Ensure patching mix contains an approved bonding and waterproofing agent and that it is installed in accordance with the manufacturer's specifications.

3.8. CURING

.1 Keep concrete moist for at least 3 days after placement, in accordance with CSA CAN-A231-M77.

.2 Method of curing shall be as specified or by one of the following approved methods if not specified:

a) Moist curing

b) Waterproofing paper or white polyethylene sheeting

c) White liquid membrane compound

d) Combination of above methods

.3 Moist curing: use burlap or approved equal. Ensure it is thoroughly wet when applied and kept continuously wet and in full contact with the surface during the curing period.

.4 Waterproof paper or white polyethylene sheeting: ensure sheet is large enough to cover entire concrete surface. Secure to prevent displacement during curing period. Immediately repair any tears or holes.

.5 White liquid membrane compound: apply at the rate of 1 litre per 5 square meters after final finishing and all free water has disappeared. Keep membrane compound agitated to prevent settling of compound. Apply membrane compound to edges immediately after formwork is removed. Ensure a continuous and unbroken membrane cover is applied.

3.9. CLEAN-UP

.1 Clean and remove all concrete spills from the site and make good any disturbance.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 05 50 00 - Metal Fabrications.

.5 Section 10 14 00 - Signage.

.6 Section 31 23 16 - Excavation.

.7 Section 32 11 23 - Aggregate Base Courses.

.8 Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

.1 ASTM A1064/A1064M-22: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 CSA A23.1:19: Concrete Materials and Methods of Concrete Construction.

.3 CSA A23.2:19: Test Methods and Standard Practices for Concrete.

.4 OPSS.MUNI 1350 (Nov. 2023): Material Specification for Concrete - Materials and Production.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 30 00.

.2 Shop Drawings: Project-specific drawings, illustrating foundation pier sizes, concrete reinforcing, embedded anchorages, and special details.

.3 Shop Drawings are to be stamped, signed, and dated by submittal engineer.

1.4 DELEGATED DESIGN SUBMITTALS

.1 Submit concrete mix designs as specified in Section 01 30 00.

.2 Concrete Mix Designs: Submitted no later than two weeks before planned concrete placement, and conforming in content to OPSS.MUNI 1350.

1.5 FIELD QUALITY CONTROL REPORTS

.1 Submit field quality control reports as specified in Section 01 40 00.

.2 Field Quality Control Reports: Include specified and actual results for compressive strength, air entrainment, and other required standards for concrete.

1.6 QUALIFICATIONS

.1 Submittal Engineer: A professional structural engineer licenced to practice at Place of the Work.

2 Products

2.1 MATERIALS

.1 Concrete: To CSA A23.1; as follows:
.1 Compressive Strength ≥ 25 MPa at 28 days.
.2 Water-to-Cement Ratio = 0.45.

.2 Tubular Forms: Spirally wound, adhesive laminated fibre paper tube forms having bursting pressure of 965 KPa, coated with hot wax; diameters as indicated on Drawings; Handiform or Permaform by Perma Tubes Ltd., or Sonotube by Sonoco Limited.

.3 Wood Formwork: As specified in Section 03 10 00.

.4 Release Agent: Mineral type, non-staining, as specified in Section 03 10 00.

.5 Reinforcing Steel: As specified in Section 03 20 00.

.6 Welded Wire Reinforcement: To ASTM A1064/A1064M; flat sheets; 152 x 152 MW 18.7 X MW 18.7 size.

.7 Tie Wire: To ASTM A1064/A1064M; minimum 3 mm OD, annealed type.

.8 Chairs, Bolsters, Bar Supports, and Spacers: Adequate for strength and support of reinforcing construction conditions.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00.

.2 Verify subgrade elevations.

3.2 PREPARATION

.1 Excavate for piers in locations indicated on Drawings.

.2 Remove excavated subsoil from Place of the Work.

3.3 PLACEMENT

.1 Erect formwork as specified in Section 03 10 00.

.2 Install tubular forms in post hole excavations and secure in place at correct elevations. Ensure against displacement during concrete pouring.

.3 Fabricate and install concrete reinforcing within forms as specified in Section 03 20 00.

.4 Set anchor bolts and other items required to be embedded in concrete.

.5 Place concrete to scheduled thickness, and vibrate. Conform to CSA A23.1.

.6 Cure concrete to CSA A23.1, Table 19.

3.4 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Conduct tests and analysis of concrete to CSA A23.2.

.3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products, and re-test at no cost to Owner.

3.5 ADJUSTING

.1 Remove formwork no sooner than 24 hours after pouring.

3.6 PROTECTION

.1 Protect concrete from harmful effects of sunshine, drying winds, and cold running of surface water for 5 days.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 12 16 - Asphalt Paving.

.2 Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

.1 OPSS.MUNI 710 (Nov. 2021): Construction Specification for Pavement Marking.

.2 OPSS.MUNI 1716 (Nov. 2021): Material Specifications for Water-Borne Traffic Paint.

1.3 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Stencils: Submit stencils to Owner upon completion of pavement marking application.

1.4 AMBIENT CONDITIONS

.1 Conform to OPSS.MUNI 710.

.2 Do not install Products during rainy or inclement weather.

.3 Apply pavement markings only when ambient conditions are as follows:
- .1 Air Temperature > 10 degrees C.
- .2 Wind Speed < 60 kph.
- .3 Precipitation: None forecasted for the next 48 hours.

2 Products

2.1 MATERIALS

.1 Traffic Paint: To OPSS.MUNI 1716; ready-mixed, homogeneous, water-borne traffic paint of uniform consistency, Flat gloss level; colours as follows:
- .1 Existing Linework Designated to be Abandoned: Black.
- .2 Crosswalks, Depressed Sidewalks, and Drop Curbs: White.
- .3 Barrier Free Parking Symbol: Yellow border, Blue field, Yellow symbol.
- .4 Electric Vehicle Parking Symbol: White border, Green field, White symbol.
- .5 Play Area Game Lines: White.
- .6 All Other Pavement Markings: Yellow.

2.2 EQUIPMENT

.1 Stencils: Re-usable stencils, 3 mm thick heavy duty plastic; lettering and symbols as indicated on Drawings, by U-Line.

3 Execution

3.1 APPLICATION

.1 Lay out pavement markings as indicated on Drawings.

.2 Apply pavement markings to OPSS.MUNI 710.

.3 Apply traffic paint evenly at rate of 3 L/m^2.

.4 Do not thin paint.

.5 Provide symbols and lines as indicated, using stencils specified above.

.6 Provide lines of uniform colour and density, with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

.8 Paint markings to be within plus or minus 12 mm of dimensions indicated.

.9 Make Good incorrect markings.

.10 Protect pavement markings until dry.

END OF SECTION

PART I – GENERAL

1.1. DESCRIPTION

.1 This section covers the supply and installation of all Engineered Wood Fiber play areas and safety surfacing.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

.3 Provide Engineered wood Fiber Playground Safety Surface material in areas indicated on plans.

.4 Provide surface immediately after installing playground equipment.

PART II – PRODUCTS

2.1. MATERIALS

.1 Drainpipe to be PVC or Big ‘O’ as specified on drawings.

.2 Provide clear stone drainage layer of 19 mm clear crushed stone (OPSS 1004) wrapped in 270R Terrafix filter fabric or otherwise specified in drawings.

.3 Wear-protection mats to be FibarMat or Woodcarpet (minimum size: 36”x36”x1.5” rubber mat) or approved equal.

.4 Engineered Wood Fiber Impact Surface to be Fiber Weave or approved equal.

.5 Material should be recently harvested North American Cedar softwood comprised of virgin “off-the-log” material only and should be:

a. Free of soil, leaves, twigs or other contaminants, which could hasten decomposition.

b. Free of any chemical treatments and/or additives.

c. Free of recycled wood from pallets or construction debris.

d. Free of tramp and heavy metals.

.6 Material should be randomly sized, to promote drainage and achieve the following gradation, sieve analysis, ASTM 136, cumulative passing by weight:

a. 3/4” sieve: 99% - 100%

b. 3/8” sieve: 75% - 100%

c. No.16 sieve: 0% - 15%

2.2. PROPERTIES

.1 Moisture absorption: maximum of 150% by weight.

.2 Moisture content: 25% to 60% by weight.
.3 Impact attenuation: ASTM 1292, Procedure C: 12” thickness rated to 12’.

.4 Accessibility: tested compliant with ASTM F1951.

.5 Product quality: tested compliant with ASTM 2075-10 – Engineered Wood Fiber Standard.

PART III - EXECUTION

3.1. INSTALLATION

.1 Install the drain system, Mats, and the wood fiber material in accordance with manufacturer's instructions and specification drawings.

.2 Avoid contamination of the wood fiber material with sand, gravel, mud, or native soil.

.3 Provide one (1) wear-protection mat (minimum size: 36"x36"x1.5" rubber mat) under each swing, slide exit, and sliding pole as per plan.

3.2. QUALITY CONTROL

.1 Supplier must provide test results for impact attenuation in accordance with ASTM F1292 Standard Specification for Impact Attenuation for Surface Systems Under and Around Playground Equipment. Results must be provided for new material and for 12-year-old material.

.2 Testing must show "g" ratings of not more than 155g for the 200mm thick system, or 120g for the 30mm system at 12' fall heights, and HIC values of less than 1,000 for both new and 12-year-old material.

.3 Supplier must provide test results in accordance with ASTM F1951 (formerly PS83) Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

.4 Supplier must certify that the surface meets the intent of the *Accessibility for Ontarians with Disabilities Act.*

.5 Supplier must provide written manufacturer's 10-year warranty against loss of resiliency, lifetime warranty on FibarFelt fabric and FibarDrain material.

.6 Must be compliant with CAN/CSA-Z614 and ASTM F1292, F1951-09b, F2075-10a.

.7 In Canada supplier must meet CSA guidelines.

END OF SECTION

PART I – GENERAL

1.1. DESCRIPTION

.1 This section specifies the supply and placement of Armour Stone for on site seating and rock features.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. SITE EXAMINATION

.1 The Contractor shall report to the Landscape Architect, in writing, of any conditions or defects encountered on the site during or before construction, upon which may adversely affect its performance.

.2 Do not commence work until such conditions or defects have been investigated and corrected.

1.3. INSPECTION AND CERTIFICATION

.1 Obtain approval of layout work for Armour Stone before proceeding with work.

.2 Have all excavation for work inspected prior to installation of Armour Stone features.

.3 The Landscape Architect shall approve the stake out provided by the Contractor or otherwise designate the extent of all areas requiring the placement of Armour Stone features. The quality of the Armour Stone placement shall be approved by the Landscape Architect.

1.4. DELIVERY AND STORAGE

.1 Delivery and storage of material shall be done in a neat and orderly fashion, all to the satisfaction of the Landscape Architect.

.2 Stockpile existing topsoil or fill materials in locations designated by the Owner or Landscape Architect.

.3 Obtain Armour Stone from approved supplier as stipulated by Landscape Architect.

.4 Filter cloth: Terrafix “Terratract 240R” Filter cloth or approved equal.

1.5. MAINTENANCE AND GUARANTEE

.1 Maintain all Armour Stone work from time of installation until acceptance.

.2 Upon completion of all Armour Stone including related work, the Contractor shall furnish a written guarantee in a form approved by the Consultant that shall extend over a period of one (1) year from the date of substantial completion.

.3 During the guarantee period, the Contractor shall repair, replace or otherwise remedy, to the Landscape Architect’s satisfaction, all defects due to faulty materials and/or workmanship. All work shall be carried out in full accordance with the drawings and specifications. Where there is substantial Armour Stone settlement, the Contract shall bring the settled area back to grade and replace and raise the Armour Stone as stipulated by the Landscape Architect.

PART II – PRODUCTS

2.1. MATERIALS

.1 Armour Stone seating used will be free from deterioration by water action or weathering and will be as per dimensions on the drawings.

.2 Armour Stone is to be obtained from an approved supplier. Sample to be provided. The contractor is to supply any additional rocks of the required size if stockpile on site is insufficient.

PART III – EXECUTION

3.1. INSTALLATION

.1 The Contractor shall excavate topsoil, fine grade and consolidate as required, to provide an even, firm foundation for the granular base and Armour Stone retaining wall and or rock features. Depressions shall be filled with granular and thoroughly compacted to 95 S.P.D.

.2 A ¾" crusher-run limestone granular base shall be placed to the depth specified on the details and compacted to 95 S.P.D. or as per the details.

.3 Stones shall be laid in close contact, and so as to break joints, and so that in the first layer, each stone is supported by the earth surface and not by adjacent stones. Spaces between larger stones is to be filled with topsoil securely rammed in place. The finished work shall present a natural rock edge to the surface @ 8:1 batter slope.

.4 Terrafix filter cloth or approved alternate is to be provided with 150mm of 19mm crusher run throughout the length of the walls greater than 1 lift. Provide 100mm dia. Big "O" Drain in sock throughout backfill to catch basin.

.5 Single lift Armour Stone retaining walls are to be placed directly on filter cloth with filter cloth coming up the back of the stone.

.6 Armour Stone backfill is to be entirely inside the property line.

.7 Overlapped stone to laser cut to match the radius as per plan.

.8 Grind to remove sharp edges.

3.2. PROTECTION

.1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection in regards to erosion.

.2 Carry out Armour Stone retaining wall construction so that each phase of work is not left exposed for an undue period of time. Follow schedule submitted to Landscape Architect.

.3 Landscape Architect may order excavation to be stopped or placing final protective stone layers to be advanced depending on anticipated weather conditions.

3.3. CLEAN-UP

.1 Upon completion, remove all surplus excavated and graded materials from the site, and leave site clean and tidy. Make good all disturbance to approval of Landscape Architect.

END OF SECTION

PART I – GENERAL

1.1. DESCRIPTION

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for inspection and placement of sod over topsoil as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.3. QUALITY ASSURANCE

.1 The contractor must have 5 years experience in sodding work.

1.4. PRODUCT, DELIVERY, STORAGE AND HANDLING

.1 Deliver sod to site within 24 hours of being harvested and lay sod within 48 hours thereafter, depending on suitable weather conditions and in accordance with good horticultural practice.

.2 Small irregular or broken pieces of sod will not be accepted.

.3 Prevent sod from drying out on site.

1.5. SAMPLE

.1 Complete the installation of one sample panel of sod of a minimum 25 m^2 (one side minimum 2.0m) and have inspected and approved by the Contract Administrator prior to proceeding with the balance of sodding operations. All other work shall conform to this approved sample.

1.6. SOIL TESTING

.1 If required by the Contract Administrator, the soil shall be tested for N, P, K and minor element values, soluble salt contents, organic matter content, and pH value.

.2 If required by the Contract Administrator, in-situ soil shall be tested for compaction levels with a soil compaction meter (penetrometer) in pounds-per-square-inch (psi).

.3 Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator.

.4 The contractor shall submit the soil analysis report to the Contract Administrator prior to the commencement of the works. Where the soil analysis report identifies deficiencies or requires remediation to meet minimum soil quality requirements, the Contractor shall, at no additional cost to the Owner, remediate the soil strictly in accordance with the report recommendations and obtain approval from the Contract Administrator prior to placement on site. Failure to comply with the approved soil analysis recommendations shall entitle the Contract Administrator to reject the topsoil and require its removal and replacement with compliant material, at the Contractor’s expense. When the source of such topsoil is exhausted, topsoil from a new source shall not be used until it is tested, and approved by the Contract Administrator.

1.7. INSPECTION

.1 The Contractor shall verify that the final site grades are in accordance with the grading plan. Obtain the approval of the Contract Administrator of the finished topsoil surface before proceeding with sodding.

.2 The Contractor shall give timely notice, in writing, that all work has been completed and maintenance period is to begin.

1.8. ACCEPTANCE

.1 Maintain sod in good condition until acceptance.

.2 At the time of acceptance, the grass must not be more than 50mm high. Minimum acceptable cut height is 45mm. All sod must have a healthy and even stand of grass, free of thin, poor or burned-out patches.

.3 Acceptance will be given when the sod is properly rooted, free of bare and dead spots and reasonably free of weeds in the opinion of the Contract Administrator.

.4 Acceptance will not be given if the topsoil and/or sod layer are excessively compacted (compaction exceeding 200 PSI).

.5 Replace any deteriorated sod with new sod at the direction of the Contract Administrator.

.6 The Contractor is responsible for a minimum of one cut of grass or as many cuts as required until acceptance.

1.9. GUARANTEE

.1 Submit written guarantee that all sodding shall be guaranteed for a period of one (1) year commencing on the date of acceptance of substantial performance.

.2 During the guarantee period, the Contractor shall make monthly inspections and replace all sod which is dead or is not in a healthy vigorous growing condition.

.3 Soil testing for N, P, K and minor element values, soluble salt contents, organic matter content, pH value and compaction shall be conducted if issues with sod growth and/or health are widespread or persistent. Arrange for and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Contract Administrator. Perform remedial actions as recommended by the soil testing results and approved by the Contract Administrator.

PART II - PRODUCTS

2.1. MATERIALS

.1 Grass sod: Certified No.1 grade cultivated turf grass sod with a composition of 50% Kentucky Blue Grass and 50% Blue Cultivar either “Fylking” or “Baron” or as specified on the drawings, grown and sold in accordance with NSGA classifications. At the time of sale, it must have a strong, fibrous root system and be free of stones and burned or bare spots. Damaged and broken pieces shall not be laid and shall be removed from the site immediately.

.2 Sod pegs: 25mm x 25mm x 230mm (minimum length). Ensure pegs are long enough to securely anchor sod.

.3 Topsoil: a fertile, friable, natural loam; containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loams to a maximum of 15%. Topsoil must be capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Contract

Administrator), and have a pH ranging from 6.0 to 8.0.

PART III - EXECUTION

3.1. PREPARATION

.1 Rototill all areas that are to receive new sod. Cultivate to a minimum depth of 100mm. Remove all rocks, roots and grass or weed clumps from the surface.

.2 Compact surface to 85% Standard Proctor Dry Density.

.3 Scarify to a depth of 25mm before placing additional topsoil or sod.

3.2. SPREADING OF TOPSOIL

.1 Spread dry topsoil during dry weather over approved, dry, unfrozen subgrade where sod is to be installed.

.2 Keep topsoil 25mm below finished grade for sodded areas.

.3 Fine grade topsoil eliminating rough and low areas and ensuring positive drainage.

.4 Roll topsoil with a 50 kg roller to compact and retain surface. Finished depth of prepared, compacted topsoil to be 200mm. Do not overcompact the soil.

.5 Provide a finished topsoil surface that is smooth and firm against footprints with a fine, loose texture before sod is placed. Topsoil level shall not be compacted beyond 200 PSI.

3.3. INSTALLATION

.1 Lay sod with tight butt joints. Do not leave any open joints or overlapping adjacent pieces of sod. Alternate joints on each row of sod.

.2 Ensure finished sod surface is flush with adjoining grass areas, pavement or top surface of curbs.

.3 On slopes steeper than 4:1, lay sod perpendicular to the slope and peg each row at intervals of not more than 600mm on each side of the sod strip. Drive pegs flush with surface of sod.

.4 Immediately after installation, water the sod with sufficient quantity of water to penetrate the sod and the top 50mm of the underlying topsoil.

.5 Apply 8-32-16 slow-release commercial fertilizer at the rate of 22 kg per 1000 square metres.

.6 When the sod has dried sufficiently to prevent damage, roll all sodded areas to ensure a good bond between sod and topsoil. Imperfections in the surface should be corrected prior to the laying of the sod and not by rolling with a heavy roller.

.7 Protect all newly sodded areas with warning signs or barricades.

3.4. PROTECTION AFTER COMPLETION

.1 Assume full responsibility for protection of all sodded areas from all sources until performance acceptance.

.2 Erect protective barriers and post signs where necessary and maintain same until

performance acceptance.

.3 Remedy all damages, wash-outs and eroded areas resulting from weather, improper protection, excessive compaction, or other causes.

3.5. CLEAN UP

.1 The Contractor must leave the site in a neat and orderly condition upon completion of work on a daily basis, all to the satisfaction of the Contract Administrator.

END OF DOCUMENT

PART I – GENERAL

1.1. DESCRIPTION

.1 The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the inspection, maintenance and planting of trees, shrubs, ground covers and perennials as shown on the Construction Drawings and as described by the Contract Specifications.

.2 Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. QUALITY ASSURANCE

.1 Planting work is to be carried out by experienced personnel under the direction of skilled foreman and in strict accordance with the Specifications and best horticultural practice.

1.3. PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Supply manufactured items such as super phosphate, fertilizer tablets, mulch, etc., in standard containers, clearly indicating contents, weight, component analysis, and the name of the manufacturer.

.2 Store manufactured materials, subject to deterioration, in a weatherproof place on site and in such a manner that their effectiveness is not impaired.

.3 Supply plant materials as specified on the plant list. Confirm quantities as specified on the drawings, plant list and bid form. Report any discrepancies.

.4 Dig materials specified “B.R.” (bare root) on the plant list, while in a dormant state and with the majority of the root system intact. Immediately after digging, wrap the roots in wet burlap and keep burlap wet during transport and storage.

.5 Provide all material, specified “B. & B.” (balled and burlapped) on the plant list, with a solid, earth root ball, wrapped in burlap.

.6 Provide all material, specified “WB” (wire basket) on the plant list, with a solid, earth root ball, bound by a wire basket.

.7 Do NOT plant material with broken or abraded trunks or branches, or with broken or cracked root balls, or plants which are strongly desiccated, as they will be subject to rejection upon arrival on the project site.

.8 Provide root balls of the following minimum sizes to meet the corresponding tree size. Ensure the root ball is large enough to accommodate at least 75% of the fibrous root system.

Deciduous Trees Caliper	Minimum Root Ball Diameter
50 mm	75 cm
60 mm	80 cm

70 mm	85 cm
80 mm	90 cm
90 mm	100 cm
1.00 m	60 cm
1.50 m	60 cm
Coniferous Tree Height	Minimum Root Ball Diameter
1.75 m	65 cm
2.00 m	70 cm
2.25 m	75 cm
2.50 m	80 cm

.9 Cut all roots cleanly when digging plants. Split roots are not acceptable. Cut roots even with the edges of the root ball.

.10 Protect all plant material from damage and breakage. Protect all parts of the plant material from drying out from the time of digging until they are installed.

.11 Do not transport plant material in an open truck unless it is adequately protected from sun and wind.

.12 Carefully tie in all branches before transporting.

.13 Pad all points of contact between plant material and equipment.

.14 Heel in any plant material that cannot be planted during the current day's operations.

.15 Keep all roots and root balls moist prior to planting.

.16 Do not remove labels attached to plants, until after final inspection.

1.4. SOIL TESTING

.1 If required by the Landscape Architect, the soil shall be tested for N, P, K and minor element values, soluble contents, organic matter and pH value.

.2 Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Landscape Architect.

.3 The Contractor shall submit the soil analysis report to the Consultant prior to the commencement of work. Where the soil analysis report identifies deficiencies or requires remediation to meet minimum soil quality requirements, the Contractor shall, at no additional cost to the Owner, remediate the soil strictly in accordance with the report recommendations and obtain approval from the Contract Administrator prior to placement on site. Failure to comply with the approved soil analysis recommendations shall entitle the Contract Administrator to reject the topsoil and require its removal and replacement with compliant material, at the Contractor's expense. When the source of such topsoil is exhausted, topsoil form a new source shall not be used until it is tested, and approved by the Landscape Architect.

1.5. JOB CONDITIONS

.1 Proceed with planting operations during suitable weather conditions.

1.6. SUBSTITUTIONS

.1 Supply and install plant material as specified on the plant list. Substitutions with other plant material will only be allowed with the written approval of the Landscape Architect.

.2 Give timely notice, in writing, to the Landscape Architect when applying for substitutions.

1.7. INSPECTIONS

.1 Make plant material available for inspection at source of supply and/or upon arrival on the site by the Landscape Architect. Notify Landscape Architect of delivery date and notify prior to shipment.

.2 Approval of plant material at source will not impair the right of the Owner or Landscape Architect to inspect plants upon arrival on the site or during the course of construction and to reject plants which have been damaged, or which, in any way, do not conform to the specifications.

.3 If partial acceptance is desired, give timely notice to the Landscape Architect in writing.

.4 Partial acceptance will be given when planting work has been delayed due to circumstances beyond the control of the contractor or where planting would be in conflict with good horticultural practices and would jeopardize the performance.

.5 Planting of materials, prior to inspection by the Landscape Architect will be the Contractor’s responsibility.

.6 Remove all rejected materials from the site immediately.

.7 Furnish all inspection certificates as may be required by federal, provincial and other applicable regulations.

.8 Labels shall indicate variety, grade and size of each plant specimen or bundle. Do not remove any labels from plants until final or partial approval by the Landscape Architect, or as directed.

.9 Final inspection of all plant material will be made at the end of the specified guarantee period. All plants must be in a healthy growing condition at the time of this inspection.

.10 The contractor is to provide the Landscape Architect with a full scale marked plan showing any substitutions or changes in colour.

1.8. MAINTENANCE

.1 Prepare and present to the Landscape Architect, two copies of a maintenance schedule prior to the beginning of the guarantee period.

.2 All plant materials shall be maintained by the Contractor immediately after any planting has been installed and shall continue until the date of final acceptance.

.3 Maintenance shall include all measures necessary to establish and maintain all plants in a vigorous and healthy growing condition, including but not limited to:

a. Weeding of planting beds and tree pits. Use herbicides in accordance with the manufacturer's directions. Make good any damage, resulting from herbicide use at no extra cost.

b. Watering when required and in sufficient quantities to saturate the root system.

c. Pruning, including the removal of dead or broken branches, and treatment of pruning wounds with approved dressing.

d. Disease and insect control when required. Use chemical methods in accordance with the manufacturer's directions. Make good any damage at no extra cost.

e. Keep all accessories in good condition and properly adjusted. Repair or replace accessories when required at no extra cost.

.4 The Contractor shall be responsible for making monthly inspections of all plantings during the guarantee period and submit a written report of each inspection to the Landscape Architect.

.5 The Contractor shall instruct the Landscape Architect in writing of any corrective or preventative measures necessary to ensure healthy plant growth. Any damage to plants shall be reported in writing to the Landscape Architect.

.6 At the time of acceptance, all material must be in a healthy vigorous growing condition. Beds and tree pits must be free of weeds, rubbish or debris.

1.9. GUARANTEE

.1 Submit written guarantee that all caliper plant materials shall be guaranteed for a period of 24 months (or as specified in the warranties section, whichever is greater), commencing on the date of acceptance of substantial performance or client acceptance, whichever is later.

.2 The guarantee period for approved "collected plants" shall extend for a period of one (1) year beyond the period stated above.

.3 During the guarantee period, the Contractor shall make monthly inspections and replace all plants which are dead, missing or which are not in a healthy vigorous growing condition.

.4 Supply and plant all replacements in strict accordance with Contract Documents and guarantee replacement as specified.

.5 Tag or mark, in a permanently visible manner, all replacement plant material and notify the Landscape Architect, in writing of the date on which replacements were planted. Include a

sketch showing location of replaced plants.

.6 Plant replacements at a time which is in accordance with good horticultural practice.

.7 Remove all accessories and cut at grade, those trees which are to be replaced at a later date. Remove plants, which are to be replaced, when found, or when notified by the Landscape Architect.

.8 All warranty replacements will be made at the expense of the contractor and at no additional cost to the Owner.

.9 Plants dying as a result of, but not limited to, handling by nurseries or the contractor, improper storage, improper planting, lack of water or rodent damage will be subject to replacement. Plants dying as a result of vandalism whether intentional or accidental are not subject to warranty replacement by the contractor.

PART II – PRODUCTS

2.1. PLANT MATERIAL

.1 All plant material must be nursery grown and meet the specifications set out in the latest Guide Specifications for Nursery Stock prepared by the Canadian Nursery Trade Association (CNTA) for quality and method of cultivation.

.2 Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and the latest edition of Standardized Plant Names.

.3 Any plant material not conforming to 2.1.1 above will be designated as collected plants.

.4 Collected plants may only be used when approved in writing, by the Landscape Architect.

.5 Plant Material: true to name and type, structurally sound, well branched; healthy and vigorous and free from disease, insect infestations, rodent damage, sun scald, frost cracks, and other abrasions to the bark and densely foliated with a healthy, well developed root system. Pruning wounds must show vigorous bark on all edges and all parts must show live and green cambium tissue when cut.

.6 All material must conform to the sizes shown on the plant list, except that larger material may be used when approved by the Landscape Architect. Use of larger plants will not increase the contract price.

.7 Plant material sizes must conform to the following standards:

a. caliper – diameter of the trunk measured 150 mm above the normal grade around the plant.

b. height – measured from the normal grade around the plant to the top of the main foliage mass.

c. spread – the diameter of the main foliage mass, at its widest point.

2.2. OTHER MATERIAL

.1 Topsoil: a fertile, friable, natural loam; mechanically screened, containing not less than 4% organic matter for clay loams and not less than 4% organic matter for sandy loams to a maximum of 15% and capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Landscape Architect) and having a pH ranging from 6.0 to 7.5.

.2 Peat moss: partially decomposed fibrous form of cellular stems and leaves of sphagnum moss, free of woody substance and harmful mineral matter, having a pH range of 4.5 to 6.0 and furnished in air dry state packed in standard bags of bales showing the name of the manufacturer.

.3 Tree Wrap: 225 g burlap supplied in strips 150 mm minimum to 250 mm maximum width or heavy, waterproof crepe paper 100 mm to 150 mm wide.

.4 Anchor stakes: metal ‘T’ bars: 51 x 51 x 5mm – 2500mm long, or Wood stakes: 50 x 50mm - 2130mm long (as specified)

.6 Wire: #10 galvanized wire for trees 75mm caliper or larger and #11 gauge galvanized wire for smaller trees. Alternative: Use 19mm (3/4”) Hemp Rope if specified.

.7 Hose: two ply, reinforced, 20mm diameter, new, black rubber garden hose.

.8 Mulch: as specified on details.

.9 Rodent Guards: 300mm Big ‘O’ pipe, 200mm MIN Height.

.10 Rodent Wrap Tree Protectors : spiral, plastic tree wrap.

.11 Fertilizer Tablets: as per details.

2.3. MIXES

.1 Provide standard planting soil mix as follows: 6 parts dark loam topsoil, to 2 parts well-rotted cow manure and 1 part peat moss. (Mix thoroughly and provide sample prior to planting.)

.2 Add bone meal at the rate of .58 kg per cubic metre and mix thoroughly for each tree or planting bed.

.3 Be prepared to adjust the above rate in response to the soil analysis report.

2.4 PLANTER SOIL MIXES

.1 Provide soil mix equal as per drawings, or approved.

PART III – EXECUTION

3.1. PREPARATION

.1 Obtain the approval of the Landscape Architect of all planting excavations

.2 Apply topsoil to a depth of 450 mm for shrub and ground cover beds.

3.2. INSTALLATION OF PLANT MATERIAL

.1 Planting shall be done during periods suitable with respect to weather conditions and locally accepted practice and to the Landscape Architect's approval.

.2 Ensure width of all planting excavations is 3 times the diameter of the root ball.

.3 Place plant plumb in the centre of the planting pit with a minimum of 150mm of compacted planting soil mixture under the root ball. Face the plant to give the best appearance or relationship to adjacent structures. Cut away any ropes which might girdle the tree. Remove all rope, wire, and burlap from top 1/3 of the root ball.

.4 Place bare root plants so that the roots lie in a natural position.

.5 Backfill with planting soil in 150mm layers and firmly tamp each layer to ensure the plant remains plumb. Ensure no air pockets remain around the roots.

.6 Water thoroughly when hole is 1/2 full of tamped soil mixture and again when the operation is complete.

.7 Except for plants in planting beds, construct an earth saucer around each plant equal to the diameter of the rootball and 100mm minimum depth to retain water around the roots.

3.3. INSTALLATION OF PLANTING ACCESSORIES

.1 Wrap all trees over 50mm caliper. Apply wrapping in a spiral manner from grade to above the second branch. Secure wrapping with suitable cord.

.2 Stake or guy all trees as outlined in the drawings and detail.

3.4. PRUNING

.1 Prune plants after planting to compensate for root loss and in such a manner that the natural shape and character are retained. Do not cut a leader. Use only clean and sharp tools, conforming to proper horticultural practice.

3.5. MULCHING

.1 Where a mulch is called for, place a minimum 100mm depth of shredded bark mulch over the planting area. Use only specified mulch. No other type of mulch is acceptable unless approved in writing by the Landscape Architect.

.2 Cut and spread a 1200 x 1200 mm piece of approved landscape cloth around the base of

each tree and shrub before mulch is spread.

3.6. CLEAN-UP

.1 At the completion of planting operations, remove all surplus material from the site at no extra cost.

.2 Make good all damage resulting from planting operations at no extra cost.

.3 Maintain all areas neat and tidy at all times until final acceptance.

END OF SECTION

PART I – GENERAL

1.1. SCOPE OF WORK

.1 This section specifies requirements for sub-drains including perforated and non-perforated flexible P.V.C. or Big 'O' pipe, and manhole/catch basin connections.

PART II – PRODUCTS

2.1. MATERIALS

.1 Granular Backfill as required except under sand play areas, concrete curbing and pavement:

Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting the following gradation limits:

ASTM Designation	% Passing
50.0 mm	100
31.5 mm	60 - 100
16.0 mm	40 - 100
4.75 mm	25 - 60
2.0 mm	20 - 45
0.425 mm	10 - 25
0.075 mm	0 - 10

.2 Common Backfill

Approved material selected from trench excavation or other source, unfrozen and free from cinders, ashes, sod, refuse or other deleterious materials, and with the natural water content within 90% of the optimum value for the Proctor compaction specified, based on the native soil which is being used for backfill.

.3 PVC Pipe

Drainage pipe shall be 100 mm to 150 mm diameter flexible, Poly Vinyl Chloride (PVC), C.S.A. unless otherwise stated on drawings. All fittings, and connections shall be PVC. Material density shall be minimum accordance to ASTM method D1505 / D1928. When the above PVC is to be perforated, it shall be installed with holes facing down, with Filter Cloth tubing as manufactured by National Sewer Pipe or approved equal.

.4 Filter Bedding Material under sand play areas and in trench with perforated PVC to be hard, durable particles of clear, natural, aggregate limestone of 10 mm diameter size and no fines.

.5 Filter Sock:

.1 Synthetic filter: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Terrafix Type 370R or approved equal.

.2 Fabric: woven construction supplied as continuous tube of 100 mm diameter.

.3 Seams: sewn in accordance with manufacturer's recommendations.

PART III – EXECUTION

3.1. TRENCHING

.1 Select shortest distance for sub-drains to existing sewer systems as shown on the drawings, avoiding all existing features such as trees, fences and other structures.

.2 Do not place bedding filter material prior to approval of excavation by the Landscape Architect.

.3 Excavate to achieve minimum percent slope of pipe as shown on the drawings.

.4 Notify Landscape Architect if soil at proposed elevation of trench bottom appears unsuitable for foundation of installation. Remove unsuitable material from trench bottom as directed by Landscape Architect.

.5 Unless otherwise authorized by Landscape Architect in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation. Fence off any open excavations to protect public.

.6 Stockpile suitable excavated materials required for trench backfill in approved location within site limits.

.7 Dispose of unsuitable or surplus material off site.

3.2. BACKFILLING

.1 Do not proceed with trench backfilling operations until Landscape Architect has inspected and approved installations.

.2 Use approved common or granular backfill material as indicated on the drawings.

.3 Backfilling around installations:

a) Place bedding and surround material as noted on drawings;

b) Place layers simultaneously on both sides of installed work to equalize loading;

c) Place material by hand under, around and over installations until required cover is provided. Dumping material directly on installations will not be permitted.

.4 Do not place backfill in freezing weather without prior approval of Landscape Architect.

.5 Place backfill material in uniform layers not exceeding 300 mm in thickness up to sub-grade elevation or top of trench. Compact each layer before placing succeeding layer.

.6 Compact trench bottom and backfill materials:

a) In pavement areas, to a density at least equal to density of adjacent, undisturbed soil;

b) Under sand in play areas to 85% Standard Proctor Density;

c) In pavement areas, compact to a minimum of 98% Standard Proctor Density.

.7 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

3.3. PIPE INSTALLATION

.1 Excavations require inspection and approval prior to commencement of installation operations.

.2 Lay drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel or each pipe is in contact with bed throughout full length.

.3 Commence laying at outlet and proceed in upstream direction.

.4 Lay perforated pipes with perforations downwards.

.5 Lay bell and spigot pipe with bell ends facing upstream.

.6 Weld joints of PVC pipe according to manufacturer's instructions.

.7 Make joints tight in accordance with manufacturer's instructions.

.8 Do not allow water to flow through pipes during construction.

.9 Make watertight connections to existing drains or catch basins where indicated and arrange for inspection by the Landscape Architect prior to backfilling.

.10 Plug open upstream ends of pipes with watertight concrete, steel or P.V.C. bulkheads.

.11 Surround pipe with filter sock and granular / filter material and compact as specified.

.12 Protect sub-drain against flotation during installation.

3.4. CONNECTIONS TO MUNICIPAL FACILITIES

.1 Connect sub-drains and catch basins to Municipal storm sewer system where indicated on the drawings. Arrange for inspection by Municipal Public Works Department and receive approval prior to backfilling.

3.5. RESTORATION

.1 Reinstate pavements and sodded areas to condition and elevation which existed before trenching to satisfaction of the Landscape Architect.

END OF SECTION