Project Manual for the

Construction of the

NELSON H.S. RENOVATIONS

at

4181 New Street
Burlington, Ontario

for

The Halton District School Board
2050 Guelph Line
Burlington, Ontario

Project No.: 2323

HDSB RFT # 24-058-02

2024 05 13

snyderarchitects

100 Broadview Avenue, Suite 301,
Toronto, Ontario M4M 3H3
Telephone: 416.966.5444

1 General

1.1 OWNER

.1 Owner for the Project is:

The Halton District School Board
2050 Guelph Line
Burlington, Ontario
L7R 3Z2

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)

Snyder Architects, Inc.
100 Broadview Avenue, Suite 301
Toronto, Ontario
M4M 3H3
Telephone: 416.966.5444

.2 Structural Engineer (S)

Kalos Engineering Inc.
300 York Boulevard
Hamilton, Ontario
L8R 3K6
Telephone: 905.333.9119

.3 Mechanical Engineer (M)

RDZ Engineering Inc.
30 Pennsylvania Avenue, Unit 17A
Vaughan, Ontario
L4K 4A5
Telephone: 905.660.7818

.4 Electrical Engineer (E)

RDZ Engineering Inc.
30 Pennsylvania Avenue, Unit 17A
Vaughan, Ontario
L4K 4A5
Telephone: 905.660.7818

END OF DOCUMENT

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP **Document**
Division 00 - Procurement and Contracting Requirements **Reponsibility**

Introductory Information
00 01 03 Project Directory . . . . . A
00 01 10 Table of Contents . . . . . A
Procurement Requirements
00 21 13 Instructions to Bidders. . . . . A
00 31 00 Available Project Information. . . . . A
Contracting Requirements
00 52 03 Cost-Plus Agreement . . . . . A
00 52 11 Subcontract Agreement . . . . . A
00 71 03 Cost-Plus Contracting Definitions . . . . . A
00 71 11 Subcontracting Definitions. . . . . A
00 72 03 General Conditions . . . . . A
00 72 11 Subcontract Conditions . . . . . A
00 73 03 Supplementary Conditions . . . . . A
00 73 11 Supplementary Subcontract Conditions . . . . . A

SPECIFICATIONS GROUP
GENERAL REQUIREMENTS SUBGROUP
Division 01 - General Requirements

01 12 00 Multiple Contract Summary. . . . . A
01 21 00 Allowances . . . . . A
01 23 00 Alternates . . . . . A
01 25 00 Substitution Procedures . . . . . A
01 26 00 Contract Modification Procedures. . . . . A
01 31 00 Project Management and Coordination. . . . . A
01 32 00 Construction Progress Documentation . . . . . A
01 33 00 Submittal Procedures . . . . . A
01 35 00 Special Procedures. . . . . A
01 40 00 Quality Requirements . . . . . A
01 50 00 Temporary Facilities and Controls. . . . . A
01 60 00 Product Requirements . . . . . A
01 71 00 Examination and Preparation . . . . . A
01 73 00 Execution. . . . . A
01 73 29 Cutting and Patching. . . . . A
01 74 00 Cleaning and Waste Management . . . . . A
01 75 00 Starting and Adjusting. . . . . A
01 76 00 Protecting Installed Construction. . . . . A
01 77 00 Closeout Procedures. . . . . A
01 78 00 Closeout Submittals . . . . . A
01 79 00 Demonstration and Training . . . . . A

FACILITY CONSTRUCTION SUBGROUP
Division 02 - Not Used

Division 03 - Concrete

03 35 46 Concrete Topical Treatments . . . . . A

Division 04 - Masonry

04 00 00 Masonry. . . . . A

Division 05 - Metals

05 50 00 Metal Fabrications. . . . . A

Division 06 - Wood, Plastics and Composites

06 10 00 Rough Carpentry . . . . . 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 21 00 Thermal Insulation . . . . . A
07 26 00 Vapour Retarders . . . . . A
07 27 00 Air Barriers . . . . . A
07 27 36 Sprayed Foam Air Barrier . . . . . A
07 52 00 Modified Bituminous Membrane Roofing . . . . . A
07 62 00 Sheet Metal Flashing and Trim . . . . . A
07 81 00 Applied Fireproofing . . . . . A
07 84 00 Firestopping . . . . . A
07 92 00 Joint Sealants . . . . . A

Division 08 - Openings

08 31 00 Access Doors and Panels . . . . . A
08 81 13 Interior Glass Glazing . . . . . A
08 90 00 Louvers and Vents . . . . . A

Division 09 - Finishes

09 21 16 Gypsum Board Assemblies . . . . . A
09 51 23 Acoustical Tile Ceilings . . . . . A
09 65 13 Resilient Base and Accessories . . . . . A
09 65 19 Resilient Tile Flooring . . . . . A
09 66 13 Portland Cement Terrazzo Flooring . . . . . A
09 68 13 Tile Carpeting . . . . . A
09 81 00 Acoustic Insulation . . . . . A
09 90 00 Painting and Coating . . . . . A
09 96 46 Intumescent Painting

Division 10 - Specialties

10 11 00 Visual Display Surfaces . . . . . A
10 14 00 Signage . . . . . A
10 51 13 Metal Lockers . . . . . A

Division 11 - Not Used

Division 12 - Furnishings

12 24 13.16 Manual Roller Window Shades . . . . . A

Divisions 13 to 19 - Not Used

FACILITY SERVICES SUBGROUP

Division 20

20 05 01 Supplementary Mechanical Bid Form . . . . . 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 35 Demolition and Revision Work . . . . . M
20 05 40 Mechanical Work Commissioning . . . . . M
20 05 50 Testing, Adjusting and Balancing . . . . . M
20 05 55 Firestopping and Smoke Seal Systems . . . . . M

Division 21 - Not Used

Division 22 - Plumbing
22 13 00 Drainage and Vent Piping and Specialties . . . . . 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 30 00 HVAC Air Distribution . . . . . M
23 33 65 Energy Recovery Ventilators . . . . . M
23 70 00 Rooftop Units. . . . . M
23 82 19 Unit Ventilators . . . . . M

Division 24 - Not Used

Division 25 - Integrated Automation
25 05 01 Supplementary Controls Bid Form . . . . . M
25 09 23 Direct Digital Control 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 34 Conduits, Conduit Fastenings and Conduit Fittings . . . . . 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 12 17 Dry Type Transformer. . . . . E
26 24 16 Panel Boards. . . . . E
26 24 17 Power Panels . . . . . 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
26 50 10 Lighting Fixture Schedule . . . . . E

Division 27 - Communications
27 11 19 Structured Cabling for Communication Systems . . . . . E
27 51 16 Public Address System . . . . . E

Division 28 - Electronic Safety and Security
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
Divisions 30 to 39 - Not Used

PROCESS EQUIPMENT SUBGROUP
Divisions 40 to 49 - Not Used

END OF TABLE OF CONTENTS

1 Invitation

1.1 BID CALL

.1 Offers will be received electronically through the designated e-procurement services provider at:
https://snyderarchitects.bidsandtenders.ca.

.2 Offers to perform Contract C00 - Contractor will be received by Owner before 3:00:00 pm local time on the ~~30th day of May, 2024~~ (hereinafter referred to as 'bid closing time').

.3 Offers to perform Subcontract SC01 - General will be received by Owner before 3:00:00 pm local time on the 30th day of May, 2024 (hereinafter referred to as 'bid closing time').

.4 Offers to perform the following trade Subcontracts will be received by Owner before 3:00:00 pm local time on the ~~30th day of May, 2024~~ (hereinafter referred to as 'bid closing time'):

"…before 3:00:00 pm local time on the 6th of June 2024…"

.1 SC03 - Mechanical.
.2 SC04 - Electrical.
.3 SC05 - Structural Steel.
.4 SC07 - Roofing.
.5 SC08 - Flooring.
.6 SC09 - Drywall and Acoustics.
.7 SC10 - Painting.

.5 The official bid closing time will be determined by the e-procurement services provider's web clock.

.6 Bids cannot be submitted after the specified bid closing time.

.7 Owner reserves the right to extend the bid closing time or cancel the bid call by addendum.

.8 Bids are by invitation only from a list of preselected bidders. Bids received from unsolicited bidders will not be considered by Owner.

.9 Bidders must have an active bidding system vendor account and be registered as a plan taker with the designated e-procurement services provider for this bid opportunity, which will enable the bidder to:
.1 Download Bid Documents,
.2 Receive email notifications,
.3 Download addenda, and
.4 Submit a bid electronically.

.10 To ensure receipt of latest information and updates via email regarding this Bid, or if a bidder has obtained Bid Documents from a third party, it remains bidder's responsibility to create a bidding system vendor account and register as a plan taker with the designated e-procurement services provider for this bid opportunity.

.11 Bids will not be opened publicly with Bidders present.

.12 Bid results will be disclosed promptly to all bidders. Such disclosure will not imply that the bids received are compliant or that a contract will be awarded to the lowest or any bidder.

1.2 INTENT

.1 The intent of this bid call is to obtain offers to perform identified portions of the Work to complete construction of the Construction of the NELSON H.S. RENOVATIONS located at 4181 New Street, Burlington, Ontario.

.2 Contract C00 is identified as a CCDC 3 Cost Plus a Fee Contract based on the Contract Documents.

.3 Subcontracts are identified as CCA 1 Stipulated Sum Subcontracts. Successful Subcontractors will enter into written agreements with successful Contractor holding Contract C00, based on Contract Documents.

1.3 CONTRACT DOCUMENTS IDENTIFICATION

.1 Contract Documents are identified as Project No.: 2323 as prepared by Consultant, Snyder Architects, Inc. located at 100 Broadview Avenue, Suite 301, Toronto, Ontario.

1.4 BID DOCUMENT AVAILABILITY

.1 Bid Documents are only available to registered plan takers in electronic form from the designated e-procurement services provider.

.2 Bid Documents are made available only for the purpose of obtaining offers for this Project. It does not confer a license to use the Bid Documents for any other purpose.

1.5 EXAMINATION OF BID DOCUMENTS

.1 Examine Bid Documents and promptly notify Consultant of any perceived errors, omissions, conflicts or discrepancies in Bid Documents.

1.6 SITE EXAMINATION

.1 Bidders shall visit Place of the Work and familiarize themselves with conditions affecting the Work before submitting a bid.

.2 Bidders' only opportunity to visit Place of the Work will be in conjunction with the specified pre-bid site meeting and site visit.

.3 Bidders visiting Place of the Work will be required to obtain a visitor badge. Upon completion of visit, sign out and return visitor badge to Owner.

.4 Bidders visiting Place of the Work shall provide their own personal protective equipment.

.5 Bidders visiting Place of the Work will be required to be accompanied at all times by a representative of Owner.

.6 Refer to Section 00 31 00 - Available Project Information which identifies available information pertaining to the Project.

.7 In accordance with General Conditions of the Contract, bidders will include in their bid price for non-concealed and known conditions that are either visible or can be reasonably inferred from a site examination at Place of the Work and a review of available project information before bid submission.

1.7 PRE-BID MEETING AND SITE VISIT

.1 A pre-bid meeting and site visit at Place of the Work has been scheduled for 3:00 pm local time on May 20, 2024. Meet at Main Office in existing facility.

.2 Attendance by Contract C00 and Subcontracts SC01, SC03 and SC04 bidders is mandatory.

.3 Bidders will be required to sign an attendance sheet during the meeting. Failure of a bidder's representative to attend and sign the attendance sheet will cause the bid to be rejected as non-compliant.

.4 Issues arising from the pre-bid meeting and site visit will be addressed as required in an addendum to the Bid Documents. No meeting minutes will be issued. Bidders may not rely upon any information given verbally or otherwise at the pre-bid meeting and site visit and that is not confirmed by addendum.

1.8 BID FORM SUPPLEMENTS

.1 Submit the following Bid Form Supplements together with the Bid Form:
.1 All Bidders: WSIB Certificate.
.2 Subcontract Bidders: List of Sub-subcontractors (as applicable).

.2 Owner may, after bid closing time and before contract award, require any bidder to submit additional supplementary information about any aspect of the bidder's bid to verify compliance with the Bid Documents.

1.9 TAXES

.1 Include in bid price all taxes and customs duties in effect at the time of bid closing, except for Value Added Taxes as defined in the Contract.

1.10 WORKPLACE SAFETY & INSURANCE BOARD CERTIFICATE

.1 Submit a signed certificate from Workplace Safety & Insurance Board (WSIB), confirming that, at the date of the certificate, the bidder maintains an account with WSIB, and is in good standing.

1.11 CONTRACT TIME

.1 The bidder, in submitting a bid, agrees to attain Substantial Performance of the Work by the date specified in Section 01 12 00, which will become the Contract Time under the Contract.

1.12 SUBSTITUTIONS

.1 Where the Bid Documents specify particular Products by proprietary name, Consultant will consider bidder requests for approval of substitutions during the bid period, as long as such requests are received, in writing, at least 7 days before the bid closing time and are in accordance with the requirements specified in Section 01 25 00 - Substitution Procedures. If Consultant accepts a substitution, the substitute Product will be named in an addendum. Otherwise bidders shall consider the request for approval of the substitution to be rejected.

1.13 SUB-SUBCONTRACTORS

.1 Refer to CCDC 3, GC 3.8 - Subcontractor and Supplier; and CCA 1, SCC 3.4 - Sub-subcontractors.

.2 Indicating Sub-subcontractors as "OWN FORCES" is not considered acceptable and may be rejected by Owner, unless the bidder can adequately prove they have sufficiently trained personnel and experience to undertake those portions of the Work.

.3 Owner reserves the right to reject a proposed Sub-subcontractor for reasonable cause. Upon such rejection, bidder will be required to propose an alternate Sub-subcontractor with a resulting change to submitted Bid Price. This change can effect the status of low bid, and may result in a different bid becoming low.

1.14 BID FORM SIGNING

.1 Electronic signatures for signing of requested documents are considered acceptable.

.2 Acceptable forms of electronic signature include, but are not limited to, typing of the bidder's authorized signing officer's name or inclusion of a graphic image of the bidder's authorized signing officer's signature, so long as the electronic signature is sufficient to identify the bidder's authorized signing officer.

.3 The bidder's authorized signing officer agrees that whatever form of electronic signature is used constitutes a signature for the purpose of executing requested documents.

1.15 BID SUBMISSION

.1 Bids will be received in electronic form only. Submit bid in compliance with the rules and procedures established by the designated e-procurement services provider.

.2 Verbal, telephone, fax, e-mail, text message or hand delivered bids will not be accepted or acknowledged.

.3 Bidders wishing to submit prices for more than one Contract or Subcontract may do so separately, in accordance with the rules and procedures described above. Do not combine information pertaining to multiple Contracts or Subcontracts in a single bid submission.

.4 Subcontract bids must include the appropriate reference to Subcontract number and title. Refer to Section 01 12 00 for summary of Subcontract numbers and titles.

1.16 BID MODIFICATION AND WITHDRAWAL

.1 Bidders shall comply with procedures for electronic bid modification and withdrawal established by the designated e-procurement services provider.

.2 If a bid is withdrawn, a new bid may be submitted in accordance with specified bidding requirements, as long as it is received before the bid closing time.

.3 Owner assumes no responsibility or liability for modifications or withdrawals that are, for any reason, delayed, illegible, unclear as to intent, ambiguous, contrary to these instructions, or otherwise improperly received. Owner may disregard improperly received modifications or withdrawals.

1.17 BIDDING IRREGULARITIES

.1 Bidders are cautioned that the timing of bid submission is based on when their bid is received by the e-procurement services provider, and not when their bid is submitted by bidder. Bid transmission can be delayed in an 'internet traffic jam' due to file transfer size, transmission speed and other electronic considerations. It is recommended that bidders allow sufficient time to upload their bid with required attachments and to resolve any issues that may arise before bid closing time.

.2 The e-procurement services provider will send a confirmation email to bidder advising their bid was submitted successfully. In the event a confirmation email is not received, bidder is urged to contact the designated e-procurement services provider's technical support department via email at:
support@bidsandtenders.ca.

.3 Bids with Bid Forms or required Bid Form Supplements that are improperly prepared, signed or submitted contrary to these Instructions to Bidders, or that contain added conditions or other irregularities of any kind, may, at Owner's discretion, be rejected as non-compliant.

.4 Owner may accept or waive a minor and inconsequential irregularity. The determination of what is, or is not, a minor and inconsequential irregularity, the determination of whether or not to accept or waive such an irregularity, and the final determination of whether the bid is compliant, will be at Owner's sole discretion.

.5 The following irregularities relate to what are considered mandatory bidding requirements. These will not be considered minor and inconsequential and will cause the bid to be rejected as non-compliant:
.1 Bid or Bid Form Supplement is received after the specified bid closing time.
.2 Required Bid Form or Bid Form Supplement is missing.
.3 Bid Form or Bid Form Supplement is not in the form provided or required.
.4 Bid price is illegible, ambiguous or unclear.
.5 One or more conditions are added to or submitted with the bid, the effect of which is a material modification of the Bid Documents.

.6 Failure to indicate in the Bid Form the addendum number(s) of all addenda received.
.7 Failure to comply with any other bidding requirement expressly characterized as mandatory elsewhere in the Bid Documents.

1.18 BID ACCEPTANCE PERIOD

.1 Bids shall remain open to acceptance by Owner and shall be irrevocable until another bidder enters into a contract with Owner for performance of the Work or until expiry of the bid acceptance period stated in the Bid Form, whichever occurs first.

.2 After bid closing and before expiry of the bid acceptance period stated in the Bid Form, Owner may request all bidders to agree to an extension of the originally specified bid acceptance period. In such case the bid acceptance period will be extended subject to the bidder, whose bid the Owner wishes to accept, having agreed in writing to the extension.

1.19 BID ACCEPTANCE

.1 The lowest or any bid will not necessarily be accepted and Owner may reject any and all bids.

.2 A Subcontract will be established if and when the successful bidder receives from Owner a written notification accepting the bid without any conditions. If Owner's written notification accepting the bid contains, or is subject to, any conditions, the Subcontract will be established if and when the bidder accepts all such conditions in writing or when the parties execute the agreement.

.3 If the lowest compliant bid exceeds Owner's budget, and Owner is unwilling or unable to award a contract at the bid price, Owner may:
.1 Negotiate, with lowest compliant bidder only, changes to the Bid Documents and a reduced bid price acceptable to Owner, or
.2 Invite the three lowest compliant bidders to re-bid on modified Bid Documents under a new bid call.

1.20 INTERPRETATION AND MODIFICATION OF BID DOCUMENTS

.1 If an inquiry requires an interpretation or modification of the Bid Documents, the response to that inquiry will be issued in the form of a written addendum only, to ensure that all bidders base their bids on the same information.

.2 Replies to inquiries or interpretations or modifications of the Bid Documents made by e-mail, verbally, or in any manner other than a written addendum, will not form part of the Bid Documents and will not be binding.

1.21 ADDENDA

.1 Addenda may be issued to modify the Bid Documents in response to inquiries or as may be considered necessary.

.2 Addenda issued during the bid period will become part of the Bid Documents.

.3 No addenda will be issued later than two Working Days before the bid closing time.

.4 Each bidder shall ascertain before bid submission that it has received all addenda issued during the bid period. Bidders must acknowledge receipt of each addendum by checking a box for each addendum and any applicable attachments issued before they can submit their bid.

1.22 INQUIRIES

.1 Inquiries must be submitted through the e-procurement services provider by selecting the "SUBMIT QUESTION" button.

.2 Submit inquiries as early as possible in the bid period and not less than 7 Working Days before the bid closing time. Inquiries received after this time may not receive a response.

END OF DOCUMENT

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 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 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: Nelson Secondary School Mechanical Upgrades, Designated Substance Audit Report, 4181 New Street, Burlington, ON;
File No.: 43920-102;
Dated: February 9, 2024;
Prepared by: MTE Consultants Inc.

.2 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.

.3 Conditions at Place of the Work identified in the report are relevant only at time of survey.

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

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

1.4 DOCUMENTS DESCRIBING EXISTING FACILITY

.1 Documents describing existing facility are available for viewing by bidders at Owner's office.

.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

1 General

1.1 AGREEMENT

.1 CCDC 3-2016 Cost Plus Contract, as amended below, forms the basis of Agreement between Owner and Contractor.

1.2 AMENDMENTS TO THE AGREEMENT

.1 Article A-4 - Cost of the Work
.1 Delete Paragraph A-4.1 in its entirety and replace with the following: *"The Cost of the Work, which excludes Value Added Taxes, shall be comprised of the stipulated sum costs of subsequently awarded Subcontracts, as nominated by the Owner, and the following:*
.1 deposits lost;
.2 the costs to the Contractor that result from any Subcontractor's or Supplier's insolvency or failure to perform;
.3 royalties, patent license fees and damages for infringement of patents and cost of defending suits therefor subject always to the Contractor's obligations to indemnify the Owner as provided in paragraph 10.3.1 of GC 10.3 - PATENT FEES;
.4 losses and expenses sustained by the Contractor for matters which are the subject of insurance under the policies prescribed in GC 11.1 - INSURANCE when such losses and expenses are not recoverable because the amounts are in excess of collectible amounts or within the deductible amounts;
.5 legal costs, incurred by the Contractor, in relation to the performance of the Work provided that they are not caused by negligent acts or omissions of the Contractor and the Work is performed in accordance with the Contract Documents; and
.6 the cost of auditing when requested by the Owner.
Notwithstanding the foregoing and any provisions contained in the General Conditions of the Contract, it is the intention of the parties that the Cost of the Work referred to herein shall cover and include any and all contingencies other than those which are the result of or occasioned by any failure on the part of the Contractor to exercise reasonable care and diligence in the Contractor's attention to the Work. Any cost due to failure on the part of the Contractor to exercise reasonable care and diligence in the Contractor's attention to the Work shall be borne by the Contractor."

.2 Article A-5 - Contractor’s Fee
.1 Delete Paragraph A-5.1.1 in its entirety.

.3 Article A-7 - Options
.1 Delete Paragraph A-7.2 in its entirety.
.2 Delete Paragraph A-7.3 in its entirety.

.4 Article A-8 - Payment
.1 Revise Subparagraph A-8.1.1 to insert the phrase *"... make progress payments to Contractor subject to GC 5.4 - Progress Payment...".*

END OF DOCUMENT

1 General

1.1 AGREEMENT

.1 CCA 1-2008 Stipulated Price Subcontract, as amended below, forms the basis of Agreement between Contractor and Subcontractor.

1.2 AMENDMENTS TO THE AGREEMENT

.1 Delete Article 1B in its entirety.

.2 Delete Article 2B in its entirety.

.3 Delete Article 3B in its entirety.

.4 Article 5 - SUBCONTRACT PRICE, delete Paragraph 5.5 in its entirety.

.5 Article 6 - PAYMENT, Paragraph 6.2, Third Sentence; revise to read as follows: *"The Contractor shall pay the Subcontractor, in accordance with the payment procedures required by the Contract Documents, no later than thirty (30) days after the date of the Consultant's certificate of payment, 90 percent of the amount applied for or such other amount as the Consultant determines to be properly due."*

.6 Article 6 - PAYMENT, Paragraph 6.4; revise to read as follows: *"... and for which the Contractor or Owner might in any way be held responsible ..."*

.7 Article 6 - PAYMENT, Paragraph 6.4; delete Subparagraph 6.4.2 in its entirety.

END OF DOCUMENT

1 General

1.1 AGREEMENT

.1 CCDC 3-2016 Cost Plus Contract, includes Definitions of specific words and terms.

1.2 SUPPLEMENTARY DEFINITIONS

.1 Amend the Definition of Contract Documents by inserting the words "*in writing*" after the words "*agreed upon*".

.2 Amend the Definition of Contractor's Fee by adding the following: *"... and including amounts for all overhead and profit, bond and insurance premiums, and any costs for labour and Products required by the Contractor to undertake portions of the Work identified in the Contract Documents and not included in an Owner-nominated Subcontract."*

.3 Delete the Definition of Guaranteed Maximum Price ("GMP") in its entirety.

.4 Delete the Definition of Target Contract Price in its entirety.

.5 Add a new Definition for Bid Documents, as follows: *"The Bid Documents shall consist of the Contract Documents, Instructions to Bidders, Bid Form and other available project information issued for the benefit of Bidders."*

END OF DOCUMENT

1 General

1.1 AGREEMENT

.1 CCA 1-2008 Stipulated Price Subcontract includes the Definitions of specific words and terms.

1.2 SUPPLEMENTARY SUBCONTRACT DEFINITIONS

.1 Add a new Definition for Bid Documents, as follows: *"The Bid Documents shall consist of the Contract Documents, Instructions to Bidders, Bid Form, and other available project information issued for the benefit of bidders."*

END OF DOCUMENT

1 General

1.1 GENERAL CONDITIONS

.1 CCDC 3-2016, The General Conditions of the Cost Plus Contract is the General Conditions between Owner and Contractor.

1.2 SUPPLEMENTARY CONDITIONS

.1 Refer to Section 00 73 03 - Supplementary Conditions for amendments and supplements to General Conditions.

.2 Where a General Condition of the Contract or a paragraph of the General Conditions of the Contract is deleted by Supplementary Condition, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

END OF DOCUMENT

1 General

1.1 SUBCONTRACT CONDITIONS

.1 CCA 1-2008, The Subcontract Conditions of the Stipulated Price Subcontract are the Subcontract Conditions between Contractor and Subcontractors.

1.2 SUPPLEMENTARY SUBCONTRACT CONDITIONS

.1 Refer to Section 00 73 11 - Supplementary Subcontract Conditions for amendments and supplements to Subcontract Conditions.

.2 Where a Subcontract Condition of the Contract or a paragraph of the Subcontract Conditions of the Contract is deleted by Supplementary Subcontract Condition, the numbering of the remaining Subcontract Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

END OF DOCUMENT

1 Supplements to General Conditions

1.1 GC 1.1 - CONTRACT DOCUMENTS

.1 Delete Paragraph 1.1.8 and replace with the following: *"The Contractor will be given one electronic-copy set of the Contract Documents without charge. The Contractor may produce as many hard-copy sets of the Contract Documents from the electronic-copy as they deem necessary to undertake the Work, at their own expense."*

.2 Add new Paragraph 1.1.11 as follows: *"The location of fixtures, outlets, conduit, piping and any other locations shown or specified but not dimensioned shall be considered approximate. The actual location shall be as approved by the Consultant and as required to suit job conditions."*

1.2 GC 2.2 - ROLE OF THE CONSULTANT

.1 Add new Subparagraph 2.2.7.1 as follows: *"Verbal instructions, regardless of the source, will not be binding on the parties to the Contract, unless otherwise confirmed in writing by the Owner or the Consultant ."*

1.3 GC 2.4 - DEFECTIVE WORK

.1 Add new Paragraph 2.4.3 as follows: *"Where defective work or work not performed as provided in the Contract Documents is the responsibility of a Subcontractor or Supplier, the Contractor shall require the responsible Subcontractor or Supplier to Make Good the defective work or work not performed as provided in the Contract Documents so as to conform with the Contract Documents."*

1.4 GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

.1 Delete Paragraph 3.2.2 in its entirety.

.2 Add new Subparagraph 3.2.2.5 as follows: *"Notify the Contractor no later than 2 Working Days prior to any other contractor or their own forces being on site. The Contractor will make all necessary arrangements to accommodate access and maintain compliance with applicable health and construction safety legislation at the Place of the Work"*.

.3 Revise Subparagraph 3.2.3.4 to read as follows: *"Assume overall responsibility for the separate contractors and Owner's own forces and for compliance with applicable health and construction safety legislation at the Place of the Work"*.

1.5 GC 3.5 - CONSTRUCTION SCHEDULE

.1 Add new Paragraph 3.5.2 as follows: *"Where portions of the Work are performed by Subcontractors or Suppliers, the Contractor shall coordinate with, and arrange for the Subcontractors and Suppliers to provide detailed construction schedules for their portion of the Work, to be submitted along with the construction schedule described herein."*

.2 Add new Paragraph 3.5.3 as follows: *"No change in Contract Time resulting from a change in the Work will be accepted, if, in the Consultant's opinion, such change in the Work can reasonably be accommodated within the approved schedule."*

.3 Amend Paragraph 3.5.1.1 by deleting the phrase *"... the first application for payment ..."* and replacing it with *"... commencing the work ..."*.

1.6 GC 3.7 - SUBCONTRACTORS AND SUPPLIERS

.1 Revise Subparagraph 3.7.1.1 to read as follows: *"enter into contracts or written agreements with Subcontractors or Suppliers, including those nominated by the Owner, to require them to perform their work as provided in the Contract Documents;*

.1 The Consultant will prepare the written agreements between the Contractor and each Subcontractor or Supplier, based upon a modified CCA 1-2008, Stipulated Price Subcontract, similar in content and intent of this Contract."

.2 Add new Subparagraph 3.7.1.4 as follows: *"immediately notify the Consultant of any acts or omissions of Subcontractors or Suppliers and of persons directly or indirectly employed by them."*

.3 Add new Subparagraph 3.7.2.1 as follows: *"The Contractor shall not change or terminate Subcontractors or Suppliers without the prior written permission of the Owner."*

.4 Add new Paragraph 3.7.6 as follows: *"The Owner may direct the Contractor to terminate the contract of a Subcontractor or Supplier and the Owner shall nominate a replacement Subcontractor or Supplier to complete that part or portion of the Work. The Contractor shall enter into a contract with the nominated Subcontractor or Supplier for the completion of that portion of the Work. In the event of such an instance, the Contract Time and the Contractor's Fee is to be adjusted by an appropriate amount. The Contractor may reasonably refuse to terminate the contract of a Subcontractor or Supplier if to comply with the Owner's direction would result in a breach of any of the Contractor's obligations under GC 9.4 - CONSTRUCTION SAFETY."*

.5 Add new Paragraph 3.7.7 as follows: *"The Contractor shall involve the Consultant in any communications with the Subcontractors or Suppliers related to GC 3.5 - CONSTRUCTION SCHEDULE and PART 6 - CHANGES IN THE WORK. The Consultant may discuss issues directly with the Subcontractors and Suppliers related to GC 3.5 - CONSTRUCTION SCHEDULE and PART 6 - CHANGES IN THE WORK , however, the Consultant shall not direct or supervise the Work."*

.6 Add new Paragraph 3.7.8 as follows: *"The Contractor shall enter into contracts or written agreements with Subcontractors for the Subcontracts identified in the Contract Documents. Such Subcontractors may be union or non-union affiliated. The Contractor shall not be party to any agreement that would prevent them from entering into such Subcontracts."*

1.7 GC 3.8 - LABOUR AND PRODUCTS

.1 Add new Paragraph 3.8.3 as follows: *"The Contractor will cooperate with the Owner to avoid labour complications and will employ workers whose presence and work will be acceptable to, and be in harmony with, other workers employed on the Work, and under conditions satisfactory to the Owner. In the event of labour difficulties resulting from the employment of workers by the Contractor or by the presence of the Contractor on the Project, the Contractor will make any necessary arrangements as required by the Owner in order to prevent delays and additional expense to the Owner."*

.2 Add new Paragraph 3.8.4 as follows: *"The Contractor is responsible for the safe on-site storage of Products and their protection (including Products supplied by the Owner) in such a way to avoid dangerous conditions or contamination to the Products or other person or property."*

1.8 GC 4.1 - CASH ALLOWANCES

.1 Delete Paragraph 4.1.1 in its entirety.

.2 Revise Paragraph 4.1.6 by deleting the phrase *"... and the Guaranteed Maximum Price ..."*.

.3 Add new Paragraph 4.1.8 as follows: *"Unexpended Cash Allowances will be deducted from the Contract Price."*

1.9 GC 5.2 - ACCOUNTING AND AUDIT

.1 Revise Paragraph 5.2.1 by replacing the phrase "... Cost of the Work as in accordance with Article A-3 - CONTRACT DOCUMENTS." with *"... payments under the Contract."*

.2 Revise Paragraph 5.2.2 by replacing the phrase "... Cost of the Work ..." with *"... payments under the Contract ..."*.

1.10 GC 5.3 - APPLICATIONS FOR PROGRESS PAYMENT

.1 Revise Paragraph 5.3.1 to read as follows: *"The Contractor shall make monthly applications for payment on account as provided in Article A-8 of the Agreement - PAYMENT as the Work progresses."*

1.11 GC 5.4 - PROGRESS PAYMENT

.1 Revise Subparagraph 5.4.1.3 to read as follows: *"The Owner shall make payment to the Contractor on account as provided in Article A-8 of the Agreement - PAYMENT no later than fourteen calendar days after the date of a certificate for payment by the Consultant."*

.2 Add a new Paragraph 5.4.2 as follows: *"The Contractor shall make payments to the Subcontractors and Suppliers in the amounts certified as payable by the Consultant, no later than twenty calendar days after the date of the certificate for payment."*

1.12 GC 5.5 - SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Add new Paragraph 5.5.4 as follows: *"The Contractor's application for a Certificate of Substantial Performance of the Work shall, without limiting the foregoing, include the following:*

.1 A written statement to the Owner and the Consultant stating that:
.1 The Contract is substantially performed,
.2 The performance of the balance of the Contract is in process, and identifying the date when this Work will be completed. Where portions of the Contract can not be completed forthwith for reasons beyond the Contractor's control, the Contractor shall indicate completion dates for each outstanding portion of the Work."

.2 A statement showing the amount of holdback monies due for release and payment following the issue of the Certificate of Substantial Performance of the Work.

.3 A statement of completion with the cost value of:
.1 the portion of the Work to be completed, including any defective work or work not performed as provided in the Contract Documents.
.2 portions of the Work which can not be performed for reasons beyond the control of the Contractor.

.4 The submission of all data, operating instructions, maintenance manuals, record drawings, spare parts and materials, evidence of all tests, instructions to Owner's representatives, warranties and any other such documents to enable the Owner to operate and maintain the Project."

.2 Add new Paragraph 5.5.5 as follows: *"When making an application for Substantial Performance of the Work, the Contractor shall submit to the Consultant all specified warranties, bonds, maintenance manuals, records, certificates and a Statutory Declaration in a form acceptable to the Consultant, signed by the Contractor, stating that all material, work and services in connection with the Contract have been paid in full, up to the holdback, and that no liens exist, including a receipt from each Subcontractor and Supplier, stating that it has been paid in full up to the holdback for all services and materials supplied in connection with this Contract, and such other statements as the Owner and Consultant may require."*

1.13 GC 5.8 - FINAL PAYMENT

.1 Revise Paragraph 5.8.4 by replacing the words *"... five calendar days ..."* to read *"... fourteen calendar days ..."*.

.2 Add new Paragraph 5.8.5 as follows: *"Subject to the lien legislation applicable to the Place of the Work, the Contractor shall make payments to the Subcontractors and Suppliers in the amounts certified as payable by the Consultant, no later than twenty calendar days after the date of the certificate for payment."*

1.14 GC 6.2 - CHANGE ORDER

.1 Revise Paragraph 6.2.1 by deleting the phrase *"... GMP or the Target Contract Price; ..."* and replacing it with *"... Contract Price; ..."*.

.2 Revise Paragraph 6.2.2 by deleting the phrase *"... GMP, Target Contract Price, ..."* and replacing it with *"... Contract Price ..."*.

.3 Add new Paragraph 6.2.3 as follows: *"The value of a change to the Contractor's Fee shall be charged as a percentage of the actual increase to the Cost of the Work, as follows:*
.1 On additional work performed by the Contractor's own forces: 5 percent;
.2 On additional work performed by Owner-Nominated Subcontractors and Suppliers: 0 percent; and
.3 On additional work performed by Contractor-appointed Subcontractors and Suppliers: 5 percent."

1.15 GC 6.3 - CHANGE DIRECTIVE

.1 Revise paragraph 6.3.1 by deleting the phrase *"... in the GMP, in the Target Contract Price, ..."* and replacing it with *"... in the Contract Price, ..."*.

.1 Revise paragraph 6.3.7 by deleting the phrase *"... to the GMP, to the Target Contract Price, ..."* and replacing it with *"... to the Contract Price, ..."*.

.2 Add new Paragraph 6.3.8 as follows: *"The value of a change to the Contractor's Fee shall be charged as a percentage of the actual increase to the Cost of the Work, as follows:*
.1 On additional work performed by the Contractor's own forces: 5 percent;
.2 On additional work performed by Owner-Nominated Subcontractors and Suppliers: 0 percent; and
.3 On additional work performed by Contractor-appointed Subcontractors and Suppliers: 5 percent."

1.16 GC 7.2 - CONTRACTOR'S RIGHT TO TERMINATE CONTRACT

.1 Add new Paragraph 7.2.6 as follows: *"If the Contractor stops the Work or terminates the Contract as provided for in the preceding paragraphs, he shall ensure that the Place of the Work and the Work are left and maintained in a secure and safe condition as required by authorities having jurisdiction and these Contract Documents."*

1.17 GC 9.1 - PROTECTION OF WORK AND PROPERTY

.1 Add new Paragraph 9.1.5 as follows: *"Should there be a stoppage of the Work, for any cause, the Contractor shall assume all responsibility for protecting the Work and Provide and maintain security to the Work and the Place of the Work during such periods, with appropriate adjustments being made to the Contractor's Fee and Contract Time when it can be proven that the stoppage of the Work was not caused by any action or lack of action on the part of the Contractor."*

1.18 GC 9.4 - CONSTRUCTION SAFETY

.1 Amend Paragraph 9.4.1 by deleting the phrase *"Subject to paragraph 3.2.3.4 of GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS"*.

.2 Add new Paragraph 9.4.2 as follows: *"The Contractor shall comply and cause all of its Subcontractors and Suppliers to comply with all applicable provisions, requirements, and safety standards of the Ontario Occupational Health and Safety Act and regulations thereto. The Contractor shall be designated and hereby accepts the responsibilities and designation as "constructor" under the Occupational Health and Safety Act on the project and hereby assumes all liabilities and obligations imposed on a "constructor" by the Occupational Health and Safety Act"*.

.3 Add new Paragraph 9.4.3 as follows: *"Prior to commencement of the Work, the Contractor shall submit to the Owner:*
.1 Documentation of a valid Workplace Safety and Insurance Board clearance certificate and confirmation of the Contractor's WSIB CAD-7 performance rating.
.2 Documentation of the Contractor's insurance coverage.
.3 Documentation of the Contractor's safety-related programs for the Project.
.4 A copy of the Notice of Project filed with the Ministry of Labour."

.4 Add new Paragraph 9.4.4 as follows: *"The Contractor hereby represents and warrants to the Owner that appropriate health and safety instruction and training has been provided and will be provided to the Contractor's employees before the Work is commenced and agrees to provide to the Owner and Consultant satisfactory proof of such instruction and training. The Contractor further undertakes to verify that other contractors and the Owner's own forces have received appropriate health and safety instruction and training in accordance with GC 3.2."*

.5 Add new Subparagraph 9.4.4.1 as follows: *"The Contractor shall require proof from the Subcontractors and Suppliers that appropriate health and safety instruction and training has been provided to the Subcontractor's and Supplier's employees before the Work is commenced. This information will be kept on file at the site."*

.6 Add new Paragraph 9.4.5 as follows: *"The Contractor shall tour the appropriate area to familiarize itself with the job site prior to the commencement of the Work"*,

.7 Add new Paragraph 9.4.6 as follows: *"The Contractor shall never work in a manner that may endanger anyone"*.

.8 Add new Paragraph 9.4.7 as follows: *"The Contractor shall indemnify and save harmless the Owner, together with the Owner's agents, officers, directors, employees, consultants, successors and assigns, from and against any and all safety infractions under the Ontario Occupational Health and Safety Act*, *and regulations thereto including the payment of all legal fees on a solicitor and client basis."*

.9 Add new Paragraph 9.4.8 as follows: *"The Contractor shall ensure that its employees, Subcontractors and Suppliers comply with the foregoing conditions"*.

1.19 GC 10.1 - TAXES AND DUTIES

.1 Add new Paragraph 10.1.2 as follows: *"With respect to taxes and duties, the Contractor shall, at the request of the Owner, assist, join in, or at the Owner's expense, make application on behalf of the Owner for any exemption, recovery or refund. The Contractor shall provide the Owner with copies, or, where required original of records, invoices, purchase orders or other documentation as may be necessary to support such application."*

.2 Add new Paragraph 10.1.3 as follows: *"Any amount included in the Contract or any Subcontract for tax or duty, whether or not paid, which is found to be inapplicable or for which a refund is obtained shall become the sole and exclusive property of the Owner."*

1.20 GC 10.2 - LAWS, NOTICES, PERMITS & FEES

.1 Add to Paragraph 10.2.2 as follows: *"The Contractor shall take all necessary steps to obtain the occupancy permit, including delivering any notice of completion of the building required by the authorities having jurisdiction."*

.2 Add new Paragraph 10.2.8 as follows: *"The Contractor's or its Subcontractor's or Supplier's compliance with statutes or regulations made thereunder or by-laws shall not relieve them of obligations set out in the Contract Documents which may be more extensive than the requirements of those statutes, regulations or by-laws."*

1.21 GC 11.1 - INSURANCE

.1 Delete Subparagraph 11.1.1.1 in its entirety and replace with the following: *"General liability insurance shall be in the joint names of the Contractor, the Owner, the Consultant, and any and all Subcontractors and subconsultants involved in the Work, with limits not less than $10,000,000 per occurrence and with a property damage deductible not exceeding $10,000. The insurance coverage shall include at least the following extensions: Premises, Property and Operations; Occurrence basis, Owners/Contractors protective, Products and Completed Operations; Blanket Contractual; Employees as Additional Insureds; Broad Form Property Damage; Broad Form Loss of Use; Personal Injury; Incidental Malpractice; Contingent Employers Liability; Cross Liability/Severability of Interests; Non-Owned Automobile Liability including Endorsement Form 96; Intentional Injury to protect persons or property, X-plate/unlicensed/specially licensed vehicles; Attached Machinery; Hostile fire exception to any pollution exclusion; Voluntary Medical Payments. To achieve the desired limit, umbrella or excess liability insurance may be used. All liability coverage shall be maintained for the completed operations hazard from the date of Substantial Performance of the Work, for 24 months following. The Policy shall be endorsed to provide the named insureds with not less than 30 days notice in writing in advance of any cancellation or change or amendment restricting coverage."*

.2 Delete Subparagraph 11.1.1.2 in its entirety.

.3 Delete Subparagraph 11.1.1.3 in its entirety.

.4 Delete Subparagraph 11.1.1.4 in its entirety.

.5 Delete Subparagraph 11.1.1.5 in its entirety.

.6 Delete Subparagraph 11.1.1.6 in its entirety.

.7 Delete Subparagraph 11.1.1.7 in its entirety.

.8 Add new Paragraph 11.1.7 as follows: *"Notwithstanding the fact that a claim has been made under any insurance policy described in GC 11.1, the Contractor shall continue to perform its obligations under the Contract ."*

1.22 GC 11.2 - CONTRACT SECURITY

~~.1 Add new Paragraph 11.2.3 as follows: *"The Contractor shall obtain and submit a Performance Bond in the name of the Owner for Fifty Percent (50%) of the Contract Price, to assure the faithful performance of the Contract, including corrections to the Work required under GC 12.3 - Warranty; on Ontario Construction Act Form 32, Performance Bond Under Section 85.1 of the Act."*~~

~~.2 Add new Paragraph 11.2.4 as follows: *"The Contractor shall also obtain and submit a Labour and Material Payment Bond in the name of the Owner for Fifty Percent (50%) of the Contract Price, to assume faithful payment of monies to parties in contract with the Contract; on Ontario Construction Act Form 31, Labour and Material Payment Bond Under Section 85.1 of the Act."*~~

1.23 GC 12.3 - WARRANTY

.1 Add new Paragraph 12.3.7 as follows: *"Should the Work be delayed due to conditions beyond the control of the Contractor, the warranty period shall commence at the time of acceptance of the Work by the Owner."*

.2 Add new Paragraph 12.3.8 as follows: "*Where warranty repairs on such parts or portions of the Work become necessary, the Consultant will notify the Contractor which Subcontractor or Supplier is responsible to rectify the defective work or work not performed as provided in the Contract Documents."*

END OF DOCUMENT

A1-1 PROJECT MANUAL – 00 73 03 SUPPLEMENTARY CONDITIONS

.1 Delete items 1.22.1 and 1.22.2.

.2 Add the following:

.1 SC01 GENERAL shall obtain and submit a Performance Bond in the name of the Owner for $2,500,000 to assure the faithful performance of the Contract, including corrections to the Work required under GC 12.3 – Warranty, on Ontario Construction Act Form 32, Performance Bond Under Section 85.1 of the Act".

.2 SC01 GENERAL shall obtain and submit a Labour and Material Payment Bond Bond in the name of the Owner for $2,500,000 to assume faithful payment of monies to parties I contract with the Contract; on Ontario Construction Act Form 31, Labour and Material Payment bond Under Section 85.1 of the Act".

A1-2 PROJECT MANUAL – 00 73 03 SUPPLEMENTARY SUBCONTRACT CONDITIONS

.1 Add the following:

1.24 SCC 11.2 CONTRACT SECURITY

.1 SC03 MECHANICAL shall obtain and submit a Performance Bond in the name of the Owner for Fifty Percent (50%) of the subcontract price to assure the faithful performance of the Contract, including corrections to the Work required under GC 12.3 – Warranty, on Ontario Construction Act Form 32, Performance Bond Under Section 85.1 of the Act".

.2 SC03 MECHANICAL shall obtain and submit a Labour and Material Payment Bond Bond in the name of the Owner for for Fifty Percent (50%) of the subcontract price to assume faithful payment of monies to parties I contract with the Contract; on Ontario Construction Act Form 31, Labour and Material Payment bond Under Section 85.1 of the Act".

1 Supplements to Subcontract Conditions

1.1 SCC 1.1 - DOCUMENTS

.1 Delete Subparagraph 1.1.7.2 in its entirety.

.2 Revise Paragraph 1.1.8 as follows: *"The Consultant shall provide the Subcontractors, without charge, ..."*

.3 Add new Paragraph 1.1.9 as follows: *"The location of fixtures, outlets, conduit, piping and any other locations shown or specified but not dimensioned shall be considered approximate. The actual location shall be as approved by the Consultant and as required to suit job conditions."*

1.2 SCC 2.2 - REVIEW AND INSPECTION OF THE WORK

.1 Revise Paragraph 2.2.2 as follows: *"... the Subcontractor shall give the Contractor and Consultant timely notice requesting inspection."*

1.3 SCC 2.3 - DEFECTIVE WORK

.1 Revise Paragraph 2.3.1 as follows: *"The Subcontractor shall within 5 Working Days remove from the Place of the Work and Make Good defective work that has been rejected by the Contractor or Consultant as failing to conform to the Contract Documents ...".*

1.4 SCC 3.4 - SUB-SUBCONTRACTORS

.1 Revise Subparagraph 3.4.1.3 as follows: *"be as fully responsible to the Contractor, Owner and Consultant for acts and omissions of Sub-Subcontractors and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the Subcontractor."*

.2 Revise Paragraph 3.4.6 as follows: *"The Contractor or Consultant may provide to a Sub-Subcontractor information as to the percentage ...".*

1.5 SCC 3.5 - SHOP DRAWINGS

.1 Revise Paragraph 3.5.2 as follows: *"The Consultant shall determine the number of copies of Shop Drawings ...the Subcontractor shall notify the Contractor and Consultant in writing of any deviations ...".*

1.6 SCC 3.7 - CUTTING AND REMEDIAL WORK

.1 Revise Paragraph 3.7.3 as follows: *"... nor alter the work of any others without the Contractor's and Consultant's written consent, where such member, existing work or other work is apparent from the Subcontract Documents, reasonable examination or instruction of the Consultant."*

.2 Add a new Paragraph 3.7.6 as follows: *"Each Subcontractor shall make allowances in his own work to accommodate other Subcontractor's work. The Contractor shall coordinate the cutting and remedial work amongst Subcontractors such that all pieces come together properly."*

1.7 SCC 4.1 - CASH ALLOWANCES

.1 Revise Paragraph 4.1.3 to read as follows: *"Expenditures under cash allowances shall be authorized by the Consultant."*

1.8 SCC 5.1 - APPLICATIONS FOR PAYMENT

.1 Revise Paragraph 5.1.2 as follows: *"The Subcontractor shall submit to the Contractor for the Consultant's approval before the first application ..."*

.2 Revise Paragraph 5.1.3 as follows: *"... supported by such evidence as the Consultant may reasonably direct and when accepted by the Contractor, with the approval of the Consultant, shall ..."*

.3 Add new Paragraph 5.1.6 as follows: *"Each application for payment must include the Subcontractor's GST Registration number."*

.4 Add new Paragraph 5.1.7 as follows: *"The Subcontractor shall submit with every application for payment, a "Certificate of Standing" from the Workplace Safety & Insurance Board (WSIB) stating that the Subcontractor has complied with the requirements of the Workers' Compensation Act and is in good standing as of the date of the Certificate."*

1.9 SCC 6.1 - CONTRACTOR'S RIGHT TO MAKE CHANGES

.1 Revise Paragraph 6.1.1 as follows: *"The Contractor, with the approval of the Consultant, and without invalidating the Subcontract, may make changes ...".*

.2 Add new Paragraph 6.1.3 as follows: *"The Subcontractor shall respond to requests for information pertaining to Changes within 10 Working Days of receipt of such requests."*

1.10 SCC 6.2 - CHANGE ORDER

.1 Revise Paragraph 6.2.2 as follows: *"When the Contractor, with the approval of the Consultant, and the Subcontractor agree ..."*

.2 Add new Paragraph 6.2.3 as follows: *"The value of a change shall be determined by actual credits and cost to the Subcontractor. Where additional work is required, the value of the change shall be the actual cost plus a percentage covering overhead and profit, after all credits included in the change have been deducted. The following percentage fee for overhead and profit shall be applied to additional work:*

.1 On work performed by the Subcontractor's own forces: the Subcontractor may charge a maximum of 5 percent combined percentage for overhead and profit;

.2 On work performed by Sub-Subcontractors, the Sub-Subcontractors may charge a maximum of 5 percent combined percentage for overhead and profit; and

.3 On work performed by Sub-Subcontractors, the Subcontractor may charge a maximum of 5 percent combined percentage for overhead and profit on work performed by the Sub-Subcontractors."

1.11 SCC 6.3 - CHANGE DIRECTIVE

.1 Revise Paragraph 6.3.1 as follows: Insert *"... prior to the Contractor receiving the approval of the Consultant..."*

.2 Revise Paragraph 6.3.6 as follows: *"The value of a change shall be determined by actual credits and cost to the Subcontractor. Where additional work is required, the value of he change shall be the actual cost plus a percentage covering overhead and profit, after all credits included in the change have been deducted. The following percentage fee for overhead and profit shall be applied to additional work:*

.1 On work performed by the Subcontractor's own forces: the Subcontractor may charge a maximum of 5 percent combined percentage for overhead and profit;

.2 On work performed by Sub-Subcontractors, the Sub-Subcontractors may charge a maximum of 5 percent combined percentage for overhead and profit; and

.3 On work performed by Sub-Subcontractors, the Subcontractor may charge a maximum of 5 percent combined percentage for overhead and profit on work performed by the Sub-Subcontractors."

.3 Revise Subparagraph 6.3.7.1 as follows: *"... under a salary or wage schedule approved by the Contractor and the Consultant, or in the absence ..."*

.4 Revise Paragraph 6.3.12 as follows: *"If the Contractor, does not have the approval of the Consultant or the Contractor and the Subcontractor do not agree ..."*.

.5 Revise Paragraph 6.3.13 as follows: *"When the Contractor, with the approval of the Consultant, and the Subcontractor reach an agreement on the adjustment to the Subcontract Price and to the Subcontract Time...."*

1.12 SCC 6.4 - CONCEALED OR UNKNOWN CONDITIONS

.1 Revise Paragraph 6.4.1 as follows: *"... shall notify the other party and the Consultant ..."*.

.2 Revise Paragraph 6.4.2 as follows: *"The Contractor and the Consultant will promptly investigate such conditions and the Consultant will make a finding.... "*

.3 Revise Paragraph 6.4.3 as follows: *"If the Consultant finds that the conditions ... are not materially different ... the Consultant shall report the reasons for his finding to the Contractor and Subcontractor in writing."*

1.13 SCC 6.5 - DELAYS

.1 Revise Paragraph 6.5.1 as follows: *"... then the Subcontract Time shall be extended for such reasonable time as the Contractor, with the approval of the Consultant and the Subcontractor shall agree that the Subcontract Work was delayed. The Subcontractor shall be reimbursed for reasonable costs incurred by the Subcontractor as a result of such delay."*

.2 Revise Paragraph 6.5.2 as follows: *"... then the Subcontract Time shall be extended for such reasonable time as the Contractor, with the approval of the Consultant and Subcontractor shall agree that the Subcontract Work was delayed. The Subcontractor shall be reimbursed for reasonable costs incurred by the Subcontractor as a result of such delay."*

.3 Revise Paragraph 6.5.4 as follows: *"... unless notice in writing of claim is given to the Contractor and Consultant not later than ..."*.

.4 Revise Paragraph 6.5.5 as follows: *"... no request for extension shall be made as a result of failure of the Contractor or Consultant to furnish instructions ..."*.

1.14 SCC 7.2 - SUBCONTRACTOR'S RIGHT TO STOP THE SUBCONTRACTS WORK OR TERMINATE THE SUBCONTRACTS

.1 Revise Paragraph 7.2.1 as follows "...*terminate the Subcontract and such notice shall be provided to the Consultant.*"

.2 Revise Paragraph 7.2.2 as follows: "...*terminate the Subcontract and such notice shall be provided to the Consultant."*

.3 Revise Paragraph 7.2.3 to read as follows: *"The Subcontractor may notify the Contractor in writing that the Contractor is in default of their contractual obligation if payment is not received as stated in Article 4 of the Subcontract Agreement - PAYMENT and the Subcontractor shall provide a copy of such notice to the Consultant"*

.4 Revise Paragraph 7.2.4 by deleting the phrase *"... to the Contractor ..."*. Add a new Sentence to read as follows: *"The Owner may remedy the Contractor's default and the Subcontractor agrees to continue to complete the Subcontract Work for the Owner or a new Contractor nominated by the Owner"*.

1.15 SCC 9.2 - TOXIC OR HAZARDOUS SUBSTANCES AND MATERIALS

.1 Revise the last sentence in Paragraph 9.2.2 as follows: *"The expert's report shall be delivered to the Consultant, the Contractor and the Subcontractor."*

.2 Revise Subparagraph 9.2.3.3 as follows: *"extend the Subcontract Time for such reasonable time as the Contractor, with the approval of the Consultant, and in consultation with the Subcontractor ..."*.

1.16 SCC 9.4 - CONSTRUCTION SAFETY

.1 Add new Paragraph 9.4.2 as follows: *"Prior to commencement of the Work, the Subcontractor shall submit to the Contractor:*

.1 Documentation of a valid Workplace Safety and Insurance Board clearance certificate and confirmation of the Subcontractor's WSIB CAD-7 performance rating.
.2 Documentation of the Subcontractor's insurance coverage.
.3 Documentation of the Subcontractor's safety-related programs for the Project.
.4 A copy of the Subcontractor's Form of Notification."

1.17 SCC 9.5 - MOULD

.1 Revise the last sentence in Subparagraph 9.5.1.3 as follows: *"The expert's report shall be delivered to the Consultant, the Contractor and the Subcontractor."*

.2 Revise Subparagraph 9.5.2.3 as follows: *"extend the Subcontract Time for such reasonable time as the Contractor, with the approval of the Consultant, and in consultation with the Subcontractor ..."*.

1.18 SCC 10.1 - TAXES AND DUTIES

.1 Add new Paragraph 10.1.3 as follows: *"With respect to taxes and duties, the Subcontractor shall, at the request of the Contractor, assist, join in, or at the Contractor's expense, make application on behalf of the Contractor for any exemption, recovery or refund. The Subcontractor shall provide the Contractor with copies, or, where required original of records, invoices, purchase orders or other documentation as may be necessary to support such application."*

.2 Add new Paragraph 10.1.4 as follows: *"Any amount included in the Subcontract for tax or duty, whether or not paid, which is found to be inapplicable or for which a refund is obtained shall become the sole and exclusive property of the Contractor."*

1.19 SCC 10.2 - LAWS, NOTICES, PERMITS & FEES

.1 Revise Paragraph 10.2.5 as follows: *"... the Subcontractor shall notify the Contractor and Consultant in writing requesting direction immediately upon such variance or change becoming known. The Consultant will make the changes required to the Contract Documents..."*.

.2 Revise Paragraph 10.2.6 as follows: *"If the Subcontractor fails to notify the Contractor and the Consultant in writing; and ..."*.

.3 Add new Paragraph 10.2.8 as follows: *"The Contractor's and Subcontractor's compliance with statutes or regulations made thereunder or by-laws shall not relieve them of obligations set out in the Contract Documents which may be more extensive than the requirements of those statutes, regulations or by-laws."*

1.20 SCC 11.1 - INSURANCE

.1 Revise Paragraph 11.1.1 as follows: *"Without restricting the generality of SCC 12.1 - INDEMNIFICATION, the Contractor will arrange for a project specific 'Wrap-up Liability' policy in the amounts of not less than $10,000,000 per occurrence with a property damage deductible not exceeding $10,000 on behalf of, and indemnification of the Owner, the Consultants, the*

Contractor, the Subcontractors, and any other parties as instructed by the Owner. The Subcontractor shall be responsible for the following insurance policies:

.1 "Subcontractor's Equipment Insurance covering construction machinery and equipment used by the Subcontractor for the performance of the Work. Such insurance shall be on an 'all risks' basis and be endorsed to provide the Consultant and the Owner with not less than 30 days notice in writing in advance of any cancellation, and of any change or amendment restricting coverage.

.2 "Automobile liability insurance in respect of licensed vehicles with limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property, and covering all licensed vehicles owned or leased by the Subcontractor. This automobile liability insurance shall be endorsed to provide the Consultant and the Owner with not less than 30 days notice in writing in advance of any cancellation, and of any change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile system, the Subcontractor shall provide the Owner with confirmation of automobile insurance coverage for all automobiles registered in the name of the Subcontractor."

1.21 SCC 12.1 - INDEMNIFICATION

.1 Add new Paragraph 12.1.7 as follows: "*The Subcontractor shall indemnify and hold harmless the Contractor, the Owner, and the Consultant, their agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings (hereinafter called "claims"), suffered or incurred on account of any obligation or a provision in the Subcontract Documents, or attributable to, the Subcontractor's performance of the Subcontract. The Subcontractor assumes towards the Contractor all the obligations and responsibilities that Contractor assumes towards Owner as set forth in the Contract Documents, insofar as applicable, generally or specifically, to the materials to be furnished and the Work to be performed under this Subcontract".*

1.22 SCC 12.3 - WARRANTY

.1 Add new Paragraph 12.3.7 as follows: *"Should the Work be delayed due to conditions beyond the control of the Subcontractor, the warranty period shall commence at the time of acceptance of the Work by the Owner."*

END OF DOCUMENT

1 General

1.1 PROJECT DESCRIPTION

.1 Work of Contractor package and several separate Subcontract packages to be performed under a single Cost Plus Contract comprises the Project, known as:

Construction of the
NELSON H.S. RENOVATIONS

located at:
4181 New Street,
Burlington, Ontario;

and further identified as:
HDSB RFT # 24-058-02, and
SAi Project No.: 2323.

1.2 CONTRACT DOCUMENTS

.1 Refer to CCDC 3, GC 1.1 and CCA 1, SCC 1.1.

.2 Contract Documents were prepared by Consultant for the account of Owner. Information contained herein reflects Consultant's best judgement in light of information available to Consultant at time of preparation. Any use which a third party makes of Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. Consultant accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on Contract Documents.

.3 Specifications are written in imperative mood in an abbreviated form. Imperative language of the Specifications is directed to Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on Drawings. The words "shall be" will be supplied by inference where a colon (:) is used within sentences and phrases. Except where worded to the contrary, fulfil and perform indicated requirements whether stated imperatively or otherwise.

1.3 CONTRACT METHOD

.1 Single Construction Contract: Contractor shall construct the Work under a CCDC 3, Cost Plus contract.

.2 Throughout execution of the Project, Consultant may bid portions of the Project and nominate Subcontractors, whose parts or portions of the Project will be incorporated as part of this Contract to make up the Work.

.3 Consultant will prepare stipulated price CCA 1 Subcontracts for execution between Contractor and Subcontractors.

.4 Refer to Supplementary Conditions and Supplementary Subcontract Conditions for information pertaining to contractual relationship between Contractor and Subcontractors.

1.4 ADMINISTRATIVE / PROCEDURAL SECTIONS APPLICABLE TO ALL CONTRACTS AND SUBCONTRACTS

.1 Section 01 12 00 - Multiple Contract Summary

.2 Section 01 21 00 - Allowances

.3 Section 01 23 00 - Alternatives

.4 Section 01 25 00 - Substitution Procedures

.5 Section 01 26 00 - Contract Modification Procedures

.6 Section 01 31 00 - Project Management and Coordination

.7 Section 01 32 00 - Construction Progress Documentation

.8 Section 01 33 00 - Submittal Procedures

.9 Section 01 35 00 - Special Procedures

.10 Section 01 40 00 - Quality Requirements

.11 Section 01 60 00 - Product Requirements

.12 Section 01 71 00 - Examination and Preparation Procedures

.13 Section 01 73 00 - Execution

.14 Section 01 73 29 - Cutting and Patching

.15 Section 01 74 00 - Cleaning and Waste Management

.16 Section 01 75 00 - Starting and Adjusting

.17 Section 01 76 00 - Protecting Installed Construction

.18 Section 01 77 00 - Closeout Procedures

.19 Section 01 78 00 - Closeout Submittals

.20 Section 01 79 00 - Demonstration and Training

1.5 CONTRACT C00 - CONTRACTOR

.1 Assume total control of the Works of the Project. Be responsible for coordination, sequencing and scheduling of work of all Subcontracts, ensure conformity with Contract Documents.

.2 Assume sole responsibility for construction means, methods, techniques, sequences and procedures, including site usage; provision of temporary utilities, facilities and services; quality control and coordination of testing and inspection services; and site administration.

.3 Fulfill role of "constructor" as defined by Ontario Occupational Health and Safety Act (Construction Projects). File required Notice of Project and carry out and enforce the provisions of the Act and requirements of Project Health and Safety Policy.

.4 Report directly to Consultant.

.5 Conduct site management duties for duration of the Project, including field engineering services necessary to layout Project and ensure accurate working lines and levels for Subcontract Work. Refer to Section 01 71 00.

.6 Appoint a single supervisor for duration of Contract, until completion of Contract. Refer to GC 3.6 - Supervision.

.7 Arrange for minimum one labourer to be present at Place of the Work each Working Day until completion of Contract.

.8 Arrange and pay for publication of Project's Certificate of Substantial Performance of the Work.

.9 Monitor site cleanliness on a daily basis and ensure conformance to requirements of authorities having jurisdiction with respect to waste audits and waste reduction work plans. Provide waste containers at Place of the Work, and arrange for periodic waste removal as necessary until completion of Contract.

1.6 COMMON REQUIREMENTS APPLICABLE TO SUBCONTRACTORS

.1 Report directly to Contractor on matters pertaining to execution of the Work.

.2 Provide and perform the following:
- .1 Electrical extension cords from distribution sources, work lights and any special power required for Subcontract Work.
- .2 Separate telephone service required for Subcontract Work.
- .3 Water hoses required for Subcontract Work.
- .4 Field offices and sheds required for Subcontract Work.
- .5 Cleaning of Subcontract Work; delivery of debris to collection.

.3 Maintain site cleanliness on a daily basis as applicable to Subcontract and ensure conformance to requirements of authorities having jurisdiction with respect to waste audits and waste reduction work plans.

.4 Sections listed as part of a particular Subcontract package may include work described under other Sections. When referenced as a Related Section, include such portions of the Work as part of that particular Subcontract.

.5 Include the following:
- .1 Division 00 - Procurement and Contracting Requirements
  - .1 00 52 11 - Subcontract Agreement
  - .2 00 71 11 - Subcontracting Definitions
  - .3 00 72 11 - Subcontract Conditions
  - .4 00 73 11 - Supplementary Subcontract Conditions.
- .2 Division 01 - General Requirements
  - .1 Administrative / procedural sections applicable to all contracts as listed above.

1.7 SUBCONTRACT SC01 - GENERAL

.1 Provide and maintain Project temporary utilities, temporary facilities and temporary controls as specified in Section 01 50 00.

.2 Perform Project final cleaning as specified in Section 01 74 00.

.3 Include the following:
- .1 Division 03 - Concrete
  - .1 Cast-in-place concrete, including forming, accessories, reinforcing and finishing as noted on Drawings.
  - .2 03 35 46 - Concrete Topical Treatments
- .2 Division 04 - Masonry
  - .1 04 00 00 - Masonry
- .3 Division 05 - Metals
  - .1 05 50 00 - Metal Fabrications
- .4 Division 06 - Wood, Plastics and Composites
  - .1 06 10 00 - Rough Carpentry
  - .2 06 20 00 - Finish Carpentry
  - .3 06 24 00 - High Pressure Decorative Laminate
  - .4 06 41 00 - Architectural Wood Casework
- .5 Division 07 - Thermal and Moisture Protection
  - .1 07 21 00 - Thermal Insulation (except for roofing applications)
  - .2 07 26 00 - Vapour Retarders (except for roofing applications)
  - .3 07 27 00 - Air Barriers
  - .4 07 81 00 - Applied Fireproofing
  - .5 07 84 00 - Firestopping
  - .6 07 92 00 - Joint Sealants

.6 Division 08 - Openings
.1 08 31 00 - Access Doors and Panels
.2 08 81 13 - Interior Glass Glazing
.3 08 90 00 - Louvers and Vents
.7 Division 10 - Specialties
.1 10 11 00 - Visual Display Surfaces
.2 10 14 00 - Signage
.3 10 51 13 - Metal Lockers
.8 Division 12 - Furnishings
.1 12 24 13.16 - Manual Roller Window Shades.

1.8 SUBCONTRACT SC02 - DEMOLITION AND ABATEMENT

.1 This Subcontract has been previously bid by Owner and has been awarded to Gardiner Environmental Services.

1.9 SUBCONTRACT SC03 - MECHANICAL

.1 Include the following:
.1 Division 20
.1 20 05 01 - Supplementary Mechanical Bid Form
.2 20 05 05 - Mechanical Work General Instructions
.3 20 05 10 - Basic Mechanical Materials and Methods
.4 20 05 20 - Mechanical Vibration Control
.5 20 05 25 - Mechanical Insulation
.6 20 05 35 - Demolition and Revision Work
.7 20 05 40 - Mechanical Work Commissioning
.8 20 05 50 - Testing, Adjusting and Balancing
.9 20 05 55 - Firestopping and Smoke Seal Systems
.2 Division 22 - Plumbing
.1 22 13 00 - Drainage and Vent Piping and Specialties
.3 Division 23 - Heating, Ventilating, and Air Conditioning
.1 23 11 23 - Natural Gas Piping System
.2 23 21 00 - Hydronic Piping Specialties and Pumps
.3 23 30 00 - HVAC Air Distribution
.4 23 33 65 - Energy Recovery Ventilators
.5 23 70 00 - Rooftop Units
.6 23 82 19 - Unit Ventilators
.4 Division 25 - Integrated Automation
.1 25 05 01 - Supplementary Controls Bid Form
.2 25 09 23 - Direct Digital Control System.

1.10 SUBCONTRACT SC04 - ELECTRICAL

.1 Include the following:
.1 Division 26 - Electrical
.1 26 05 00 - Form of Supplementary Electrical Tender
.2 26 05 01 - Electrical Work General Instructions
.3 26 05 21 - Wires and Cables
.4 26 05 28 - Grounding
.5 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets
.6 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings
.7 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
.8 26 08 10 - Access Panels
.9 26 08 20 - Electric Heating System
.10 26 08 30 - Pipe Tracing System
.11 26 08 40 - Building Automation System
.12 26 12 17 - Dry Type Transformer
.13 26 24 16 - Panel Boards

.14 26 24 17 - Power Panels
.15 26 27 26 - Wiring Devices
.16 26 28 13 - Fuses
.17 26 28 23 - Disconnect Switches - Fused and Non-Fused
.18 26 29 01 - Contactors
.19 26 29 10 - Motor Starters
.20 26 50 00 - Lighting
.21 26 50 10 - Lighting Fixture Schedule
.2 Division 27 - Communications
.1 27 11 19 - Structured Cabling for Communication Systems
.2 27 51 16 - Public Address System
.3 Division 28 - Electronic Safety and Security
.1 28 46 00 - Fire Detection and Alarm System
.2 28 46 01 - Fire Detection and Alarm System Verification.

1.11 SUBCONTRACT SC05 - STRUCTURAL STEEL

.1 Include structural steel framing and steel decking as noted on Drawings.

1.12 SUBCONTRACT SC06 - WINDOWS

.1 This Subcontract has been previously bid by Owner and has been awarded to Windspec Inc.

1.13 SUBCONTRACT SC07 - ROOFING

.1 Include the following:
.1 Division 07 - Thermal and Moisture Protection
.1 07 21 00 - Thermal Insulation (roofing applications only)
.2 07 26 00 - Vapour Retarders (roofing applications only)
.3 07 52 00 - Modified Bituminous Membrane Roofing
.4 07 62 00 - Sheet Metal Flashing and Trim.

1.14 SUBCONTRACT SC08 - FLOORING

.1 Include the following:
.1 Division 09 - Finishes
.1 09 65 13 - Resilient Base and Accessories
.2 09 65 00 - Resilient Tile Flooring
.3 09 66 13 - Portland Cement Terrazzo Flooring
.4 09 68 13 - Tile Carpeting.

1.15 SUBCONTRACT SC09 - DRYWALL AND ACOUSTICS

.1 Include the following:
.1 Division 09 - Finishes
.1 09 21 16 - Gypsum Board Assemblies
.2 09 51 23 - Acoustical Tile Ceilings.

1.16 SUBCONTRACT SC10 - PAINTING

.1 Include the following:
.1 Division 09 - Finishes
.1 09 90 00 - Painting and Coating.

1.17 WORK SEQUENCE

.1 Construct the Work in stages to accommodate Owner's continued use of premises during construction.

.2 Each construction stage must be completed and ready for Owner occupancy before the next stage may commence.

.3 Coordinate construction progress schedule and coordinate with Owner occupancy during construction.

.4 Required Stages: As indicated on Drawings.

1.18 CONTRACTOR ACCESS TO AND USE OF PLACE OF THE WORK

.1 Contractor shall limit use of existing facility, including Place of the Work, for execution of the Work, for storage and for access, to allow:
.1 Owner occupancy,
.2 Work by other contractors, and
.3 Public usage.

1.19 OWNER OCCUPANCY OF EXISTING FACILITIES

.1 Owner will occupy existing facilities during entire construction period for execution of normal operations.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.20 PARTIAL OWNER OCCUPANCY OF THE WORK

.1 Owner may temporarily occupy designated areas of the Work for purpose of storing furnishings and equipment, and installing equipment.

.2 In accordance with GC 5.10 - Non-Conforming Work, partial Owner occupancy will not be considered an acceptance of the Work, nor in any way relieve Contractor of responsibility to complete the Work.

1.21 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Refer to GC 5.5 - Substantial Performance of the Work.

.2 Substantial Performance of the Work is required on or before December 12, 2025.

END OF SECTION

1 General

1.1 CASH ALLOWANCES

.1 Refer to GC 4.1 - Cash Allowances.

.2 Upon request, submit to Consultant before submission of final application for payment, certified copies of invoices and statements from Suppliers and Sub-subcontractors furnishing Products or services under a cash allowance.

.3 When a cash allowance is described as including supply only of a Product, affected Subcontractor is responsible for ensuring cost of installation, including connections to facility services, has been included in Subcontract Price.

.4 Amount of each allowance, for Work specified in respective specification Sections:
.1 Subcontract SC01: Include the stipulated sum of $30,000 for the following parts of the Work:
.1 Inspection and testing services as described in Section 01 40 00.
.2 Completion of electronic as-built drawings as described in Section 01 78 00.
.3 Supply and installation of signage as described in Section 10 14 00.

1.2 CONTINGENCY ALLOWANCE

.1 A Subcontract Price may include a contingency allowance when stated in the Contract Documents.

.2 A contingency allowance includes a Subcontractor's overhead and profit in connection with such contingency allowance.

.3 Expenditures under a contingency allowance shall be authorized and valued as provided in SCC 6.1 - Contractor's Right to Make Changes, SCC 6.2 - Change Order and SCC 6.3 - Change Directive.

.4 A Subcontract Price shall be adjusted by Change Order to provide for any difference between the authorized expenditures and the contingency allowance.

.5 Subcontract SC01: Include in Subcontract Price a contingency allowance in the amount of $500,000.

END OF SECTION

A1-3 PROJECT MANUAL – 01 21 00 ALLOWANCES

.1 SC01 : Add the following cash allowances

1.1.4.1.4 Subcontract SC01 Include the stipulated sum of $30,000 for existing projectors to be disconnected, stored and reinstalled with new HDMI as required.

1 General

1.1 INSTRUCTIONS

.1 Drawings stipulate pertinent requirements for Products and methods to achieve work stipulated under each alternative.

.2 Coordinate affected parts of the Work and modify surrounding construction to integrate each alternative.

1.2 DEFINITIONS

.1 In accordance with CCDC 23-2018 - A Guide to Calling Bids and Awarding Construction Contracts, the following terms are defined as follows:
  .1 Alternate Price: The amount stipulated by the bidder for an alternative, which can be stated as an addition, a deduction, or no change to the base Bid Price. Unless incorporated by written agreement prior to the execution of the Agreement, an Alternate Price is not included in the Contract Price.
  .2 Itemized Price: The bidder's price for a specific item of the Work included in the base Bid Price, and is identified for information purposes only. An Itemized Price will not be used to modify the scope of the Work or adjust the base Bid Price.

.2 The out-dated term "Separate Price" is considered synonymous with Alternate Price.

1.3 AWARD / SELECTION OF ALTERNATIVES

.1 Indicate variation to Bid Price for alternatives described below on the bid form supplements. Note that this form requests a difference in cost by adding to or deducting from the Bid Price.

.2 Do not include Value Added Taxes in alternatives.

.3 Owner may accept any of the alternatives and corresponding alternate prices in any order or combination, including all or none.

.4 Alternatives and corresponding alternate prices are open for acceptance by Owner for same period of time as Bid Price.

.5 In accordance with CCDC 23-2018 - A Guide to Calling Bids and Awarding Construction Contracts, the low bid will be determined by adjusting each bidder's Bid Price by the identified amounts to incorporate those alternatives for which prices have been invited and which are to be incorporated in the Work.

END OF SECTION

1 General

1.1 PRODUCT SUBSTITUTION PROCEDURES

.1 Requests for substitution will only be considered when submitted in sufficient time to permit proper evaluation by Consultant.

.2 When requesting Consultant review of a proposed Product substitution, demonstrate the proposed substitute will perform equally as well or better as the specified Product.

.3 Accompany each request for substitution with a list of properties for both the specified Product and the proposed substitute, including the following information:
- .1 Product identification, including manufacturer's name, address, telephone and fax numbers, and web site address where available.
- .2 Manufacturer's Product data sheets, including material descriptions, compliance with applicable reference standards, and performance and test data.
- .3 A summarized comparison of physical properties and performance characteristics for the specified Product and the proposed substitution, and clearly highlighting significant variations.
- .4 Indication of availability of maintenance services and sources of replacement materials and parts, including associated costs and time frames.
- .5 Indication of cost savings and reduction of construction schedule.
- .6 Verification that the substitute will not result in additional costs or a reduction in performance to other portions of the Work.
- .7 Reason for requesting the substitution.

.4 The clauses "or equal", "or approved equal", or other similar clauses, will not be construed as an invitation to submit requests for substitution or to unilaterally substitute Products in place of specified Products and systems.

.5 The abbreviation "eg." means "for example", and a Product listed thereafter is named as an example of the Product upon which the Specification is based. Similar Products from other listed manufacturers are acceptable for use, provided they meet specified criteria.

.6 Failure to order specified Products in adequate time to meet the approved construction schedule will not be a valid reason to submit a request for substitution. In accordance with GC 6.5 - Delays, such delays remain the responsibility of Contractor, and will not result in an extension to Contract Time or be subject to reimbursement by Owner.

.7 Owner is under no obligation to consider Product or system substitutions recommended by Contractor.

.8 Remove and replace substitutions incorporated into the Work without Consultant's written approval.

END OF SECTION

1 General

1.1 CLARIFICATIONS

.1 Request written clarifications when meaning of Contract Documents is unclear.

.2 Do not proceed with related parts of the Work until clarification is received.

.3 Failure to notify Consultant when Contract Documents are unclear or inconsistent will result in Contractor incurring responsibility for resulting deficiencies and additional costs.

.4 Clarifications issued by Consultant are deemed to supercede the relevant parts of Contract Documents, regardless whether those documents are cited in the written clarification.

1.2 REQUESTS FOR INFORMATION

.1 Contractor may, after exercising due diligence to locate the required information, request from Consultant clarification or interpretation of Contract Documents, hereinafter referred to as a request for information (RFI).

.2 Submit RFI on a form acceptable in content to Consultant, including a detailed description of Contractor's review of Contract Documents leading up to issuance of RFI. Requests for information that fail to include a detailed review description, or whose description is insufficient in Consultant's opinion, may not be considered and may be rejected.

.3 Maintain a log of RFI sent to and responses received from Consultant, complete with corresponding dates. Submit updated RFI log with each application for payment.

.4 Submit RFI to Consultant sufficiently in advance of affected parts of the Work so as not to cause delay in the Work. Additional costs incurred as a result of failure to submit RFI in sufficient time will not be reimbursed by Owner.

.5 Submit one RFI per RFI form, numbered consecutively in a single sequence, in order submitted.

.6 Consultant will review and respond to RFI with reasonable promptness.

.7 Consultant's response to RFI will not be considered a Changer Order or Change Directive, nor does it authorize changes in the Work, Contract Price and Contract Time.

.8 If, at any time, Contractor submits a large quantity of RFI, such that Consultant cannot process them within a reasonable period of time, then Consultant will notify Contractor of such in writing. In this event, Contractor and Consultant will jointly prepare an estimate of time necessary for processing RFI, as well as determining an order of priority among submitted RFI. Contractor will accommodate such necessary time at no increase in Contract Time and Contract Price.

.9 If information requested in an RFI is apparent from field observations, is contained in Contract Documents or is reasonably inferable from them, Contractor shall be responsible to Owner for reasonable costs charged by Consultant for additional services required to prepare and issue such information.

.10 A request for information (RFI) will not constitute a notice of claim for a delay.

1.3 CONTRACT MODIFICATION PROCEDURES

.1 Refer to GC 6.1 - Owner's Right to Make Changes, GC 6.2 - Change Order and GC 6.3 - Change Directive.

.2 Once a Proposed Change has been issued by Consultant, ensure that no work is carried out that may increase the cost of the contemplated variation.

.3 Consultant will assess the fair market cost of each change before issuing a Change Order. Assist Consultant with this task by quoting variations in a complete manner, listing:
   .1 Quantity of each material,
   .2 Unit cost of each material,
   .3 Man hours involved,
   .4 Cost per hour, and
   .5 Subcontractor quotations.

.4 Consultant may require further quotations in order to show a breakdown of costs.

.5 Owner and Consultant will not be responsible for delays to the Work resulting from late, incomplete or inadequately broken down valuations submitted by Contractor.

.6 Minor variations may be made in the Project from time to time as approved by Consultant. Such alterations or adjustments shall not constitute a change in cost unless a request is made at that time. No extra will be contemplated except where a clear indication is made that extra payment is claimed, in which case a Proposed Change or Change Directive will be issued by Consultant in accordance with GC 6.1 - Owner's Right to Make Changes, or GC 6.3 - Change Directive. Unless this procedure is followed, no claims for extras will be allowed.

END OF SECTION

1 General

1.1 COORDINATION

.1 Coordinate the Work to ensure the Project proceeds safely and expeditiously.

.2 Ensure adequate communication among involved parties.

.3 Allocate mobilization areas at Place of the Work; for field offices and sheds, for access, for traffic and for parking facilities.

.4 Coordinate use of Place of the Work and facilities through procedures for submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.

.5 Submit information required for preparation of coordination and interference drawings. Review and approve revised drawings for submission to Consultant.

1.2 DOCUMENTS AT PLACE OF THE WORK

.1 Maintain an up-to-date copy of the following documents at Place of the Work:
- .1 Contract Documents, including Drawings, Specifications, addenda, bid revisions, Notices in Writing, Supplemental Instructions, proposed changes, Change Orders, Change Directives, and other modifications to the Contract.
- .2 Accepted Shop Drawings, Product data and samples.
- .3 Quality control submittals, including test and evaluation reports.
- .4 Manufacturer's instructions, including installation and maintenance guidelines.
- .5 Construction progress schedule.
- .6 Additional requested schedules.
- .7 Consultant's field review reports and deficiency reports.
- .8 Reports from authorities having jurisdiction.
- .9 Permits.
- .10 Construction daily log.
- .11 Record as-built documents as described in Section 01 78 00.

.2 Make documents available to Consultant for review at Place of the Work.

.3 Construction Daily Log: Maintain a construction log, recording on a daily basis the following information:
- .1 Number of workers actively working at Place of the Work, organized on a Subcontract basis.
- .2 Subcontractors working at Place of the Work.
- .3 Identify the parts of the Work being worked on.
- .4 Identify the working hours being kept at Place of the Work.
- .5 Activities with intermittent progress.
- .6 Time lost with an explanation as to cause.
- .7 Difficulties encountered, such as construction activity delays, labour inefficiencies, labour shortages, etc.
- .8 Product deliveries.
- .9 Equipment mobilization and de-mobilization.
- .10 Demolition conditions.
- .11 Start and finish dates for each part of the Work.

1.3 OTHER CONTRACTORS

.1 Cooperate with any separate contractor employed by Owner and, if necessary, co-ordinate with their work.

.2 Submit necessary information to Owner to assist in required scheduling of other contractors.

1.4 CONTINUANCE OF OWNER OPERATIONS IN OCCUPIED FACILITIES

.1 Coordinate and schedule the Work to minimize disruption of normal functions at existing facility.

.2 Changes to traditional scheduling of construction may be required and certain portions of the Work may not be able to proceed in continuous sequence.

.3 Every reasonable effort will be made to cooperate with the construction process.

.4 Owner may modify proposed scheduling where such changes are in Owner's best interests regarding operation of existing facility.

1.5 GENERAL REQUIREMENTS FOR PROJECT MEETINGS

.1 Schedule and administer project meetings in consultation with Consultant, throughout progress of the Work.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 4 days in advance of meeting date to Consultant and Owner.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record meeting minutes. Include significant proceedings and decisions. Identify required actions by affected parties.

.7 Reproduce and distribute copies of minutes within 5 days after meeting and transmit to meeting participants, affected parties not in attendance, Consultant and Owner.

.8 Representative of Contractor, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

.9 Schedule meetings at regular 14 day intervals, on a day that is determined to be convenient by Contractor and Consultant.

1.6 PRE-CONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting with Owner to discuss and resolve administrative procedures and responsibilities.

.2 Conduct meetings with Subcontractors and Suppliers to discuss and resolve administrative procedures and responsibilities.

.3 Owner, Consultant, Contractor, Subcontractors, field inspectors and supervisors will be in attendance.

.4 Establish time and location of meeting and notify parties concerned a minimum of 5 days before meeting date.

.5 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.6 Pre-construction Meeting Agenda: include the following:
.1 Appointment of official representative of participants in the Work;
.2 Schedule of Work, progress scheduling;
.3 Schedule of submissions of Shop Drawings, samples, colour chips;
.4 Requirements for temporary facilities, Project identification sign, field offices, storage sheds, utilities, fences and protective enclosures;
.5 Delivery schedule of specified equipment;
.6 Site security;

.7 Proposed changes, Change Orders, Change Directives, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements;
.8 Owner-supplied Products;
.9 As-built drawings;
.10 Operation and maintenance manual;
.11 Take-over procedures, acceptance, warranties, extra stock materials;
.12 Monthly progress claims, administrative procedures, photographs, holdbacks;
.13 Procedures for publishing Certificate of Substantial Performance of the Work, including identification of publisher, and notification of Subcontractors and Suppliers;
.14 Appointment of inspection and testing agencies or firms; and
.15 Insurances, transcripts of policies.

1.7 PREINSTALLATION MEETINGS

.1 During course of the Work, schedule preinstallation meetings as required by Contract Documents.

.2 Wherever possible, schedule preinstallation meetings on same date as regularly scheduled progress meetings.

.3 Contractor, affected Subcontractors and Suppliers, manufacturer's representatives, field inspectors and supervisors, Consultant and any other specified parties are to be in attendance.

.4 Preinstallation Meeting Agenda: Include the following:
.1 Review of existing conditions and affected parts of the Work, and any testing thereof;
.2 Review of installation procedures and requirements;
.3 Review of environmental and field condition requirements;
.4 Schedule of the applicable parts of the Work;
.5 Schedule of submission for samples and other items requiring Consultant's selection;
.6 Requirements for Temporary Work;
.7 Requirements for notification for reviews. Allow a minimum of 48 hours notice for Consultant to review the affected parts of the Work;
.8 Requirements for inspections and tests as applicable. Schedule and undertake inspections and tests;
.9 Delivery schedule for Products; and
.10 Special safety requirements and procedures.

1.8 PROGRESS AND PROGRESS DRAW MEETINGS

.1 During course of the Work and two weeks prior to completion of the Contract, schedule progress meetings biweekly.

.2 During course of the Work, schedule progress draw meetings monthly.

.3 Submit to Consultant a copy of the application for payment not less than two Working Days before scheduled progress draw meeting. Consultant may require changes to the application for payment prior to progress draw meeting.

.4 Contractor, major Subcontractors involved in Work, Consultant, and Owner are to be in attendance.

.5 Progress Meeting Agenda: include the following:
.1 Review, approval of minutes of previous meeting;
.2 Review of Work progress since previous meeting;
.3 Field observations, problems, conflicts;
.4 Problems impeding construction schedule;
.5 Review of off-site fabrication delivery schedules;
.6 Corrective measuring and procedures to regain project schedule;
.7 Revision of construction schedule;
.8 Progress, schedule, during succeeding work period;

.9 Review submittal schedules, record drawings: expedite as required;
.10 Maintenance of quality standards;
.11 Review of proposed changes for affect on construction schedule and on completion date;
.12 Other business.

END OF SECTION

1 General

1.1 SUBMISSION REQUIREMENTS

.1 Submit initial schedules within 15 days after award of Contract.

.2 Re-submit updated schedules with each application for payment.

.3 Submit schedules electronically in the form of portable document format (.pdf) files.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Prepare construction progress schedule using critical path method.

.2 Include complete sequence of construction activities.

.3 Include dates for commencement and completion of each major element of construction.

.4 Show projected percentage of completion of each item as of first day of month.

.5 Indicate progress of each activity to date of submission of the schedule.

.6 Update schedule monthly and resubmit with each application for progress payment. Consultant will not review an application for payment that does not include an updated construction progress schedule.

.7 Show changes occurring since previous submission of schedule:
.1 Major changes in scope.
.2 Activities modified since previous submission.
.3 Revised projections of progress and completion.
.4 Other identifiable changes.

.8 Provide a narrative report to define:
.1 Problem areas, anticipated delays, and impact on schedule.
.2 Corrective action recommended and its effect.
.3 Effect of changes on schedules of other contractors.

1.3 ADDITIONAL SCHEDULES

.1 Concurrently with construction progress schedule, prepare and submit a schedule of values, a cash flow schedule, a submittal schedule, an inspection and testing schedule, and an equipment delivery schedule; prepared in formats acceptable to Consultant.

.2 Schedule of Values: To CCDC 24-2016, A Guide to Model Forms and Support Documents.

.3 Cash Flow Schedule: Broken down on a monthly basis, indicating anticipated monthly progress billings for duration of Contract.

.4 Submittal Schedule:
.1 Refer to GC 3.10 - Shop Drawings.
.2 Indicate anticipated submission dates and review periods for Shop Drawings, samples, lists of materials and other documentation.
.3 Highlight critical items, including latest date for submittal review by Consultant.
.4 Design sequence of submissions to reflect requirements of construction schedule.

.5 Inspection and Testing Schedule:
.1 Schedule inspection and testing in consultation with Owner's appointed inspection and testing agency.
.2 Identify time required for the performance of tests and inspections, and for the preparation and distribution of reports.

.6 Equipment Delivery Schedule: Indicate list of manufactured equipment complete with order dates and anticipated delivery dates.

1.4 PROGRESS PHOTOGRAPHS

.1 Concurrently with each monthly application for payment and with final application for payment, submit sufficient quantity of colour photographs, clearly illustrating progress of the Work.

.2 Format photographs as bitmap (bmp) or JPEG (jpg) image files, with minimum resolution of 10 megapixels.

.3 Ensure photographs are taken by a person experienced in photography.

.4 Submit additional photographs showing special conditions when requested by Consultant.

.5 Photographs will be properly exposed and in focus, with unobstructed views.

.6 Identify each photograph with:
.1 Name of Project,
.2 Name of photographer,
.3 Description of view, and
.4 Date photograph was taken.

END OF SECTION

1 General

1.1 ADMINISTRATIVE

.1 Collect Submittals requested by Contract Documents, as required by authorities having jurisdiction and as may be reasonably requested by Consultant from relevant Subcontractors, Suppliers and manufacturers.

.2 Make submissions with reasonable promptness and in an orderly sequence so as not to delay the Work. Be responsible for delays and pay additional costs as a result of failure to make submissions in due time to allow proper reviews.

.3 Submittals containing unauthorized substitutions will be rejected. Refer to Section 01 25 00 for substitution procedures.

.4 Ensure submissions are complete for each particular Submittal required.

.5 Where submissions are not complete, indicate which Submittal components are not included, and stating when they will be made available. Consultant reserves the right to delay their review of the Submittal until submission is complete.

.6 Do not proceed with parts of the Work affected by a Submittal, including ordering Products, until relevant Submittal has been reviewed and accepted by Consultant.

.7 Prepare Submittals in units of measurement consistent with those used on Drawings.

.8 Digital files are to be electronically created from original files. Scanned images will be rejected.

1.2 SUBMISSION PROCEDURES

.1 Coordinate each Submittal with Contract Documents.

.2 Include with each submission a duplicate transmittal document indicating:
.1 Date of initial submission,
.2 Date of each resubmission, and
.3 Project title and Consultant's Project number.

.3 Indicate on each submission, the following information:
.1 Name of Contractor,
.2 Name of Subcontractor,
.3 Name of Supplier (as applicable),
.4 Name of manufacturer (as applicable),
.5 Name of person responsible for preparation of submission, and
.6 Relevant specification Section numbers.

.4 Identify Submittals numerically by Section number, numeric indicator, revision number and a brief worded description. For example, a Submittal for masonry wall ties might be identified as "04 05 19-01-R0-Wall Ties".

.5 When required by Consultant's review, make necessary changes to Submittal and resubmit for final acceptance.

.6 Notify Consultant in writing of any additional revisions made to Submittal beyond those required by Consultant's review.

.7 Upon acceptance of Submittal by Consultant, distribute copies to affected parties.

1.3 REVIEW BY CONTRACTOR

.1 Before making submissions to Consultant, review Submittals for conformity to Contract Documents.

.2 Contractor's review of Submittals must be conducted by the authorized representative familiar with the Work.

.3 Check each Submittal and make necessary notations before forwarding Submittals to Consultant.

.4 Distribute copies of Submittals to affected Subcontractors for their comment prior to submitting them to Consultant.

.5 Verify noted dimensions with actual constructed measurements at Place of the Work.

.6 Confirm fabrication techniques and installation means and methods.

.7 Where Submittal does not conform to Contract Documents, reject Submittal and return to source for revisions. Do not forward rejected Submittals to Consultant.

.8 Contractor assumes sole responsibility for conflicts that may arise in execution of the Work as a result of failure to properly review and coordinate Submittals.

.9 Submittals forwarded to Consultant must bear Contractor's review stamp, signed and dated by authorized representative.

.10 Submittals received by Consultant that fail to include Contractor's review stamp, date and signature will be returned without review.

.11 Notify Consultant in writing of changes made on Submittals to Contract Documents. Consultant's review of Submittals does not relieve Contractor of responsibility for unauthorized changes made to Contract Documents.

.12 Keep copies of accepted Submittals at Place of the Work in a neat, orderly condition.

.13 Perform the Work in conformance with accepted Submittals. Remove and replace Products not matching accepted Submittals.

1.4 REVIEW BY CONSULTANT

.1 Review of Submittals by Consultant is only for general conformity to Contract Documents.

.2 Consultant review does not imply approval of construction means, methods, techniques or detailing, responsibility for which remains with Contractor.

.3 Consultant review does not relieve Contractor of responsibility for errors or omissions in Submittals, or responsibility for meeting requirements of Contract Documents.

.4 Consultant markings on Submittals and resulting required actions:
- .1 Submittals requiring no changes will be marked 'REVIEWED', and will be submitted for as-built purposes.
- .2 Submittals requiring some minor changes will be marked 'REVIEWED AS NOTED', and will be revised and submitted for as-built purposes.
- .3 Submittals requiring substantial changes will be marked as 'REVISE AND RESUBMIT' and will be revised and resubmitted until Consultant subsequently marks them as 'REVIEWED' or 'REVIEWED AS NOTED'.

.5 Consultant's review and markings on Submittals do not authorize changes in the Work.

.6 If, in Contractor's opinion, Consultant's review of a Submittal constitutes a change in the Work, then Contractor will notify Consultant in writing and request an interpretation as specified in Section 01 26 00.

.7 If Consultant determines that a change in the Work is justified, then a Change Order itemizing the change in Contract Price and Contract Time will be issued.

.8 Submittals not requested by Contract Documents or Consultant, or not required by authorities having jurisdiction, will not be reviewed by Consultant, and will be returned marked as NOT REVIEWED.

1.5 ENGINEERED SUBMITTALS

.1 Submittals required to be sealed by a professional engineer are to be prepared, sealed, signed and dated under the direct control and supervision of a qualified professional engineer licensed to practice at Place of the Work.

.2 Include proof of professional liability insurance with minimum limit of liability of $5,000,000 per claim, and identifying insurer, policy number, and policy term on duly signed certificate of insurance.

.3 Design includes life safety, sizing of supports, anchors, framing, connections, spans and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction and design requirements of Contract Documents.

.4 Engineered Submittals are to include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented in the Submittal. Prepare calculations in a clear and comprehensive manner so that they can be properly reviewed.

.5 Submittal engineer shall undertake periodic field review, including review of associated mock-ups when applicable. Such reviews will include review during fabrication at the point of manufacture, and during installation at Place of the Work. Prepare and submit a field review report for each review undertaken.

.6 Conduct field reviews at intervals appropriate to the progress of the parts of the Work relevant to engineered Submittal. Report on progress and quality of the affected parts of the Work. Determine if installation is in general conformity with Contract Documents and in strict conformance with accepted engineered Submittal.

.7 Upon completion of the parts of the Work affected by engineered Submittal, Submittal engineer shall prepare and submit a Letter of General Conformity to Contractor, Consultant and authorities having jurisdiction. Certify that the parts of the Work affected by engineered Submittal have been designed, fabricated and installed in accordance with Contract Documents and applicable regulatory requirements.

.8 Include costs of Submittal engineer's services in Contract Price.

1.6 SUBMITTALS PRIOR TO START OF WORK

.1 Submit the following documents within the time stipulated, or, if not stipulated, prior to first application for payment:
- .1 Insurance certificates,
- .2 Surety Bonds (as applicable),
- .3 Workplace Safety and Insurance Board certificates,
- .4 Construction progress schedule,
- .5 Interference drawings,
- .6 Schedule of values,
- .7 Cash flow schedule,
- .8 Submittal schedule,
- .9 Inspection and testing schedule, and
- .10 Equipment delivery schedule.

1.7 PRODUCT DATA

.1 Submit Product data sheets and brochures electronically in the form of portable document format (.pdf) files for requirements requested in Specifications and as Consultant may reasonably request where Shop Drawings will not be prepared due to standardized manufacture of Product.

.2 Include sufficient space for application of review stamps by Contractor and Consultant.

.3 After review, Consultant will return marked-up Product data sheets to Contractor. Produce and distribute necessary copies to affected parties.

.4 Retain one set of accepted Product data sheets for inclusion in operation and maintenance manual. Refer to Section 01 78 00.

1.8 SHOP DRAWINGS

.1 Refer to GC 3.10 - Shop Drawings.

.2 Unless specified otherwise, submit Shop Drawings electronically in the form of portable document format (.pdf) files for each requirement requested in Specifications and as Consultant may reasonably request.

.3 Include sufficient space for application of review stamps by Contractor and Consultant.

.4 Shop Drawings are to be legible, and basically include the following information:
- .1 Fabrication and erection dimensions.
- .2 Plans, Sections, Elevations, arrangements and sufficient full-size details indicating complete construction, components, methods of assembly and interconnections with adjacent parts of the Work.
- .3 Design and engineering calculations, substantiating member sizes and connections, based on design loads.
- .4 Clear assignment of responsibility for the parts of the Work described thereon. Do not include phrases such as; "by others" or "by purchaser". Shop Drawings marked in this manner will be rejected.
- .5 Location and type of exposed anchors and fasteners, including any concealed reinforcements for attachment of same.
- .6 Adhesives, joinery methods and bonding agents.
- .7 Grades and Types of Products, including their physical characteristics, finishes and other fabrication information.
- .8 Configurations, sizes, and styles of Product required.
- .9 Mechanical and electrical characteristics of equipment.
- .10 Data verifying superimposed loads will not affect function, appearance or safety of installed components and adjacent construction.
- .11 Chases, sleeves, cuts and holes required, including those required in adjacent structural building elements.
- .12 Locations and types of welded connections. Include AWS symbols and indicate net weld lengths and sizes.
- .13 Product and manufacturer names, complete with model numbers.
- .14 Installation guidelines.
- .15 Operation and maintenance guidelines.

.5 Refer to Product Specifications for material-specific requirements of Shop Drawings.

.6 After review, Consultant will return marked-up Shop Drawings to Contractor. Produce and distribute necessary copies to affected parties.

.7 Retain one set of accepted Shop Drawings for inclusion in operation and maintenance manual. Refer to Section 01 78 00.

1.9 SAMPLES

.1 Submit samples to Consultant as requested in Contract Documents.

.2 Deliver samples prepaid to Consultant's business office.

.3 Identify samples with Project name and number, Consultant's name, Contractor's name, Subcontractor's name, date of submission, specification Section number, manufacturer's name, Product name and model number, and colour name and number.

.4 Upon request of Consultant, prepare representative panels of Products, illustrating selected textures, patterns and colours.

1.10 INTERFERENCE DRAWINGS

.1 Prepare a set of interference drawings, identifying and resolving potential conflicts among various parts of the Work, including sprinkler systems, HVAC ductwork, plumbing and drainage lines, lighting, and electrical systems.

.2 Submit interference drawings electronically to Consultant in the form of portable document format (.pdf) files prior to commencement of the Work.

.3 Coordinate and review interference drawings with affected Subcontractors prior to commencement of their portions of the Work.

1.11 CERTIFICATES AND CERTIFICATION SUBMITTALS

.1 Submit written statements, as requested in Contract Documents, certifying installed Products meet specified criteria.

.2 Include signature of person responsible for preparing certification.

1.12 TEST AND EVALUATION REPORTS

.1 Submit manufacturers' test and evaluation reports electronically in the form of portable document format (.pdf) files for requirements requested in Specifications and as Consultant may reasonably request.

.2 Ensure results are expressed in SI Metric units of measurement. Test and evaluation reports recording results only in Imperial units of measurement may be rejected.

.3 Clearly indicate compliance with specified performance criteria, tested in accordance with specified test methods, and conducted by independent testing agency.

.4 Test results achieved through the use of alternative test methods will be rejected.

END OF SECTION

1 General

1.1 CONSTRUCTION SAFETY

.1 Refer to GC 9.4 - Construction Safety.

.2 Assume role of "Constructor" as defined by applicable regulatory requirements.

.3 Prepare and submit one copy of Registration Forms of Construction and Employers of Workers to authority having jurisdiction.

.4 Hold regular, scheduled safety meetings.

1.2 SPECIAL PROCEDURES FOR INFECTION CONTROL

.1 Conform to latest edition of CCA COVID-19 - Standardized Protocols for All Canadian Construction Sites.

1.3 PROPER CONDUCT OF WORKERS

.1 Ensure workers conduct themselves in a proper and civilized manner at all times.

.2 Workers are required to be properly attired at all times.

.3 Workers wearing clothing exhibiting hateful or offensive images or language will be required to replace or cover such clothing. Workers refusing to do so will be required to leave Place of the Work and will be replaced by Contractor.

.4 Workers using improper language, cat calls, lewd comments or improper behaviour will be required to leave Place of the Work and will be replaced by Contractor.

.5 Smoking or vaping of any substance is not permitted at Place of the Work.

.6 Consumption of alcohol and use of controlled substances is not permitted at Place of the Work.

1.4 LABOUR CONDITIONS

.1 Ensure rates of wages, working hours and working conditions at Place of the Work are in accordance with applicable regulatory requirements.

1.5 EMERGENCY CONTACT INFORMATION

.1 Submit emergency contact information for site superintendent to authority having jurisdiction, for their use 24 hours a day, 7 days a week, 52 weeks a year.

.2 Immediately notify authority having jurisdiction when emergency contact information changes.

1.6 NOISY WORK RESTRICTIONS

.1 Conform to applicable noise regulations and legislation.

.2 Schedule noisy work, or work requiring use of pneumatic tools, in a manner to avoid disturbance to existing facility occupants.

.3 This may require portions of the Work to be performed outside normal working hours.

1.7 SPECIAL PROCEDURES FOR CONTRACTORS WORKING IN EXISTING FACILITY

.1 Comply with Owner's procedures and requirements for construction personnel working in existing facilities.

.2 Conform to latest edition of "Guidelines For Maintaining Fire Safety During Construction in Existing Buildings", as issued by Office of the Fire Marshal.

.3 Coordinate requirements with local fire department. Discuss fire safety planning issues and alternative measures.

1.8 TIME OF WORK RESTRICTIONS IN EXISTING FACILITY

.1 When performing portions of the Work within existing facility, coordinate with Owner's representative to ensure operational program of existing facility is not disrupted. Conduct such coordination not less than 48 hours prior to commencing such portions of the Work.

.2 Work performed within existing facility is restricted to the following times:
.1 July 1 to August 31: Mondays to Fridays, between the hours of 7:30 am and 4:00 pm.
.2 September 1 to June 30: Mondays to Fridays, between the hours of 4:00 pm and 10:30 pm.

.3 Make special arrangements with Owner to perform any parts of the Work in existing facility outside of these hours. Submit requests for special arrangements not less than 48 hours in advance.

.4 Submit written notice to Owner and Owner's representative within 24 hours of any potential disruptions to continuing operations of existing facility.

.5 Schedule the Work so as to avoid potential disruptions to continuing operations of existing facility. Notify Owner in writing at least 24 hours in advance of any potential disruption to any adjoining areas to Place of the Work. Cooperate with Owner when scheduling such portions of the Work.

1.9 FOOD AND BEVERAGE RESTRICTIONS IN EXISTING FACILITY

.1 There shall be no food or beverages allowed within existing facility.

.2 Only water will be permitted to be consumed within existing facility.

.3 No sunflower seeds, peanuts, nuts, or similar foods are permitted at Place of the Work.

.4 Workers found to be in violation of this requirement will be required to leave Place of the Work and will be replaced by Contractor.

1.10 FIRE ALARMS IN EXISTING FACILITY

.1 Fire and smoke sensors are installed throughout existing facility. These devices may be triggered by jarring either directly or indirectly while working in adjacent areas.

.2 Determine nature and exact locations of existing fire and smoke sensors prior to commencement of the Work.

.3 Notify Owner prior to commencement of any part of the Work in the vicinity of fire and smoke sensor devices.

.4 Owner reserves the right to charge Contractor for costs incurred as a result of false fire alarms activated as a result of execution of the Work.

1.11 SPILL RESPONSE

.1 Prepare and initiate spill response procedure in accordance with appropriate regulatory requirements prior to commencing the Work.

.2 Supply and maintain spill kit at Place of the Work.

1.12 SPECIAL PROCEDURES FOR WORKING IN CONFINED SPACES

.1 Perform work in confined spaces in accordance with applicable legislation.

.2 Work in confined spaces must be supervised and performed by licenced confined space and hazardous materials personnel.

1.13 SPECIAL PROCEDURES FOR WORKING WITH DESIGNATED SUBSTANCES

.1 Prepare and initiate a Health and Safety Plan in accordance with authorities having jurisdiction prior to commencing work involving excavating and transporting or handling potentially contaminated materials.

.2 Keep an up-to-date copy of Health and Safety Plan at Place of the Work.

.3 Adhere to Health and Safety Plan for duration of removal and disposal of contaminated material from Place of the Work.

.4 Provide and maintain a safe working environment for on-site personnel and minimize the impact of construction activities on the general public and surrounding environment.

.5 Verify workers and visitors to Place of the Work have and are adequately trained in the use of appropriate personal protective equipment.

.6 Should any unforeseen, or site-peculiar safety related factor, hazard, or condition become evident during performance of the Work, notify authority having jurisdiction and Consultant immediately, and take prudent temporary action to establish and maintain safe working conditions until suitable permanent action can be implemented. Safeguard workers, the public and surrounding area from contamination.

.7 Perform routine air monitoring at Place of the Work, testing for organic vapours, explosive conditions and oxygen deficient conditions. Evacuate affected areas immediately and implement corrective measures if unsatisfactory conditions are discovered.

.8 Guidelines by Authorities Having Jurisdiction: Conform to the following guideline documents issued by Province of Ontario:
.1 Silica on Construction Projects.
.2 Lead on Construction Projects.

.9 Mercury Precautions: Ensure workers handling, removing and disposing of mercury-containing materials have been properly trained by a competent and qualified person.

.10 In the event of injury to on-site personnel, contact designated hospital and describe injury prior to or during transport of injured personnel. Transport injured personnel to defined medical facility along predefined route.

.11 Take appropriate measures to minimize contact of vehicles and equipment with potentially contaminated materials. Vehicles, equipment and workers which do contact contaminated materials shall be decontaminated in an approved manner prior to leaving Place of the Work.

1.14 SECURITY DEPOSITS

.1 When Owner has submitted security deposits to authorities having jurisdiction prior to award of a particular Subcontract, responsible Subcontractor shall reimburse deposit amount to Owner. Failure to reimburse Owner the required amount will result in postponement of payment of Subcontractor's first application for payment.

END OF SECTION

1 General

1.1 REGULATORY REQUIREMENTS

.1 Perform the Work in accordance with latest editions of applicable regulatory requirements.

.2 Conform to requirements of authorities having jurisdiction.

.3 Nothing contained in Contract Documents shall be construed to be in conflict with any law, by-law or regulation of municipal, regional, provincial, federal or other authority having jurisdiction.

1.2 PERMITS AND FEES

.1 Refer to GC 10.2 - Laws, Notices, Permits and Fees.

.2 Determine detailed requirements of authorities having jurisdiction.

.3 Pay construction damage deposits levied by municipality in connection with issuing a building permit.

1.3 REFERENCES

.1 Where edition date is not specified, consider references to manufacturer's data, and published codes, standards and specifications are made to latest edition or revision, approved by issuing organization.

.2 Reference standards and specifications are quoted to establish minimum standards. Work which in quality exceeds the specified minimum will be considered to conform.

.3 Requirements of Contract Documents govern over requirements of reference standards and specifications.

.4 Specifications refer to standards writing, testing and certification organizations by their acronyms or initialisms, as follows:

.1 AA The Aluminum Association;
.2 AABC Associated Air Balance Council;
.3 AAMA American Architectural Manufacturers Association;
.4 ACI American Concrete Institute;
.5 AISC American Iron and Steel Construction;
.6 AMCA Air Movement and Air Control Association;
.7 ANSI American National Standards Institute;
.8 ARI Air Conditioning and Refrigeration Institute;
.9 ASCC American Society of Concrete Contractors;
.10 ASME American Society of Mechanical Engineers;
.11 ASTM American Society for Testing and Materials;
.12 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.;
.13 AWMAC Architectural Woodwork Manufacturers' Association of Canada;
.14 AWPA American Wire Producers Association;
.15 BHMA Builders Hardware Manufacturers Association;
.16 BIA Brick Industry Association;
.17 CaGBC Canadian Green Building Council;
.18 CCMPA Canadian Concrete Masonry Producers Association;
.19 CFCA Concrete Floor Contractors Association of Canada;
.20 CGA Canadian Gas Association;
.21 CGSB Canadian General Standards Board;
.22 CHPVA Canadian Hardwood Plywood and Veneer Association;
.23 CISC Canadian Institute of Steel Construction;
.24 CISCA Ceiling & Interior Systems Construction Association;
.25 CKCA Canadian Kitchen Cabinet Association;
.26 CLFMI Chain Link Fence Manufacturers' Institute;

.27 CPC Concrete Polishing Council;
.28 CPCI Canadian Precast Concrete Institute;
.29 CPCQA Canadian Precast Concrete Quality Assurance;
.30 CPSC Consumer Product Safety Commission;
.31 CRCA Canadian Roofing Contractors' Association;
.32 CRI Carpet and Rug Institute;
.33 CSA Canadian Standards Association;
.34 CSC Construction Specifications Canada;
.35 CSDMA Canadian Steel Door Manufacturers' Association;
.36 CSSBI Canadian Sheet Steel Building Institute;
.37 CUFCA Canadian Urethane Foam Contractors Association Inc.;
.38 CWB Canadian Welding Bureau;
.39 CWC Canadian Wood Council;
.40 CWTA Canadian Wood Truss Association;
.41 DASMA Door & Access Systems Manufacturers' Association, International;
.42 DHI Door and Hardware Institute;
.43 DIN Deutsches Institut für Normung E.V.;
.44 GA Gypsum Association;
.45 GANA Glass Association of North America;
.46 HPVA Hardwood Plywood and Veneer Association;
.47 ICEA Insulated Cable Engineers Association;
.48 ICRI International Concrete Repair Institute;
.49 IEEE Institute of Electrical and Electronics Engineers;
.50 IGMAC Insulated Glass Manufacturers' Association of Canada;
.51 ISCA Interior Systems Contractors Association of Ontario;
.52 IWFA International Window Film Association;
.53 LEED Leadership in Energy and Environmental Design;
.54 MPI Master Painters' Institute;
.55 MSS Manufacturers Standardization Society of the Valve and Fittings Industry;
.56 NAAMM National Association of Architectural Metal Manufacturers;
.57 NCMA National Concrete Masonry Association;
.58 NEMA National Electrical Manufacturers Association;
.59 NFPA National Fire Protection Association;
.60 NFRC National Fenestration Rating Council Incorporated;
.61 NHLA National Hardwood Lumber Association;
.62 NLGA National Lumber Grades Authority;
.63 OIRCA Ontario Industrial Roofing Contractors' Association;
.64 OMCA Ontario Masonry Contractors' Association;
.65 OPSD Ontario Provincial Standard Drawings;
.66 OPSS Ontario Provincial Standard Specifications;
.67 OWTFA Ontario Wood Truss Fabricators Association;
.68 PCI Precast Concrete Institute;
.69 PEI Porcelain Enamel Institute;
.70 RSIC Reinforcing Steel Institute of Canada;
.71 SEFA Scientific Equipment & Furniture Association;
.72 SMACNA Sheet Metal and Air Conditioning Contractors' National Association;
.73 SSPC The Society for Protective Coatings;
.74 SWI Sealant and Waterproofer's Institute;
.75 TPIC Truss Plate Institute of Canada;
.76 TTMAC Terrazzo, Tile and Marble Association of Canada;
.77 ULC Underwriters' Laboratories of Canada;
.78 ULI Underwriters' Laboratories Incorporated;
.79 WDMA Window and Door Manufacturers' Association; and
.80 WHI Warnock-Hersey International.

1.4 QUALITY ASSURANCE

.1 Quality of work shall be best quality, executed by workers experienced and skilled in the respective duties for which they are employed.

.2 Maintain good order and discipline among workers engaged on Project. Do not employ on the Work anyone not skilled in their assigned tasks.

.3 Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.4 Decisions as to the quality or fitness of work in cases of dispute rest solely with Consultant, whose decision is final.

1.5 QUALITY CONTROL

.1 Refer to GC 2.3 - Review and Inspection of the Work.

1.6 TESTING AND INSPECTION SERVICES

.1 Independent inspection and testing agencies will be engaged by Owner for the purpose of inspecting and testing portions of the Work.

.2 Cost of testing and inspection by inspection and testing agencies shall be paid from the stipulated sum cash allowances specified in Section 01 21 00.

.3 Supply equipment required for executing inspection and testing by appointed agencies.

.4 Employment of inspection and testing agencies does not relax the responsibility to perform Work in accordance with Contract Documents.

.5 If defects are revealed during inspection and testing, the appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no additional cost to Owner. Pay costs for retesting and reinspection.

.6 Allow inspection and testing agencies access to the Work, off-site manufacturing and fabrication plants.

.7 Cooperate to provide reasonable facilities for such access.

.8 Notify appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.

.9 Submit samples 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.

.10 Provide labour and facilities to obtain and handle samples and materials at Place of the Work. Provide sufficient space to store and cure test samples.

1.7 DEFECTIVE WORK

.1 Refer to GC 2.4 - Defective Work.

1.8 QUALITY CONTROL REPORTS

.1 Submit identified quantity of quality control reports promptly to each of the following:
- .1 Consultant: Two copies.
- .2 Owner: One copy.
- .3 Authorities having jurisdiction: One copy each.

.2 Forward copies of quality control reports promptly to each affected Subcontractor.

1.9 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be required.

.2 Costs of tests and mix designs beyond those called for in Contract Documents or beyond those required by laws at Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.10 MANUFACTURER FIELD REVIEW

.1 When required by Contract Documents, arrange for a qualified manufacturer's representative to review relevant parts of the Work and verify those portions of the Work are being executed in accordance with manufacturer's written recommendations and installation guidelines.

.2 Manufacturer field review services are intended to ensure specified Products are being used and are being installed on substrates that have been prepared in accordance with manufacturer's written recommendations.

.3 Unless specified otherwise, manufacturer's representative will undertake minimum one field review, with additional reviews being conducted as deemed necessary by manufacturer.

.4 Within two Working Days of a field review, manufacturer will submit a field review report recording manufacturer representative's observations and recommendations.

.5 Distribute copies of manufacturer's field review reports to affected Subcontractors, Consultant and authorities having jurisdiction.

1.11 MOCK-UPS

.1 Prepare mock-ups for portions of the Work specifically requested in Contract Documents. Include all Product and labour necessary to construct each mock-up.

.2 Construct mock-ups in locations acceptable to Consultant.

.3 Prepare mock-up for Consultant review with reasonable promptness and in an orderly sequence, so as not to cause delay in the Work.

.4 Failure to prepare mock-up in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Consultant will assist in preparing a schedule fixing the dates for preparation.

.6 Specifications identify whether mock-up may remain as part of the Work or must be removed.

1.12 MILL TESTS

.1 Submit mill tests certificates as may be requested.

1.13 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for facility services.

.2 Refer to facility services Sections for definitive requirements.

END OF SECTION

1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Provide temporary utilities, facilities and controls in order to execute the Work expeditiously.

.2 Maintain temporary utilities, facilities and controls in a neat and tidy condition.

.3 Remove temporary utilities, facilities and controls from Place of the Work when no longer required.

1.2 TEMPORARY WORK

.1 Refer to GC 3.3 - Temporary Supports, Structures and Facilities.

1.3 TEMPORARY UTILITIES

.1 Temporary Electricity
- .1 Owner will designate an existing source, and pay usage costs for temporary power during construction to ensure adequate temporary lighting; operation of power tools; temporary heating and ventilation; and to ensure proper completion of the Work.
- .2 Arrange for connection to designated source, and pay costs for installation, maintenance and removal.
- .3 Ensure use of existing power source does not interrupt or affect continuing operations of existing facility.
- .4 Provide and maintain temporary electrical systems to CSA C22.1:21, Canadian Electrical Code, Part 1 - Safety Standard for Electrical Installations.

.2 Temporary Heating, Cooling and Ventilating
- .1 Provide temporary heating and cooling required during construction period, including attendance, maintenance and fuel.
- .2 Unless specified otherwise, maintain temperatures between 10 degrees C and 35 degrees C in areas where construction is in-progress.
- .3 Temporary heaters will be forced hot air type, operated in a well ventilated location. Vent direct fired heaters directly to exterior and extend vent beyond wall face to avoid staining. Open flame heaters or salamanders are not permitted.
- .4 Uniformly distribute heat to avoid hot and cold areas and to prevent excessive drying.
- .5 Upon approval of Owner, the existing permanent heating system, or portions thereof, may be used when available. Be responsible for damage thereto.
- .6 On completion of the Work, replace filters in permanent heating system and clean ducts.
- .7 Ventilation: Provide minimum one air change per hour for enclosed areas receiving architectural finishes.
- .8 Ensure adequate ventilation whenever using hazardous or volatile adhesives, coatings or substances.
- .9 Do not allow excessive build up of moisture in the Work.

.3 Temporary Lighting: Provide and maintain suitable lighting during hours of darkness at danger points.

.4 Temporary Communications: Provide temporary telephones, and wireless internet service at Place of the Work, for own use and use of the Consultant.

.5 Temporary Water:
- .1 Owner will designate an existing source, and pay the usage costs, for a continuous supply of potable water for construction use.
- .2 Arrange for connection to designated source, and pay costs for installation, maintenance and removal.
- .3 Ensure use of existing water sources does not interrupt or affect continuing operations of existing facility.

1.4 CONSTRUCTION FACILITIES

.1 Field Offices
  .1 Provide and maintain in clean condition during progress of Work, an adequately lighted, heated and ventilated construction office with sufficient space and furnishings to accommodate holding meetings, filing documents and laying out Contract Documents.
  .2 Subcontractors may provide their own field offices as necessary. Direct location of Subcontractor field offices.

.2 Storage Facilities
  .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of Products and Construction Equipment.
  .2 Do not store Products or Construction Equipment in field office.

.3 First Aid
  .1 Provide appropriate emergency and first aid equipment in accordance with authorities having jurisdiction.
  .2 Mount emergency and first aid equipment in a prominent and easily accessible location with easily identifiable labels.
  .3 A minimum of one person trained in basic first aid must be present at Place of the Work at all times during execution of the Work. This person may perform other duties, but must be immediately available to render first aid when needed.

.4 Sanitary Facilities
  .1 Provide sufficient quantity of separate temporary sanitary facilities for male and female workers in accordance with authorities having jurisdiction.
  .2 Keep sanitary facilities clean and fully stocked with necessary supplies.
  .3 New and existing permanent sanitary facilities may not be used.
  .4 Except where connected to municipal sewer system, periodically remove wastes from Place of the Work.

1.5 TEMPORARY HOISTS AND CRANES

.1 Provide, operate and maintain temporary hoists and cranes required for moving of workers, Products and Construction Equipment.

.2 Make financial arrangements with Subcontractors for use thereof.

.3 Temporary hoists and cranes must be operated by properly trained and qualified operators.

1.6 CONSTRUCTION PARKING

.1 Limited parking will be permitted at Place of the Work, as long as it does not disrupt continuing operations of existing facility.

1.7 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work, ensuring continuous access by emergency vehicles.

.2 Construct and maintain temporary access roads as required or where indicated on Drawings.

.3 Existing private roadways at Place of the Work may be used for access to Place of the Work. Contractor assumes responsibility for any damage caused by construction traffic and agrees to prevent or promptly clean up mud tracking or material spillage.

.4 Clean municipal roadways located immediately adjacent to Place of the Work, regardless of cause, as follows:
  .1 At least once per week on Friday afternoons, just before end of Working Day,
  .2 After construction equipment or vehicles have left Place of the Work, resulting in soil or debris being deposited on roadway surfaces,

.3 As directed by authorities having jurisdiction, and
.4 As directed by Consultant.

.5 Municipal Road Closures: Conform to requirements of authorities having jurisdiction.

1.8 TEMPORARY BARRIERS AND ENCLOSURES

.1 Protective Enclosures:
.1 Erect 1 800 mm high temporary modular metal fencing system around Place of the Work.
.2 Protect public and workers from injury.
.3 Protect public and private property from damage.
.4 Provide locking gates to restrict access to only authorized personnel and vehicles.
.5 Provide and maintain full safety protection at open shafts in floors, roof decks and other working surfaces.
.6 Provide and maintain suitable warning signs as required by applicable regulatory requirements.

.2 Weather Enclosures:
.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Dust Barriers:
.1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, finished areas of Work and existing facility occupants.
.2 Maintain and relocate protection until such Work is complete.

.4 Security Measures:
.1 Maintain security at Place of the Work by controlling access through enclosing fences, barricades and hoardings during times the Work is in progress, and by locking hardware otherwise.
.2 After the Work is enclosed, maintain its security by adequate barriers to entry, and by temporary doors equipped with locking hardware.
.3 Maintain security at all times construction is shut down due to strikes or lockouts.
.4 Make Good damage resulting from vandalism or other breaches of security.
.5 Replace stolen and damaged Products resulting from breaches of security.

.5 Existing Building Entrances and Exits:
.1 Maintain existing building entrances and exits to ensure public safety.
.2 Where existing entrances and exits are blocked or adversely affected by construction activities, Provide temporary entrances and exits in accordance with regulatory requirements.

1.9 TEMPORARY CONTROLS

.1 Erosion and Sediment Control: Provide erosion and sedimentation fencing with filter mat as required by authorities having jurisdiction.

.2 Temporary Dewatering:
.1 Provide temporary drainage and pumping as necessary to keep excavations and Place of the Work free from water.
.2 Dispose of water containing silt-in-suspension in accordance with authorities having jurisdiction.
.3 Maintain existing drainage, above ground and underground, adjacent to the Work or affected by the Work.
.4 Before commencing any portion of the Work likely to affect the drainage of water from existing facility or Place of the Work, Provide necessary alternative drainage systems to ensure water will be conducted to alternative outlets. Do not block or impede any drain, roof outlet or rainwater leader after such safety precautions have been made.

.3 Clean catch basins and storm lines at Place of the Work as required to ensure their continuous operation during execution of the Work.

1.10 PROJECT IDENTIFICATION

.1 Owner will supply and install one Project identification sign.

.2 Project identification sign will be approximately 2 440 x 6 100 mm in size; constructed of wood framing and plywood, and mounted to 4 wooden posts set in concrete pier foundations.

.3 Maintain Owner's Project identification sign in clean condition for duration of the Contract.

.4 Remove and dispose of Owner's Project identification sign, including concrete pier foundations, when directed by Consultant.

.5 Make Good surrounding landscaping to match.

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Not In Contract (NIC) means an item that requires coordination for its later installation, and which is not Provided as part of the Work.

.2 Owner-supplied Products means an item that will be supplied by Owner to SC01 - General Subcontractor for installation as part of the Work.

1.2 BASIC PRODUCT REQUIREMENTS

.1 Refer to GC 3.8 - Labour and Products.

.2 Products referred to in the singular implies the supply and installation of as many Products as necessary to complete the Work.

.3 Unless specified otherwise, Consultant may select colours from manufacturer's complete range of available colours, textures and patterns, including those considered to be premium.

.4 Conceal trademarks and labels, including applied labels, in finished areas of the Work. Trademarks and labels that are essential for identifying Products for maintenance purposes, and for identifying life safety, fire resistance and temperature rise ratings may remain visible.

1.3 OWNER-SUPPLIED PRODUCTS

.1 Owner Responsibilities
- .1 Order and pay for Owner-supplied Products not already in Owner's possession.
- .2 Arrange and pay for delivery of Owner-supplied Products F.O.B. Place of the Work, within time frames required by Contractor's construction progress schedule. If delivered sooner than required by Contractor's latest construction progress schedule submitted to Owner, arrange and pay for delivery to a temporary storage location and subsequent delivery to Place of the Work.
- .3 Advise Contractor in writing of the value of Owner-supplied Products for Contractor's insurance purposes.
- .4 Arrange and pay for delivery to Contractor of reviewed Shop Drawings, Product data, samples, and manufacturer's instructions and certificates.
- .5 Inspect deliveries jointly with Contractor.
- .6 Submit claims for transportation damage.
- .7 Arrange for replacement of damaged, defective or missing items identified at time of delivery.
- .8 Arrange for manufacturer's field services.
- .9 Arrange for delivery of manufacturer's warranties to Contractor for inclusion in operation and maintenance manuals.

.2 Contractor Responsibilities
- .1 Designate in construction progress schedule, time frames for delivery of Owner-supplied Products to Place of the Work and for receipt of related submittals. If Place of the Work is not ready to receive delivery of Owner-supplied Products within the time frame indicated in the latest construction progress schedule submitted to Owner, arrange and pay for delivery to a temporary storage location and subsequent delivery to Place of the Work.
- .2 Review required submittals and notify Consultant of any observed discrepancies or anticipated problems.
- .3 Ensure that course of construction insurance is adequate to cover Owner-supplied Products.
- .4 Receive and unload Owner-supplied Products at Place of the Work.
- .5 Inspect deliveries jointly with Owner. Record and notify Owner and Consultant of shortages and visibly damaged or defective items.

.6 Handle Owner-supplied Products at Place of the Work, including uncrating and storage. Dispose of waste materials and debris.
.7 Take appropriate precautions to protect Owner-supplied Products from loss or damage.
.8 Repair or replace items damaged at Place of the Work.
.9 Assemble, install, connect, adjust and finish Owner-supplied Products.
.10 Arrange for inspections required by authorities having jurisdiction.
.11 Arrange for or perform testing required by authorities having jurisdiction.
.12 Workmanship warranty for installation.
.13 Make Good Owner-supplied Products damaged by Contractor or Subcontractors at Place of the Work.

.3 Schedule of Owner-supplied Products:
.1 Subcontract SC03 - Mechanical
.1 Unit ventilators.
.2 Roof top units.

1.4 PRODUCT DELIVERY REQUIREMENTS

.1 Ensure Products are packaged, delivered and stored to prevent damage and to ensure their moisture content is not increased beyond manufactured or specified installation limits.

.2 Label packaged goods to completely describe contents.

.3 Immediately review Product delivery requirements and anticipate foreseeable supply delays for any items.

.4 In the event Contractor fails to notify Consultant of foreseeable supply delays at commencement of the Work, Consultant reserves the right to substitute more readily available Products of similar character, at no increase in Contract Price.

1.5 PRODUCT STORAGE AND HANDLING REQUIREMENTS

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

.2 Provide necessary protection for those materials that require it.

.3 Store Products in a neat and tidy manner.

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

.5 Do not allow Product to be placed in contact with ground nor with other materials that could stain them. Store Product subject to damage from weather in weatherproof enclosures.

.6 Store paint and other volatile substances in a separate structure located at least 15 metres from existing facility, and equipped with a suitable size and type of fire extinguisher.

.7 Store materials within existing facility only as approved by Owner. Move materials stored within existing facility should they become a hindrance to Owner's operations, performance of the Work or to delivery of other materials.

.8 Receive, handle, protect and store furniture, fitments and equipment (FF&E) purchased by Owner for use in the Project as they are delivered to Place of the Work.

.9 Remove flammable rubbish and packing materials from Place of the Work.

END OF SECTION

1 General

1.1 CONCEALED CONDITIONS

.1 Refer to GC 6.4 - Concealed or Unknown Conditions.

1.2 EXAMINATION AND ACCEPTANCE OF CONDITIONS

.1 Verify conditions are ready to receive installation.

.2 Ensure substrate surfaces are clean, dimensionally stable, cured and free of contaminants such as oil, sealers and curing compounds.

.3 Notify Consultant in writing of unacceptable conditions.

.4 Commencement of installation means acceptance of conditions.

END OF SECTION

1 General

1.1 EXECUTION REQUIREMENTS

.1 Unless noted otherwise, install, apply or erect Products in strict accordance with manufacturer's written installation instructions and guidelines.

.2 Specifications requiring installation, erection or application of Products to conform to a consensus standard does not replace or supercede the requirement to also conform to manufacturer's written installation instructions and guidelines.

.3 Where manufacturer's installation instructions and requirements of a specified consensus standard are contradictory, manufacturer's written installation instructions and guidelines will govern.

.4 Improper installation, application or erection of Products will result in Consultant requiring their complete removal and replacement with new Products at no increase in Contract Price.

.5 In finished areas, conceal facility service components within construction assemblies, except where indicated otherwise.

.6 Extra payment for incidental furring or other enclosure will not be approved.

.7 Prevent electrolytic and galvanic reactions from occurring between dissimilar metals and materials.

.8 Make holes and voids required for facility service penetrations of correct size to accommodate penetrating items plus any fill material such as backer rods and joint sealants, insulation, firestops and smoke seals.

.9 Remedial Work: Refer to GC 3.12 - Cutting and Remedial Work, and Section 01 73 29.

1.2 COLD WEATHER REQUIREMENTS

.1 Perform the Work continually and avoid weather delays.

.2 Provide temporary heating and cold weather working measures during cold weather periods and winter months. Refer to Section 01 50 00.

.3 Construction delays, whether the responsibility of Contractor or otherwise, which result in unanticipated or extended winter work will not be considered justification for claims for additional payments.

.4 Uniformly distribute heat to avoid hot or cool areas or excessive drying.

1.3 SITE STORAGE AND OVERLOADING

.1 Refer to GC 3.11 - Use of the Work.

.2 Unless specifically indicated, do not cut, drill or sleeve any load bearing structural member without prior written approval of Consultant.

1.4 EXISTING UTILITIES

.1 Refer to GC 9.1 - Protection of Work and Property.

.2 When breaking into or connecting to existing facility or utility services, execute Work at times directed by authorities having jurisdiction, with minimum disturbance to the Work, and to pedestrian and vehicular traffic.

.3 Protect, relocate or maintain existing active services.

.4 When existing services are encountered, cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service.

1.5 INTERFERENCES

.1 Prior to commencement of the Work, coordinate placement of Products to ensure components are properly accommodated within designed spaces. Prepare and submit interference drawings as specified in Section 01 33 00.

.2 Be responsible for additional work and costs necessitated by failure to coordinate the parts of the Work.

.3 Provide adequate access and clearances around Products as required by authorities having jurisdiction, and as required for maintenance purposes by manufacturers.

.4 Notify Consultant if Contract Documents are in conflict with access and clearance requirements.

1.6 LOCATION OF FIXTURES AND FITMENTS

.1 Locations of fixtures and fitments indicated on Drawings are approximate only.

.2 Locate fixtures and fitments precisely in the Work after consultation with affected installer and Consultant.

1.7 INSERTS, ANCHORS AND FASTENERS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Provide fasteners to the full required complement. Products with missing fasteners will be rejected by Consultant.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected Specification.

.4 Use only factory made, threaded or toggle type inserts for supports and anchors, properly sized for load being carried.

.5 Where inserts cannot be placed, use factory made expansion shields for light weights only.

.6 Provide inserts, holes, anchor bolts and sleeves during placement or fabrication of structural elements.

.7 Fasteners stressed in withdrawal will be rejected.

.8 Metal fasteners are to be of a material that will not set up a galvanic reaction with the materials being fastened.

.9 Powder-actuated fasteners are to be a system suitable for the specific application, corrosion-resistant, and capable of sustaining without failure a load equal to 10 times the design load when tested to ASTM E1190.

.10 Do not use powder-actuated fasteners stressed in withdrawal for finished work.

.11 Do not use powder-actuated fasteners within 100 mm of concrete or masonry edges.

.12 Do not use powder-actuated fasteners in post-tensioned concrete.

1.8 TEMPLATES, BUILT-INS AND DIMENSIONS

.1 Take dimensions necessary for the proper execution of the Work.

.2 Assume responsibility for accuracy and completeness of dimensions.

.3 Provide forms, templates, anchors, inserts and accessories to be fixed to or inserted as part of the Work.

.4 Prepare and submit setting drawings, templates and other information necessary for placement and installation of Products, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels.

.5 Supply items in sufficient time, complete with templates and other necessary information, to accommodate installation without causing delay to the Work. Failure to do so will not result in an increase in Contract Price and Contract Time.

.6 Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated, which maintain levels and clearances to adjacent work, as set out in Contract Documents.

.7 Ensure defective and rejected work is corrected before subsequent construction commences. Refer to Section 01 71 00.

.8 Verify details and measurements at Place of the Work prior to fabricating Products of special design to ensure fit.

END OF SECTION

1 General

1.1 SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of any element of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or other contractor.

.2 Include in request:
- .1 Identification of Project.
- .2 Location and description of affected work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on work of Owner or other contractor.
- .7 Written permission of affected other contractors.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit requests for substitutions as specified in Section 01 25 00.

1.3 PREPARATION

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

.2 After uncovering, inspect conditions affecting performance of work.

.3 Beginning of cutting and patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill to complete the Work.

.2 Fit the several parts together, to integrate with other work.

.3 Uncover work to install ill-timed work.

.4 Remove and replace defective and non-conforming work.

.5 Remove samples of installed work for testing.

.6 Provide openings in non-structural elements of the Work for penetrations by facility services.

.7 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ properly trained labourers to perform cutting and patching for weather-exposed and moisture-resistant elements, and for visually-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed with masonry materials without prior written approval.

.10 Restore work with new Products in accordance with requirements of Contract Documents.

.11 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire-rated assemblies, completely seal voids with firestopping and smoke seal materials, for full thickness of assembly. Conform to Section 07 84 00.

.13 Refinish surfaces to match adjacent finishes, as follows:
- .1 Continuous Surfaces: Refinish to nearest intersection.
- .2 Assemblies: Refinish entire unit.

END OF SECTION

1 General

1.1 PROGRESS CLEANING

.1 Maintain the Work in tidy condition, free from accumulation of waste and debris, other than that caused by Owner or other contractors.

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

.3 Remove waste and debris from Place of the Work in an approved manner at end of each Working Day.

.4 Clean interior areas prior to installing finishing Products.

.5 Maintain areas free of dust and other contaminants during finishing operations.

1.2 FINAL CLEANING

.1 Refer to GC 3.13 - Cleanup.

.2 Provide professional cleaning by a recognized, established cleaning company.

.3 Standards Meeting: Prior to final cleaning, hold a meeting at Place of the Work to determine the acceptable standard of clean. Owner, Consultant, Contractor and cleaning Subcontractor to be in attendance.

.4 Lock each room after completing final cleaning in that area.

.5 Restrict access to areas that have been final cleaned. Re-clean areas that have been accessed by workers prior to Owner occupancy.

.6 Remove stains, dirt and smudges from finished surfaces. Conform to respective manufacturers' recommendations.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, and plastic laminate.

.8 Replace broken, scratched or disfigured glass.

.9 Clean electrical and mechanical fixtures and other fittings of labels, wrappings, paper and other foreign material.

.10 Vacuum clean and dust building interiors, including inside ducts, blowers and coils and behind grilles, louvres and screens.

.11 Wax, seal, shampoo and prepare floor finishes as recommended by manufacturers.

.12 Power wash exterior paved surfaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Conform to CCA 81-2001, A Best Practices Guide to Solid Waste Reduction.

.2 Fire and burning of waste and debris at Place of the Work is not permitted.

.3 Burying of waste and debris at Place of the Work is not permitted.

.4 Disposal of waste or volatile materials, such as kerosene, mineral spirits, oil or paint thinner into storm or sanitary sewers is prohibited. Collect such waste in appropriate containers and dispose of in accordance with applicable regulatory requirements.

.5 Provide on-site disposal service for rubbish accumulated by Subcontractors and Suppliers, in accordance with authorities having jurisdiction.

.6 Prevent extraneous materials from contaminating air beyond application areas by constructing temporary enclosures as specified in Section 01 50 00.

.7 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.8 Deposit packaging materials in appropriate container at Place of the Work for recycling or reuse.

.9 Avoid using landfill waste disposal procedures when recycling facilities are available.

.10 Keep discarded packaging away from children.

1.4 HAZARDOUS WASTE DISPOSAL

.1 If and when required, remove and dispose of contaminated material in accordance with applicable regulatory requirements.

.2 Transport contaminated material using a licensed waste hauling company.

.3 Submit one copy of waste hauling company's Certificate of Approval to authority having jurisdiction prior to transporting contaminated materials.

.4 Stockpile suspected contaminated material temporarily in neat and secure stockpiles overlying a double layer of 0.20 mm thick high density polyethylene.

.5 Isolate stockpiles from remainder of Place of the Work and cover with a single layer of 0.20 mm thick polyethylene to prevent entry, wind disturbance or collection of surface water.

.6 Do not transport potentially contaminated material until such material has been identified by authority having jurisdiction.

END OF SECTION

1 General

1.1 REFERENCES

.1 AABC National Standards for Field Measurements and Instrumentation, Total Systems Balance, Air Distribution Hydronics Systems.

1.2 QUALITY ASSURANCE

.1 Testing Organization: Current member in good standing of AABC certified to perform specified services.

.2 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.3 SUBMITTALS

.1 Prior to commencement of the Work, submit names of specialty personnel proposed to perform services.

.2 Submit 3 copies of final reports on applicable forms.

1.4 SYSTEM START-UP PROCEDURES

.1 Comply with procedural standards of certifying associations under whose standards these services will be performed.

.2 Arrange for affected Subcontractors to send senior and capable personnel for demonstrations, training and start-up instructions prior to system start-up.

.3 Start-up equipment and systems, bringing them to expected operational levels.

.4 Report to Consultant any deficiencies or defects noted during start-up.

.5 Prepare each system for testing and balancing.

1.5 TESTING, ADJUSTING AND BALANCING PROCEDURES

.1 Test equipment, balance distribution systems and adjust devices.

.2 Cooperate with testing organization, ensuring adequate access to equipment and systems.

.3 Notify testing organization 7 days prior to when Project will be ready for testing, adjusting and balancing.

.4 Provide instruments required for testing, adjusting and balancing operations.

.5 Verify systems installation is complete and in continuous operation.

.6 Verify lighting is turned on when lighting is included in cooling load.

.7 Verify equipment is in full operation.

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Make Good means to restore new or existing work after being damaged, cut, patched or rejected by Consultant. Use materials identical to original materials, with visible surfaces matching appearance of original surfaces in all respects and with no apparent junctions between new and original surfaces.

1.2 PROTECTING INSTALLED CONSTRUCTION AND ADJACENT PROPERTY

.1 Refer to GC 9.1 - Protection of Work and Property.

.2 Refer to Product Specifications for material-specific protection requirements.

.3 Adequately protect parts of the Work that are either completed or in-progress.

.4 Unless specified otherwise, maintain protection until Substantial Performance of the Work.

.5 Provide protective coverings at walls, projections, corners and jambs, sills and soffits of openings in and adjacent to traffic areas.

.6 Remove protection and protective coverings upon expiry of specified duration.

.7 Protect Products from frost during construction.

.8 Remove snow and ice from the uncompleted roof and from any floors.

.9 As soon as the Work is sufficiently advanced, and in order to prevent delay, enclose the Work using tarpaulins, plastic sheeting or glazing, and temporary lockable doors.

.10 Provide protection for completed and partially completed finishes and equipment during performance of the Work.

.11 Protect prefinished Products from damage caused by subsequent construction operations.

.12 Protect existing trees and vegetation designated to remain as part of Project to OPSS.MUNI 801. Provide snow fencing or other protection where directed by Consultant.

1.3 UNDERGROUND AND CONCEALED SERVICES

.1 Protect facility and utility services from damage during performance of the Work.

.2 Take necessary precautions to locate underground and concealed utility services. Protect concealed utility services from damage.

1.4 WATERPROOFING AND ROOFING

.1 Restrict traffic from using waterproofed and roofed surfaces and restrict material storage on these surfaces.

.2 Keep waterproofed and roofed surfaces free of debris.

1.5 MAKING GOOD

.1 Make Good defective and damaged portions of the Work.

.2 Make Good damage to property adjacent to Place of the Work.

.3 Make Good damage to existing surfaces designated to remain as part of the Work.

.4 Make Good damage to the Work resulting from lack of adequate heating protection.

.5 Make Good damaged utility or facility services in accordance with authorities having jurisdiction.

END OF SECTION

1 General

1.1 CLOSEOUT PROCEDURES

.1 Conform to OGCA 100 - OAA/OGCA Takeover Procedures FOR PROJECTS UNDER THE CONSTRUCTION ACT (after July 1, 2018).

.2 Additional Reviews Required of Consultant: In the event Consultant must undertake additional reviews and assessments beyond those described, and resulting from either Contractor's lack of preparation or their inability to correct deficiencies within the time prescribed, then Contractor shall reimburse Consultant for such additional reviews and assessments, paid for at Consultant's standard hourly rate.

.3 Video Inspections of Underground Utility Services
- .1 Prior to applying for Substantial Performance of the Work, conduct a video inspection of the interior condition of underground utility services, including water mains, storm sewers and sanitary sewers.
- .2 Pay for video inspection as Cost of the Work.
- .3 Submit video record to Consultant.

.4 Above Ceiling Work
- .1 Prior to installation of gypsum board ceilings and placement of acoustical lay-in ceiling tiles, advise Consultant that above-ceiling work is complete and ready for review. Allow minimum 72 hours notice for any cancellation or changes; failure to do so may result in back charges to Contractor for costs of Owner's personnel.
- .2 Owner, Consultant and affected subconsultants will conduct above-ceiling review and prepare list of deficiencies.
- .3 Correct deficiencies and advise Consultant when they have been corrected.
- .4 Do not install gypsum board ceilings or acoustical ceiling panels until Consultant has verified that above-ceiling deficiencies have been corrected.
- .5 Substantial performance inspection may not proceed until above-ceiling deficiencies have been corrected.

.5 Substantial Performance of the Work
- .1 Refer to GC 5.5 - Substantial Performance of the Work.
- .2 Prior to requesting Substantial Performance of the Work, prepare and submit a complete deficiency list.
- .3 Owner, Consultant and affected subconsultants will review the Work and may require additional items be added to deficiency list.
- .4 Prior to requesting Substantial Performance of the Work, submit the following:
  - .1 Written statement that the Work has been substantially performed in accordance with Contract Documents, and is ready for use.
  - .2 Verification that operation of systems has been demonstrated to Owner.
  - .3 Two copies of complete and reviewed operation and maintenance manuals.
  - .4 Inspection and acceptance certificates required from authorities having jurisdiction.
  - .5 Life safety systems verification.

.6 Final Payment
- .1 When deficiencies have been corrected, and not later than 60 days after the date of Substantial Performance of the Work, request a final review of the Work.
- .2 Owner, Consultant and affected subconsultants will review the Work and notify Contractor of outstanding deficiencies.
- .3 After expiry of 60 day period, Owner may elect to correct outstanding deficiencies and deduct resulting costs from final payment. Deficient work shall be valued at 150 percent of normal cost with no item less than $50.00.
- .4 Prior to claiming final payment, submit:
  - .1 As-built drawings.

.2 A complete set of reviewed Shop Drawings, folded to 8-1/2" x 11" size, contained in heavy duty manila envelopes, numbered and labelled. Follow specification format with no more than one Section per envelope.
.3 Operation and maintenance manual.
.4 A final accounting of approved changes to Contract Price, including adjustments to cash allowances.

END OF SECTION

1 General

1.1 OPERATION AND MAINTENANCE MANUAL

.1 Submit to Consultant two bound hard copies and one digital copy of completed operation and maintenance manual.

.2 Prepare digital copy in the form of portable document format (.pdf) files.

.3 Organize data in the form of an instructional manual, with hard copies bound in commercial-quality binders, 8-1/2" x 11" size, with maximum ring size.

.4 Cover: Identify each binder with typed or printed title "Operation and Maintenance Manual"; listing volume number, Project name and identifying subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Prepare hard copies with tabbed fly leaf for each separate Product and system, with typed description of Product and major component parts of equipment.

.7 Prepare digital copy with electronic bookmarks for each separate Product and system, with description of Product and major component parts of equipment.

.8 Extended Warranties: Arranged in systematic order matching specification format. Include a listing of extended warranties. Each warranty must indicate Project name and address, Owner's name, corresponding Section number and title, and issuer's name, address, telephone number, web site address, contact person information, seal and signature.

.9 Prepare Drawings with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

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

.11 As a minimum requirement, include the following information as applicable:
- .1 Table of Contents. If more than one volume is required, provide a cross-reference contents page at the front of each volume.
- .2 Complete list of Subcontractors and Suppliers, indicating name, address, telephone and fax numbers, contact person information, and description of work performed.
- .3 Complete list of Products used in the Work, indicating Product name, part number or code and manufacturer for each listing.
- .4 Door hardware schedule, as amended.
- .5 Schedule of paints and coatings, including identification of each surface with applicable paint or coating used. Enclose copy of colour schedule.
- .6 Maintenance instructions for finished surfaces.
- .7 Brochures, cuts of equipment and fixtures.
- .8 Operation and maintenance instructions for equipment.
- .9 Valve manual.
- .10 Controls schematics.
- .11 Air and water balancing reports.
- .12 Extended warranties.
- .13 Maintenance contracts.
- .14 Other data required by Contract Documents.

1.2 AS-BUILT DOCUMENTS

.1 Promptly record revisions, omissions and additions on one set of black line opaque Drawings and in Specifications.

.2 Keep as-built documents up-to-date at all times. Failure to do so may result in postponement of payment.

.3 Record information concurrently with construction progress.

.4 Do not conceal work until required information is recorded.

.5 Legibly mark each item to record actual construction, including manufacturer name, trade name and catalog number of each product actually installed, particularly optional items and substitutions.

.6 Maintain manufacturers' certifications, inspection certifications, hardware schedules, colour schedules and field test records as required by Specifications.

.7 Mark revised documents as "AS-BUILT".

.8 Include revisions, with special emphasis on mechanical, electrical, structural steel and reinforced concrete.

.9 Prior to Substantial Performance of the Work, collect marked-up drawings from Subcontractors and have information electronically transferred to a master set of drawing files by Consultant. Pay Consultant for electronic transfer of as-built information from cash allowance specified in Section 01 21 00.

1.3 SPARE PARTS, SPECIAL TOOLS AND EXTRA MAINTENANCE MATERIALS

.1 Two weeks prior to requesting Substantial Performance of the Work, submit to Consultant special tools or equipment required for maintenance purposes.

.2 Spare parts and maintenance materials shall be new, not damaged or defective, and of same quality and manufacture as Products incorporated in the Work. If requested, furnish evidence as to type, source and quality of spare parts and maintenance materials.

.3 Defective Products will be rejected, regardless of previous inspections. Replace defective Products.

.4 Store spare parts and extra maintenance materials in a manner to prevent damage or deterioration.

.5 Submit spare parts, special tools, maintenance and extra materials in specified quantities.

END OF SECTION

1 General

1.1 DEMONSTRATION AND TRAINING

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing and maintenance of each item of equipment at agreed upon times and at designated locations.

.2 Owner will prepare a list of personnel to receive instructions, and will coordinate their attendance at agreed upon times.

.3 Prior to demonstrations proceeding, ensure equipment has been inspected and put into proper operation, including start-up, testing, adjusting and balancing.

.4 Instruct personnel in phases of operation and maintenance using operation and maintenance manual as basis of instruction.

.5 Review contents of operation and maintenance manual in detail to explain aspects of operation and maintenance.

.6 Allow Owner to video record demonstration and training instructions.

.7 Prepare and insert additional data in operation and maintenance manual when need for additional data becomes apparent during instructions.

END OF SECTION

1 General

1.1 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating Product composition, physical and chemical properties, Product limitations and installation guidelines, and warranty details.

1.2 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.

1.3 QUALIFICATIONS

.1 Applicator: A firm specializing in applying concrete floor sealers, having minimum 5 years documented experience.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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.

1.5 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 Section 01 25 00.

2.2 MATERIALS

.1 Concrete Floor Sealer: Single-component, acrylic, polymer-based, high solids, liquid sealer; non-yellowing formulation; chemical resistant; and as follows:
.1 Colour: Clear.
.2 VOC Content: $\leq$ 10.8 g/L.
.3 Manufacturer and Product Name: 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 71 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 76 00.

.2 Restrict foot traffic for 12 hours.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 - Metal Fabrications.

.2 Section 07 92 00 - Joint Sealants.

.3 Section 08 12 13 - Hollow Metal Frames.

.4 Section 08 31 00 - Access Doors and Panels.

.5 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM A641/A641M-19: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.2 ASTM A951/A951M-22: Standard Specification for Steel Wire for Masonry Joint Reinforcement.

.3 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.

.4 ASTM C331/C331M-23: Standard Specification for Lightweight Aggregates for Concrete Masonry Units.

.5 CSA A165 SERIES-14 (R2019): CSA Standards on Concrete Masonry Units.

.6 CAN/CSA-A179-14: Mortar and Grout for Unit Masonry.

.7 CSA A370-14 (R2018): Connectors for Masonry.

.8 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.

.9 CSA A3001-18: Cementitious Materials for Use in Concrete.

.10 CSA A3002-18: Masonry and Mortar Cement.

.11 CSA G30.18-09 (R2014): Carbon Steel Bars for Concrete Reinforcement.

.12 CSA S304-14: Design of Masonry Structures.

.13 NCMA TEK 3-2A-2005: Grouting Concrete Masonry Walls.

.14 NCMA TEK 10-2C-2010: Control Joints for Concrete Masonry Walls - Empirical Method.

1.3 QUALIFICATIONS

.1 Manufacturers: A firm specializing in manufacturing concrete masonry units, having minimum 5 years documented experience and a member of CCMPA.

.2 Installers: A firm specializing in installing commercial masonry, having minimum 5 years documented experience and a member of OMCA.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver mortar and grout materials in original unbroken and undamaged packages with manufacturer's name and brand distinctly marked.

.3 Store mortar and grout materials in a shed until ready for use.

.4 Store or pile sand on a plank platform and protect from dirt and rubbish.

.5 Store mortar materials and sand in such a manner as to prevent deterioration or contamination by foreign materials.

.6 Deliver masonry units in an approved protective film.

.7 Store masonry units off ground with care to avoid damage. Damaged units will not be acceptable for face work.

1.5 AMBIENT CONDITIONS

.1 Environmental Requirements: To CAN/CSA-A371.

.2 Do not use anti-freeze, liquid salts, or other substances to lower the freezing point of mortar or grout.

2 Products

2.1 MORTAR AND GROUT MATERIALS

.1 Portland Cement: To CSA A3001, Type GU; Grey colour.

.2 Masonry Cement: To CSA A3002, Type N.

.3 Mortar Aggregate: 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.

.7 Plasticizer: Water reducing type, reducing porosity and absorption to increase bond strength.

.8 Water Repellent: Mixture of calcium carbonate and hydrous magnesium aluminum silicate powders; eg. Hydrocide Powder by Degussa Building Systems.

2.2 MASONRY UNITS

.1 Concrete Masonry Unit - Normal Weight (CMU): To CSA A165.1, using N aggregate; 190 mm face height, 390 mm face length, bed depths as indicated on Drawings; types as follows:
.1 Hollow: H/15/A/M.
.2 Solid (75 percent): S/15/A/M.
.3 Solid (100 percent): S_f/15/A/M.

.2 Concrete Masonry Unit - Lightweight (CMU-LWT): To CSA A165.1, using $L_2$20S slag aggregate to ASTM C331; 190 mm face height, 390 mm face length, bed depths as indicated on Drawings; types as follows:
.1 Hollow: H/15/C/M.
.2 Solid (75 percent): S/15/C/M.
.3 Solid (100 percent): S_f/15/C/M.

2.3 ACCESSORIES

.1 Single Wythe Joint Reinforcement: To CSA A370, Ladder-type, Heavy Duty, fabricated from steel wire to ASTM A951/A951M; mill galvanized; BL-10 by Blok-Lok.

.2 Reinforcing Steel: To CSA G30.18, Grade 400R; new billet steel, deformed bars; sizes as indicated on Drawings.

.3 Joint Filler: Closed cell polyurethane or polyethylene oversized by 50 percent; self-expanding.

.4 Building Paper: No. 15 asphalt saturated felt.

2.4 MORTAR MIXES

.1 Mortar for Use with Loadbearing Concrete Unit Masonry: To CAN/CSA-A179, Type S using the Proportion specification method; Portland cement-masonry cement-sand mix, complete with water repellent admixture.

.2 Mortar for Use with Non-Loadbearing Concrete Unit Masonry: To CAN/CSA-A179, Type N using the Proportion specification method; masonry cement-sand mix, complete with water repellent admixture.

2.5 MORTAR MIXING

.1 Thoroughly mix materials in proper measured quantities needed for immediate use, to CAN/CSA-A179.

.2 Provide uniformity of mix and colouration.

.3 Take representative samples for testing consistency of strength and colour to CAN/CSA-A179.

.4 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.

.5 Discard mortars exceeding time limits specified above.

2.6 GROUT MIXES

.1 Grout for Use in Spaces 50 mm or Wider: To CAN/CSA-A179, Coarse Grout using the Property Specification method.

.2 Grout for Use in Spaces Narrower than 50 mm: 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 materials 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.

2.8 FINISHES

.1 Mill Galvanized Coating: To ASTM A641/A641M, Regular; 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 Apply bonding agent to existing concrete surfaces.

.4 Plug clean-out holes with masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.2 COORDINATION WITH OTHERS

.1 Securely install Products supplied by other Sections.

.2 Anchor frames with backs of jambs solidly packed with mortar. Where mortar additives have been used to prevent freezing, coat metal frames with bitumen paint before installation.

.3 Provide openings wherever required, including those required by facility service Subcontractors. Locating openings is the responsibility of component installer.

.4 Accurately locate chases and openings and neatly finish to required sizes.

.5 No pipe, conduit chase or enclosure shall be covered until after the affected parts of the Work have been inspected and tested.

.6 Coordinate placement of steel and concrete anchors with applicable Subcontractors.

3.3 COURSING

.1 Place masonry to lines and levels indicated.

.2 Maintain masonry courses to uniform width.

.3 Lay concrete masonry units in half-running bond.

.4 Maintain 10 mm thick mortar joints in both directions.

.5 When thumbprint hard, tool mortar joints to a smooth, tightly compressed, concave profile.

3.4 PLACING AND BONDING

.1 Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

.2 Fully bond intersections, and external corners.

.3 Strike mortar joints flush where resilient base is scheduled.

.4 Isolate masonry partitions from vertical structural framing members with a control joint.

.5 Extend and anchor non-loadbearing partitions to underside of structural deck.

.6 Use bull-nosed concrete masonry units at exposed corners.

3.5 REINFORCEMENT AND ANCHORAGES

.1 Conform to CSA A370.

.2 Place masonry joint reinforcement continuous in every second horizontal joint.

.3 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend 400 mm minimum each side of opening.

.4 Place joint reinforcement continuous in first and second joint below top of walls.

.5 Install reinforcing bars supported and secured against displacement.

.6 Reinforce joint corners and intersections of concrete unit masonry walls and partitions with strap anchors 400 mm OC.

3.6 LINTELS

.1 Install loose steel lintels as scheduled. Set steel lintels dry to permit movement.

.2 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.

3.7 GROUTED COMPONENTS

.1 Install masonry grout to NCMA TEK 3-2A.

.2 Fill masonry cores located within 300 mm of a wall opening solid with masonry grout.

3.8 CONTROL JOINTS

.1 Provide control joints in concrete unit masonry to NCMA TEK 10-2C.

.2 Do not continue horizontal joint reinforcing across control joints.

.3 Size joints as specified in Section 07 92 00 for sealant performance.

3.9 TOLERANCES

.1 Variation from Unit to Adjacent Unit: $\leq$ 1.5 mm.

.2 Variation of Joint Thickness: $\leq$ 3 mm within 1 000 mm.

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.

3.11 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as described in Section 01 40 00.

.2 Submit sample cubes of mortar and grout for laboratory testing and test data as specified in Section 01 40 00 and to CSA S304.

.3 Report on the compressive strength and water content of mortar and grout mixes.

.4 Submit product data on design mix, indicate Proportion or Property specification method used, required environmental conditions and admixture limitations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 07 84 00 - Firestopping.

.3 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.

.2 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.3 AAMA 2605-22: 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-17: 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-17: 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-23: 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-09(2015): 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 B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.17 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.18 ASTM D6386-22: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

.19 ASTM D7803-19: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

.20 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

.21 ASTM F467M-06a(2012): Standard Specification for Nonferrous Nuts for General Use (Metric).

.22 ASTM F468M-06(2012): Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use (Metric).

.23 ASTM F593-22: Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.

.24 ASTM F594-22: Standard Specification for Stainless Steel Nuts.

.25 ASTM F3125/F3125M-23: 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.

.26 CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel.

.27 CSA G40.21-13 (R2018): Structural Quality Steel.

.28 CSA S136-16: North American Specification for the Design of Cold-Formed Steel Structural Members.

.29 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.

.30 CSA W47.2-11 (R2020): Certification of Companies for Fusion Welding of Aluminum.

.31 CSA W55.3-08 (R2018): Certification of Companies for Resistance Welding of Steel and Aluminum.

.32 CSA W59-18: Welded Steel Construction.

.33 CSA W59.2-M1991 (R2018): Welded Aluminum Construction.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 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.

1.4 QUALIFICATIONS

.1 Fabricator: A firm specializing in fabricating custom metal components, having minimum 3 years documented experience.

.2 Welders: Workers certified by CWB to CSA W47.1, CSA W47.2 and CSA W55.3 as applicable.

2 Products

2.1 DESIGN CRITERIA

.1 Design cold-formed steel fabrications to CSA S136.

.2 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; 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.

2.3 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 A563/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 washers, 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.

.11 Primer for Ferrous Metal Surfaces: Red oxide type.

.12 Primer for Galvanized Surfaces: Zinc-rich paint type.

2.4 FABRICATION

.1 Prior to fabrication, verify existing conditions and take field measurements to ensure perfect fit of fabricated items.

.2 Fabricate cold-formed steel components to CSA S136.

.3 Shop weld steel components to CSA W59.

.4 Shop weld aluminum components to CSA W59.2.

.5 Fit and shop assemble components in largest practical sections to accommodate delivery to Place of the Work.

.6 Seal joints with continuous welds.

.7 Grind visually-exposed joints flush and smooth with adjacent finish surface.

.8 Make visually-exposed joints butt tight, flush and hairline.

.9 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; except where specifically noted otherwise.

.10 Supply components required for anchorage of fabrications.

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 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 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.

.5 Monochromatic Paint Coating on Aluminum: To AAMA 2605; two-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.03 mm dry film thickness; eg. Duranar by PPG Industries, Inc.; colours as selected by Consultant.

.6 Metallic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, complete with metal flakes incorporated in colour coat; factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc.; colour as selected by Consultant.

.7 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colours as selected by Consultant.

.8 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, colours 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 and or embedded in masonry with setting templates, to appropriate Sections.

3.2 INSTALLATION

.1 Install components plumb and level, accurately fitted, free from distortion or defects.

.2 Provide fasteners and anchors necessary to secure components rigidly in place.

.3 Field weld steel components to CSA W59.

.4 Field weld aluminum components to CSA W59.2.

.5 Field bolt and weld to match shop bolting and welding.

.6 Mechanically fasten joints butted tight, flush, and hairline.

.7 Grind welds smooth and flush.

.8 After erection, prime welds, abrasions, and surfaces not yet shop primed or galvanized, except surfaces to be in direct contact with concrete.

.9 Make Good damaged 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 countertops, 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.

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 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 F593-22: 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 CAN/CSA O80 Series-08 (R2012) Consolidated: Wood Preservation.

.6 CAN/CSA-O86-09 Consolidated: Engineering Design in Wood.

.7 CSA O112.9-10: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.8 CSA O121-08 (R2013): Douglas Fir Plywood.

.9 CSA O141-05 (R2009): Softwood Lumber.

.10 CSA O151-09: Canadian Softwood Plywood.

.11 NLGA Standard Grading Rules for Canadian Lumber, August 2017 Edition.

.12 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 60 00.

.2 Deliver and store Products under waterproof cover.

.3 Prevent damage to Products, existing property and to the Work.

.4 Store Products where it does not hinder progress of the Work.

1.5 EXISTING CONDITIONS

.1 The Work involves renovations and alterations to an existing facility.

.2 Include re-blocking or re-framing as required.

.3 Make minor adjustments from Drawings wherever existing conditions dictate.

2 Products

2.1 MATERIALS

.1 Dimension Lumber: To CSA O141, S4S; SPF species, kiln dried to S-DRY moisture content; preservative treated for exterior applications where noted on Drawings, sizes as indicated on Drawings; NLGA Light Framing Grade Category, Standard and Better Common Grade Mix.

.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 Adhesive: To CSA O112.9.

.8 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.

.9 Touch-Up Wood Preservative: To CAN/CSA O80; brush-applied copper azole (CBA-A or CA-B) or alkaline copper quaternary (ACQ) preservative.

.10 Touch-up Flame Retardant Coating: To CAN/CSA O80; brush-applied Dricon by Lonza.

2.3 FINISHES

.1 Flame Retardant Treatment
.1 Flame Retardant Treatment: To CAN/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 a ULC classification label.

.2 Wood Preservative Treatment:
  .1 Wood Preservative Treatment: To CAN/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 Fasteners: To ASTM A153/A153M, Classes C or D; hot dipped zinc alloy coating.

3 Execution

3.1 SITE APPLIED WOOD TREATMENT

.1 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.

.2 Apply two coats of touch-up wood preservative to sawn ends of preservative treated material.

.3 Apply two coats of touch-up flame retardant coating to sawn ends of flame retardant treated material.

.4 Apply touch-up coatings to CAN/CSA O80.

3.2 INSTALLATION

.1 Erect wood framing members 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 secured 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 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 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 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 4.0-2021: North American Architectural Woodwork Standards.

.7 CSA O121-08 (R2013): Douglas Fir Plywood.

.8 CSA O141-05 (R2009): Softwood Lumber.

.9 CSA O151-09: Canadian Softwood Plywood.

.10 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.

.11 NHLA Grading Rules.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 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 full panel sheet, edge and joint trim.
- .3 Hardwood Trim: 300 mm long, illustrating size and shape of profiles, and quality of wood grain.

1.4 QUALIFICATIONS

.1 Trim and Finish Carpenter: A firm employing workers specializing in finish carpentry work, and having minimum 3 years documented experience.

2 Products

2.1 LUMBER

.1 Dressed Softwood Lumber (DL-SWD): To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content, with mixed grain capable of receiving high quality opaque finish; sizes as indicated on Drawings.

.2 Dressed Hardwood Lumber (DL-HWD): Maple species, to NHLA Select and Better Grade; kiln dried to maximum 7 percent moisture content, 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.

2.2 PLYWOOD

.1 Softwood Plywood (PLY-SWD): CSP to CSA O151; SEL TF Grade; SPF 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): CSP to CSA O151; 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: Maple species; Face Grade A; Plain-Sliced; of clear Pleasing match 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: Maple species; Face Grade A; Plain-Sliced; of clear Pleasing match grain capable of receiving high quality transparent finish.

2.3 COMPOSITE BOARDS

.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; inter-felted ligno-cellulosic fibers consolidated under heat and pressure; minimum 500 kg/m^3 density; S1S surface finish; thicknesses as indicated on Drawings.

2.4 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.

2.5 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 Screws: Galvanized steel, tapered head suitable for counter sunk applications; sizes necessary to ensure adequate securement.

.7 Bolts, Nuts, Washers, Lags and Blind Fasteners: Size and type to suit application; plain finish.

.8 Primer: Alkyd primer sealer type.

.9 Wood Filler: Solvent base, tinted to match surface finish colour.

.10 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

2.6 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 4.0, Custom 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 where indicated on Drawings.

.8 Install coat hooks where indicated on Drawings.

.9 Seal gaps and joints as specified in Section 07 92 00.

3.2 ADJUSTING AND CLEANING

.1 Set exposed fasteners.

.2 Apply wood filler over exposed nail and staple 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.

1.2 REFERENCES

.1 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.

.2 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.

.3 CAN/CGSB-71.20-M88: Adhesive, Contact, Brushable.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate chains of laminate samples, illustrating available colours, patterns and textures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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 RH or greater than 60 percent RH 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 Formica.
- .3 Nevamar.
- .4 Pionite.
- .5 Tafisa.
- .6 Wilsonart.

.2 Substitution Procedures: Refer to Section 01 25 00.

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 Vertical Postforming Type: Grade VGP; 0.7 mm thick.
- .5 Cabinet Liner Type: Grade CLS; 0.5 mm thick.
- .6 Backer Type: Grade BKM; 1.0 mm thick.

.2 Core Materials: As indicated on Drawings.

.3 Sealer: Water-resistant type.

.4 Draw Bolts and Splines: Suitable for new core bases, and acceptable to fabricator.

.5 Contact Adhesive: To CAN/CGSB-71.20-M.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify cutouts in core materials are prepared for 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 4.0.

.2 Install Products plumb, true and square, neatly scribed and fitted to adjoining surfaces.

.3 Ensure adjacent laminate sheets match in colour, texture and pattern.

.4 Ensure decorative laminate and core profiles coincide to ensure full continuous support and bond over entire surface.

.5 Use continuous lengths to minimize joints. Maintain joints minimum 600 mm from cutouts.

.6 Offset joints in decorative laminate from joints in core material.

.7 Apply decorative laminate to exposed edges of core material for straight self-edging strips or flat work.

.8 Chamfer exposed edges of decorative laminate uniformly at 20 degrees.

.9 Do not mitre decorative laminate edges.

.10 Apply backing sheets where required to conceal and balance core material.

.11 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 76 00.

.2 Protect completed installation from damage with removable, temporary protective coverings.

.3 Maintain protection until Owner occupancy.

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.

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-17: 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 4.0-2021: North American Architectural Woodwork Standards.

.9 ANSI/BHMA A156.9-2015: Cabinet Hardware.

.10 ANSI/BHMA A156.11-2014: Cabinet Locks.

.11 ANSI/BHMA A156.26-2017: Continuous Hinges.

.12 CSA O112.9-10: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.13 CSA O112.10-08 (R2013): Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.14 CSA O121-08 (R2013): Douglas Fir Plywood.

.15 CSA O141-05 (R2009): Softwood Lumber.

.16 CSA O151-09: Canadian Softwood Plywood.

.17 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.

.18 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.

.19 NHLA Grading Rules.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, materials, component profiles and sizes, fastening methods, jointing details, finishes, accessories, locations of outlets, anchorage and hardware.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 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 Panel: 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 Trim: 300 mm long, illustrating profile 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 architectural wood casework, having minimum 3 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: Full-size, 450 mm wide sample of each type of architectural wood casework, including materials, finishes, hardware and 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 Substantial Performance of the Work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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 existing property and 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.

1.8 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: A two year AWMAC Guarantee Certificate, covering replacement, re-working, and re-finishing of deficient Product resulting from faulty workmanship or defective materials.

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 Section 01 25 00.

2.2 LUMBER

.1 Dressed Hardwood Lumber (DL-HWD): Maple species; NHLA Select and Better Grade; kiln dried to maximum 7 percent moisture content, capable of receiving high quality transparent finish; sizes as indicated on Drawings.

.2 Dressed Softwood Lumber (DL-SWD): To CSA O141, S4S; AWMAC Custom grade; Eastern White Pine, Douglas Fir or Spruce species, kiln dried to maximum 7 percent moisture content, with mixed grain capable of receiving high quality opaque 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 G2S, thicknesses as indicated on Drawings; as follows:
.1 Core: Hardwood veneer core, minimum 9 plies.
.2 Face Veneers: Maple species; Face Grade A; Plain-Sliced; of clear Book match grain capable of receiving high quality transparent finish.

.2 Hardwood Plywood - Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G2S, 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: Maple species; Face Grade A; Plain-Sliced; of clear Book match 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 ACCESSORIES

.1 Adhesive for Wet Area Exposures: To CSA O112.9.

.2 Adhesive for Dry Area Exposures: To CSA O112.10.

.3 Nails: To ASTM F1667, Type I (NL); galvanized steel, common wire; sizes necessary to ensure adequate securement.

.4 Spikes: To ASTM F1667, Type III (SP); 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 Screws: Galvanized steel, bugle head, power driven type, sizes necessary to ensure adequate securement.

.7 Anchors: Galvanized steel, drilled and epoxy-fastened types; sizes necessary to ensure adequate securement.

.8 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 304; sizes and thicknesses as indicated on Drawings.

.9 Stainless Steel Bar and Shape: To ASTM A276/A276M, Type 304; sizes and profiles as indicated on Drawings.

.10 Decorative Laminate: High pressure decorative laminate, Type HPDL as specified in Section 06 24 00.

.11 Solid Plastic Edgebanding: 3 mm thick PVC edgebanding with eased edge, colour and pattern to match cabinet panel faces, unless noted otherwise.

.12 Tackable Surface: 6 mm thick linoleum-based cork sheet, Krommenie by Forbo Linoleum Inc., colour as selected by Consultant.

.13 Eggcrate Lay-in Panel: 13 mm thick acrylic eggcrate grating, White colour; percentage opening and dimensions as indicated on Drawings.

.14 Metal Grille: Extruded aluminum to ASTM B221M, 6061-T5 alloy; anodized finish; linear design with percentage opening and dimensions as indicated on Drawings.

.15 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.

2.6 CASEWORK HARDWARE

.1 Unless specified otherwise, Provide cabinet hardware to ANSI/BHMA A156.9, Grade 1.

.2 Casework Hinges: Fully-concealed, adjustable, articulated, screw on type metal hinges; accommodating 100 degree, 110 degree, 125 degree, and 170 degree openings, and complete 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 complete with 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; Chrome finish, keyed to Owner's master keying system.

.7 Slide Bolt For Inactive Leaf: 60 mm long barrel bolt, nickel plated.

.8 Elbow Catch: Heavy duty type, nickel finish; eg. Model 5540180 by Richelieu.

.9 Door Bumper: Nylon bumper; 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 Wire Management Moulding: 50 x 38 mm size, lengths as indicated; complete with mounting screws; Black colour; eg. Model 512490 by Richelieu.

.15 Table Leg: 700 mm high adjustable metal leg, 60 mm OD; adjustable from 0 - 30 mm; chrome plated finish; complete with mounting plate, 4 legs per set; eg. Model 615710140 by Richelieu.

.16 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.

.17 Base Cabinet Leveller: 100 mm size, adjustable to minus 5 mm and plus 10 mm; Model 637.45.326 by Hafele.

2.7 FABRICATION

.1 Prior to fabrication, verify existing conditions and take field measurements necessary to ensure a perfect fit.

.2 Fabricate Products to AWMAC NAAWS 4.0, Custom 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 alterations 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 4.0.

.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: Factory install cabinet hinges, runners and hardware, anchoring components firmly into position for long life under hard use. Provide quantity of hinges per leaf, as follows:
- .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 Equally space banks of drawers, with minimum height of 120 mm.

.15 Apply decorative laminate to core materials as specified in Section 06 24 00.

.16 Factory seal cutouts and service fitting openings in countertops with moisture-resistant epoxy.

.17 Drill holes in gables to receive adjustable shelving pins. Provide ferow sleeves in drilled holes.

.18 Install neoprene or rubber bumpers at top and bottom of doors and drawers.

.19 Adjust doors and drawers to proper operation prior to installation.

2.8 FINISHES

.1 Transparent Finish on Hardwood and Hardwood Veneer-clad Products: To AWMAC NAAWS 4.0, System 12 - POLYURETHANE, WATER-BASED, Custom Grade for Transparent finish; colour and sheen as selected by Consultant.

.2 Opaque Finish on Unfaced Composite Panel and Softwood Products: To AWMAC NAAWS 4.0, 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.

2.9 SOURCE QUALITY CONTROL

.1 Arrange for an AWMAC appointed inspector to inspect the work of this Section at the plant.

.2 Pay costs of AWMAC inspection.

.3 Make Good rejected Products and workmanship.

3 Execution

3.1 INSTALLATION

.1 Install Products to AWMAC NAAWS 4.0, Custom Grade.

.2 Where practical, assemble finished casework at mill and deliver to Place of the Work ready for installation.

.3 Accurately fit joints and miters and set nail heads ready for finishing.

.4 Set and secure materials and components in place, rigid, square and plumb.

.5 Provide wood blocking, framing or furring shown on Drawings as part of casework fabrication or erection.

.6 Accurately scribe and closely fit compounds to irregularities of adjacent surfaces.

.7 Use draw bolts and splines to form tight, flush, hairline joints. Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.

.8 Provide heavy duty fasteners, securely anchoring casework to floor, ceiling and wall surfaces. Use only concealed type fasteners.

.9 Where permitted, secure concealed elements with small headed finishing nails. Countersink nail heads with nail setter.

.10 Provide sinks, service fittings and electrical outlets. Coordinate with other Sections for connection to facility services.

.11 Where access is required to valves and other facility service components located behind casework, Provide removable wood access panels, each secured with minimum 4 brass screws.

.12 Install laminate-clad countertops as specified in Section 06 24 00.

.13 Provide closers and filler strips in matching finish as required to ensure a neat and complete finished assembly.

.14 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.

3.2 FIELD QUALITY CONTROL

.1 Arrange for an AWMAC appointed inspector to inspect the work of this Section after installation.

.2 Pay costs of AWMAC inspection.

.3 Make Good rejected Products and workmanship.

3.3 ADJUSTING

.1 Adjust doors and drawers to proper operation after installation.

.2 Fill and touch up damaged finishes to match factory finish.

.3 Replace damaged Product that can not be repaired.

3.4 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect completed installation from damage with temporary protective coverings.

.3 Maintain protection until Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 26 00 - Vapour Retarders.

.2 Section 07 27 00 - Air Barriers.

.3 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.4 Section 07 84 00 - Firestopping.

.5 Section 09 21 16 - Gypsum Board Assemblies.

.6 Section 09 81 00 - Acoustic Insulation.

1.2 REFERENCES

.1 ASTM C518-21: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTM C612-14(2019): Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.3 ASTM C1104/C1104M-19: Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.4 ASTM D1621-10: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.5 ASTM D2842-19: Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.6 ASTM E96/E96M-24: Standard Test Methods for Water Vapor Transmission of Materials.

.7 CGSB 71-GP-24M: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

.8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.

.10 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.11 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.

.12 CAN/ULC-S701.1-2017: Standard for Thermal Insulation, Polystyrene Boards.

.13 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.14 ULC-S702.2-15: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation.

.15 CAN/ULC-S704.1-2017: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

.16 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 60 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 Products 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 batt and blanket insulation having Product considered acceptable for use:
.1 CertainTeed Canada, Inc.
.2 Knauf Insulation.
.3 Owens-Corning Canada Inc.
.4 Rockwool.

.4 Substitution Procedures: Refer to Section 01 25 00.

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 per 25 mm of thickness.
.2 Board Size: 600 x 2 400 mm.
.3 Compressive Strength (ASTM D1621): 210 KPa.
.4 Water Absorption (ASTM D2842): $\leq$ 0.7 percent by volume.
.5 Edges: Shiplap.
.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 SM by DuPont de Nemours, Inc.

.2 Rigid Board Insulation (INS-RB-2): 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 per 25 mm of thickness.
.2 Compressive Strength (ASTM D1621): 140 kPa.
.3 Faces: Glass reinforced mat facers both sides.
.4 Water Absorption (ASTM D2842): < 1 percent.
.5 Edges: Square.
.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 a minimum of two layers.
.9 Manufacturer and Product Name: eg. ISO 95+GL by Elevate.

2.4 BATT AND BLANKET INSULATION

.1 Batt Insulation (INS-BB-1): To CAN/ULC-S702.1, Type 1; mineral fibre non-rigid, friction fit thermal batt insulation, manufactured from glass, rock, or slag fibers; and as follows:
.1 Aged Thermal Resistance (ASTM C518): RSI $\geq$ 0.75 per 25 mm of thickness.
.2 Facing: Unfaced.
.3 Batt Size: 413 x 1 219 mm.
.4 Density (ASTM C612): 32 kg/m^3.
.5 Combustibility (CAN/ULC-S114): Noncombustible.
.6 Thickness: As indicated on Drawings.
.7 Manufacturer and Product Name: eg. ComfortBatt by Rockwool.

2.5 ACCESSORIES

.1 Adhesive for Use with Polystyrene: To CGSB 71-GP-24M, Type 1.

.2 Adhesive for Use with Other Materials: Mastic type, synthetic rubber base, fungi resistant, gun or trowel applied.

.3 Tape: 50 mm wide polyester self-adhering tape.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Ensure air seals and vapour retarders are in place.

3.2 RIGID BOARDS

.1 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 secure in-place.

.3 Stagger side and end joints.

.4 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 76 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 other Sections.

.5 Protect insulation requiring a thermal barrier in accordance with applicable regulatory requirements.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 21 00 - Thermal Insulation.

.2 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.3 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM E96/E96M-24: Standard Test Methods for Water Vapor Transmission of Materials.

.2 CAN/CGSB-51.34-M86: Vapour Barrier, Polyethylene Sheet for Use In Building Construction.

.3 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 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria and limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 33 00.

.2 Manufacturer's Instructions: Manufacturer's standard installation guidelines, indicating preparation and installation requirements and techniques.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of bituminous membrane vapour retarders having Product considered acceptable for use:
.1 Carlisle Coatings and Waterproofing.
.2 Elevate.
.3 Henry (a Carlisle Company).
.4 IKO Industries, Ltd.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 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.

2.3 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.
.3 Manufacturer and Product Name: eg. Super Six by Polytarp Products.

.2 Bituminous Membrane Vapour Retarder: Self-adhering bituminous membrane with laminated top surface; as follows:
.1 Thickness: 0.76 mm.
.2 Core: SBS modified asphalt.
.3 Top Surface: Tri-laminate woven high density polyethylene.
.4 Water Vapour Permeance (ASTM E96/E96M): $\leq$ 1.5 Ng/Pa•s•m^2.
.5 Manufacturer and Product Name: eg. V-Force Vapour Barrier Membrane by Elevate.

.3 Primer for Bituminous Membrane Vapour Retarder: Single-component, water-based primer; eg. V-Force WB Primer by Elevate.

.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 Bituminous Membranes: Exterior flashing sealant, Type SEAL-EXT-FL.

3 Execution

3.1 PREPARATION

.1 Ensure substrate surfaces are clean, dry and free of oil, grease, dirt, excess mortar or other contaminants.

.2 Cure new concrete for minimum two weeks.

.3 Prime substrate prior to applying self-adhering bituminous membranes.

3.2 INSTALLATION

.1 Install Products to SWI Sealant and Caulking Guide Specification.

.2 Plastic Sheet Vapour Retarders
.1 Position sheet joints or laps over firm bearing to achieve an effective and permanent seal.
.2 Seal laps, joints and terminations with joint sealant to ensure complete, continuous seal of building envelope.

.3 Bituminous Membrane Vapour Retarders
.1 Apply self-adhered bituminous membranes over primed surface, from low points to high points, overlapping edges by 65 mm.
.2 Stagger end laps.
.3 Install membrane to avoid fishmouths and wrinkles.
.4 Roll membrane with a weighted roller wrapped in resilient material.

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 vapour retarder membranes with joint sealant, as specified in Section 07 92 00.

.3 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 then only concealed upon Consultant acceptance.

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 07 21 00 - Thermal Insulation.

.2 Section 07 26 00 - Vapour Retarders.

.3 Section 07 27 36 - Sprayed Foam Air Barrier.

.4 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 08 90 00 - Louvers and Vents.

1.2 REFERENCES

.1 ASTM D412-16: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

.2 ASTM D882-12: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.3 ASTM E96/E96M-24: Standard Test Methods for Water Vapor Transmission of Materials.

.4 ASTM E154/E154M-08a(2019): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

.5 ASTM E2178-21: 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-S741-2008 (R2016): Standard for Air Barrier Materials - Specification.

.8 CAN/ULC-S742-2011 (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 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria and Product limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 33 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 60 00.

.2 Deliver Products in undamaged containers and original packaging indicating name of manufacturer and product.

.3 Store roll materials on end in original packaging.

.4 Store adhesives and primers at 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 assembly.

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 SRP Canada, Inc.
.4 VaproShield.
.5 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.
.6 W. R. Meadows of Canada Limited.

.3 Substitution Procedures: Refer to Section 01 25 00.

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 wall and roof opening frames.

2.3 MATERIALS

.1 Air/Vapour Barrier Sheet Membrane: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; SBS rubberized asphalt sheet membrane, self-adhering grade; 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).

.2 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).

.3 Air/Vapour Barrier Sealant: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; single-component, trowel- or brush-applied solvent type synthetic rubber; 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 Attachments: Galvanized steel bars and anchors.

.5 Adhesive: Compatible with sheet barrier and substrate, permanently non-curing.

.6 Tape: 66 mm wide, self-adhesive polypropylene tape.

.7 Primer: As recommended by self-adhering membrane manufacturer.

.8 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

3 Execution

3.1 PREPARATION

.1 Ensure surfaces are clean, dry and free of oil, grease, dirt, excess mortar and other contaminants.

.2 Cure new concrete for minimum two weeks.

.3 Fill spalled concrete or open mortar joints to an even plane.

.4 Apply primer to substrates.

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 sealant.

.9 Do not leave installed membranes exposed to UV or weather for more than 42 days.

3.3 FIELD QUALITY CONTROL

.1 Inspect completed installation prior to concealment and identify gaps, holes and punctures.

.2 Seal gaps, holes and punctures with air/vapour barrier sealant.

.3 Request Consultant inspection 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 then only concealed upon Consultant acceptance.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean extra material from adjacent surfaces.

.3 Leave a suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 21 00 - Thermal Insulation.

.2 Section 07 27 00 - Air Barriers.

.3 Section 08 90 00 - Louvers and Vents.

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 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria and Product limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's instructions as specified in Section 01 33 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 60 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 Section 01 25 00.

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 Air Sealant Foam (ASF-1): To CAN/ULC-S710.1; one-component polyurethane sealant.

.2 Air Sealant Foam (ASF-2): To CAN/ULC-S711.1; two-component polyurethane sealant.

3 Execution

3.1 PREPARATION

.1 Ensure surfaces are clean, dry and free of oil, grease, dirt, excess mortar and other contaminants.

3.2 INSTALLATION

.1 Install air sealant foam in accordance with authorities having jurisdiction.

.2 Avoid overfilling restricted spaces.

.3 Seal gaps between air barrier membranes and frames installed in openings.

.4 Apply air sealant foam Type ASF-1 to cracks or openings 6 mm to 50 mm wide. Conform to CAN/ULC S710.2.

.5 Apply air sealant foam Type ASF-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 a suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 30 00 - Steel Deck.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 07 26 00 - Vapour Retarders.

.5 Section 07 62 00 - Sheet Metal Flashing and Trim.

.6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM C1278/C1278M-17: Standard Specification for Fiber-Reinforced Gypsum Panel.

.2 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.4 CRCA Roofing Specifications.

.5 CSA A123.4-M1979: Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.6 CSA A123.21:20: Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.

.7 CSA A123.23-15: Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced.

.8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.

.10 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.11 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.

.12 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 31 00.

.2 Prior to commencement of deck installation, review and document methods and procedures related to roof deck and roofing system construction, including:
   .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 33 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.

1.5 CERTIFICATES

.1 Manufacturer Certificates: Signed by roofing manufacturer verifying installer is approved, authorized or licensed by manufacturer to install specified Products.

.2 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 33 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.

1.7 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 QUALIFICATIONS

.1 Applicator: A firm specializing in applying modified bituminous membrane roofing, having minimum 10 years documented experience and a member of OIRCA.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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, the 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.

1.10 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.

1.11 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 cover damage to building and contents resulting from failure to resist penetration of water.

.3 Manufacturer's Extended Warranty: A written warranty stating manufacturer will replace, at no cost to Owner, any portion of roofing membrane experiencing actual leaks resulting from manufacturing defects for a period of 15 years after Substantial Performance of the Work.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Elevate.
.2 Henry (a Carlisle Company).
.3 IKO Industries Ltd.
.4 Johns Manville.
.5 Soprema Inc.

.2 Substitution Procedures: Refer to Section 01 25 00.

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): As follows:
.1 Field of Roof: 1.2 kPa.
.2 Edge of Roof: 1.7 kPa.
.3 Corners of Roof: 2.74 kPa.

.3 Conform to CAN/ULC-S126 and CAN/ULC-S107.

2.3 MATERIALS

.1 Underlay and Cover Boards: 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 $\leq$ 5.
.2 Smoke Developed Index = 0.

.2 Vapour Retarder: Bituminous membrane vapour retarder, as specified in Section 07 26 00.

.3 Flat Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-2, minimum two layers, as specified in Section 07 21 00.

.4 Tapered Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-2 as specified in Section 07 21 00; slopes and thicknesses as indicated on the tapered insulation Shop Drawings.

.5 Base Sheet: To CSA A123.23, Type C, Grade 3; 2.5 mm thick SBS modified bituminous membrane, self-adhering grade, non-woven reinforced composite mat strengthened with glass fiber strands; removable silicone-treated release film on underside, and removable split release film on upper surface.

.6 Cap Sheet: To CSA A123.23, Type C, Grade 1; 4.0 mm thick SBS modified bituminous membrane, self-adhering grade, non-woven reinforced composite mat strengthened with glass fiber strands; removable film strip on underside, ceramic mineral granules factory-embedded on upper surface, colour as selected by Consultant.

2.4 ACCESSORIES

.1 Primer: Quick drying, solvent based adhesive; eg. S.A.M. Adhesive by IKO Industries Ltd.

.2 Bitumen: To CSA A123.4-M, Type 3.

.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 Base and Cap Flashing Membranes: Similar to base and cap sheet roofing membranes.

.5 Insulation Adhesive: One-component elastomeric foamable adhesive; eg. Millennium Adhesive by IKO Industries, Ltd.

.6 Miscellaneous Adhesives: As recommended by roofing manufacturer.

.7 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.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 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 application.

3.3 UNDERLAY BOARD

.1 Securely adhere underlay boards over metal roof deck, using beads of adhesive, applied at manufacturer's recommended rate of application.

.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.

3.4 VAPOUR RETARDER

.1 Adhere roof vapour retarder membrane 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 wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.

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 Embed minimum two layers of rigid board insulation into continuous beads of insulation adhesive.

.3 Lay subsequent layers of insulation with joints staggered 150 mm.

.4 Lay insulation boards with edges in moderate contact without forcing.

.5 Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

.6 Install tapered insulation boards where indicated and in accordance with accepted Shop Drawings.

.7 When recommended by insulation manufacturer, tape joints of insulation boards.

.8 Apply no more insulation than can be sealed with cover board and roof membrane in same day.

3.6 COVER BOARD

.1 Adhere single layer of cover board over insulation using beads of insulation adhesive, applied at manufacturer's recommended rate of application.

.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 BASE SHEET

.1 Starting at low point of roof and at right angles to slope, unroll and align base sheet.

.2 Adhere membrane to primed substrate, eliminating wrinkles, gaps, bubbles, air pockets and fishmouths. Heat fuse side laps.

.3 Install base sheet with minimum 75 mm side laps and minimum 150 mm end laps.

.4 Ensure adjacent end laps are staggered minimum 2 000 mm.

.5 Nail each mopped sheet at insulation stops at 200 mm OC where roof slope exceeds 1:12.

.6 Terminate base ply sheets at top of cant.

.7 Cut base sheet flashing from base sheet roll giving pieces 1 000 mm wide by a length that will run minimum 100 mm onto roof surface at base of cant, and will extend up and over parapet. Ensure proper size prior to installation.

.8 Apply base flashing using similar fastening method as base sheet application. Ensure minimum 75 mm wide end laps, staggered from base ply side laps.

3.8 CAP SHEET

.1 In same direction as base sheet, and staggering 500 mm from base sheet side lap and 2 000 mm from base sheet end lap, unroll and align cap sheet membrane.

.2 Adhere cap sheet membrane to base sheet, eliminating wrinkles, gaps, bubbles, air pockets and fishmouths. Heat fuse side laps.

.3 Terminate cap ply sheets at top of cant.

.4 Cut cap sheet flashing from cap sheet roll giving pieces 1 000 mm wide by a length that will run minimum 150 mm onto roof surface at base of cant, and will extend over cant minimum 200 mm above roof surface. Ensure proper size prior to installation.

.5 Apply cap sheet flashing using similar fastening method as cap sheet application. Ensure minimum 75 mm wide end laps, staggered from cap sheet side laps.

3.9 CANTS

.1 Unless shown otherwise on Drawings, install fibreboard cants at junctions between roof and vertical surfaces. Protect cants from moisture with continuous coating of bitumen on all surfaces.

.2 Install cants in continuous bed of bitumen, applied to both horizontal and vertical surfaces.

.3 Provide tight flush joints between lengths of cants and mitre corners.

3.10 ROOF PENETRATIONS

.1 Make roof penetrations watertight.

.2 Prime roof flanges with roofing mastic prior to roofing membrane installation. Install membrane continuously over penetration, then cut out and trim neatly to interior facing. Coat membrane with bitumen, and set and secure any clamping rings in bed of mastic as required.

.3 Insulate sleeves and soil pipes with mineral fibre insulation.

.4 Set caps or collars, and seal with approved sealant to provide a watertight installation.

.5 Apply flashings to ensure a complete and watertight fit of roofing accessories.

.6 Install roof drains only after roofing has been completed, and low points in roof structure have been determined. Ensure roof screens are secured in place over roof drains with mechanical device approved by Consultant.

3.11 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Advise Consultant and roofing inspector 48 hours prior to start of roofing operations.

.3 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect application (minimum twice per week) and confirm roofing installation is 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 76 00.

.2 Adequately protect Products and the Work from damage by weather, traffic and other causes.

.3 At 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 06 10 00 - Rough Carpentry.

.2 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.3 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 B32-20: Standard Specification for Solder Metal.

.4 ASTM D1970/D1970M-21: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.5 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.6 SMACNA Architectural Sheet Metal Manual, Seventh Edition, 2012.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets for manufactured items, indicating:
.1 Catalogue numbers,
.2 Product and manufacturer names,
.3 Available finishes, and
.4 Other pertinent data.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 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.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Verification Samples: 450 mm long samples, indicating sheet metal flashing design, method of locking and method of anchoring. Include one interior corner and one exterior corner condition.

1.6 QUALIFICATIONS

.1 Installer: A firm 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-Ups: Full-width, 1 220 mm long, mock-up panels for each type of sheet metal flashing, demonstrating interfaces with adjacent construction; 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 Substantial Performance of the Work.

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 leakage, joint spalling and similar defects.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of membrane underlayment having Product considered acceptable for use:
.1 Grace.
.2 Henry (a Carlisle Company).
.3 Soprema Inc.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Prefinished Sheet Steel: To ASTM A755/A755M, Structural Steel (SS) Grade 230, Types 1 and 2; galvanized sheet steel, 0.76 mm thick before galvanizing; with monochromatic paint coating.

.2 Galvanized Sheet Steel: To ASTM A653/A653MASTM A792/A792M, Structural Steel (SS) Grade 230, Types 1 and 2; galvanized sheet steel, 0.61 mm thick before galvanizing.

.3 Nails: To ASTM F1667, Type I (NL); common wire, corrosion-resistant type, material compatible with adjacent surfaces; sufficient length to penetrate minimum 25 mm into substrate.

.4 Cleats: 0.76 mm thick sheet steel; minimum 38 mm wide and interlocked with metal flashing.

.5 Starter Strips: 0.76 mm thick sheet steel; continuous lengths.

.6 Back-up Plates: 0.91 mm thick prefinished sheet steel; minimum 300 mm wide where adjacent lengths of cap flashing meet.

.7 Screws, Bolts 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.

.8 Solder: To ASTM B32; 50 percent block tin, 50 percent pig lead.

.9 Flux: Commercial hydrochloric acid cut with zinc, or 10 - 20 percent solution of orthophosphoric acid in water, for use with galvanized work.

.10 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 Grace.

.11 Primer: Water-based primer, eg. Perm-A-Barrier WB Primer by Grace.

.12 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

.13 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.

2.4 FABRICATION

.1 Shop fabricate flashing components as much as possible to minimize site operations.

.2 Fabricate Products to SMACNA Architectural Sheet Metal Manual.

.3 Form sheet metal on bending brake.

.4 Perform shaping, trimming and hand seaming on bench, where practicable, using proper sheet metal working tools.

.5 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.

.6 Clean tools and dies which have been used on carbon steel prior to fabrication to prevent contamination of surface with carbon steel dust.

.7 Form sections square, true and accurate to size. Flashings shall be free from distortion, waves, twists, buckles or other defects detrimental to appearance and performance.

.8 Allow for thermal movement when forming, installing, interlocking and soldering sheet metal components to avoid buckling, fullness of metal straining of joints or seams.

.9 Limit maximum length of flashing pieces to 2 400 mm.

.10 Double back exposed edges at least 12 mm for appearance and stiffness.

.11 Fabricate flashings, copings, closures, plastic boxes, pipe sleeves and flashings for roof mounted equipment to details shown, unless otherwise indicated.

.12 Wipe and wash clean soldered joints immediately after joint is soldered to remove acid.

.13 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 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 Prime substrates designated to receive self-adhered membrane underlayment.

.2 Secure membrane underlayment in place and lap joints 100 mm.

3.2 INSTALLATION

.1 Install Products to SMACNA Architectural Sheet Metal Manual.

.2 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.

.3 Install sheet metal flashings with joints lapped, locked, cleated with S-cleats and sealed, or soldered, as required.

.4 Hem exposed edges 12 mm.

.5 Type of joints used shall be adequate for various conditions, subject to approval.

.6 Fabricate exposed fastening in such a manner to prevent water penetration at point of fastening.

.7 Provide starter strips where indicated or required to present true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation.

.8 Make end joints where adjacent lengths of metal flashing meet using 300 mm long back-up flashing secured in place before installing flashing.

.9 Apply beads of sealant on face of back-up plate to seal ends of metal flashing.

.10 Leave 12 mm wide space between end of adjacent lengths of metal flashings.

.11 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.

.12 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.

.13 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.

3.3 ADJUSTING

.1 Imperfections in sheet metal work (such as holes, dents, creases or oil-canning) will be rejected.

.2 Make Good damaged sheet metal work.

.3 Wash entire installation down, and leave in neat condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 12 00 - Structural Steel.

.2 Section 05 30 00 - Steel Deck.

.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 C612-14(2019): Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.2 ASTM C847-18: Standard Specification for Metal Lath.

.3 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.

.5 ASTM E605/E605M-19: Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

.6 ASTM E736/E736M-19: Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

.7 ASTM E759/E759M-92(2020): Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

.8 ASTM E760/E760M-92(2020): Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.

.9 ASTM E761/E761M-92(2020): Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.

.10 ASTM E859/E859M-93(2020): Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

.11 ASTM E937/E937M-93(2020): Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

.12 ASTM E1513/E1513M-93(2020): 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 33 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 33 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 Installer: A firm specializing in applying spray-applied fire resistive coatings, and licensed or certified as an installer by Product manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver Products to Place of the Work in manufacturer's unopened packages, fully identified as to 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 air 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 AD Fire Protection Systems.
- .2 Cafco Industries Inc.
- .3 Grace Canada Inc.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

.1 Spray-Applied Fire Resistive Coating
  .1 Deflection (ASTM E759/E759M): Material shall not crack or delaminate when 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): Material shall not crack or delaminate from concrete topped galvanized deck to which it is applied.
  .3 Cohesion / Adhesion (ASTM E736/E736M): 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): Material shall not deform more than 10 percent when subjected to a crushing force of 68.9 kPa.
  .6 Corrosion Resistance (ASTM E937/E937M): 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): Material shall meet minimum individual and average density values as listed in appropriate UL/ULC design or as required by authority having jurisdiction, or shall have a minimum average density of 240 kg/m^3.

.2 Conduct tests and report 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 Cafco Industries Inc.

.2 Refractory Mineral Wool Board Fire Protection: To ASTM C612, Class 4; rigid boards 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 $\geq$ 0.76 @ 24 degrees C.
  .2 Surface Burning Characteristics (ASTM E84):
    .1 Flame Spread Index $\leq$ 15.
    .2 Smoke Developed Index $\leq$ 5.
  .3 Density: $\geq$ 144 kg/m^3.
  .4 Manufacturer and Product Name: eg. Cafco-board Mineral Wool Board Fire Protection by Cafco Industries Inc.

.3 Fastening Accessories: For each fire resistive assembly in which mineral wool board fire protection serves as rigid fire protection, Provide board fastening system complying with applicable 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 71 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 substrate.

.3 Ensure clips, hangers, supports, sleeves and other attachments to substrate are installed prior to application of spray-applied fire resistive materials.

.4 Ensure installation of suspended equipment shall not occur until application of sprayed fire protection is complete in affected area.

3.2 PREPARATION

.1 Prepare substrates to ULC 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 required thicknesses and densities necessary to achieve fire resistance ratings indicated on Drawings.

.3 Do not apply Products to steel floor decks prior to application of concrete.

.4 Do not apply Products to underside of roof deck until 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 identified ULC fire resistance design and manufacturer's written recommendations.

.7 Topcoat materials shall be type recommended and approved by manufacturer of each spray-applied fire resistive material required by Contract Documents.

.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 appropriate fire resistance design assembly noted in Contract Documents.

.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 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 76 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 Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 00 00 - Masonry.

.3 Section 05 50 00 - Metal Fabrications.

.4 Section 07 81 00 - Applied Fireproofing.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 09 21 16 - Gypsum Board Assemblies.

.7 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: Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.3 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.

.5 ASTM E814-23a: Standard Test Method for Fire Tests of Penetration Fire Stop Systems.

.6 ASTM E2174-20a: Standard Practice for On-Site Inspection of Installed Firestop Systems.

.7 ASTM E2393-20a: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.8 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

.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-S115-2018: Standard Method of Fire Tests of Firestop Systems.

.12 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

.13 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.14 ULC List of Equipment and Materials.

1.3 PREINSTALLATION MEETINGS

.1 Prior to commencing installation of firestopping and smoke seals, arrange and conduct preinstallation meeting as specified in Section 01 31 00.

.2 Preinstallation Meeting: Discuss proposed methods and materials to be used in each instance.

.3 Representatives of Owner, Contractor, Consultant, Subcontractor, 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 33 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 33 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 stamped, signed and dated by manufacturer's design engineer.
.2 Submit Shop Drawings to Consultant and to authority having jurisdiction for review and acceptance.

1.6 CERTIFICATES

.1 Submit certification as specified in Section 01 33 00.

.2 Certificate: Sealant manufacturer's letter of certification verifying Products meet or exceed specified requirements.

1.7 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 33 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 field quality control submittals as specified in Section 01 40 00.

.2 Manufacturer's Field Inspection Reports: Manufacturer's written acceptance of installation based on regular inspections.

.3 Engineered Judgements: Where completed installations deviate from tested design assembly, submit engineered judgements prepared by manufacturer's design engineer verifying compliance with applicable regulatory requirements.

1.9 QUALIFICATIONS

.1 Manufacturer's Design Engineer: A professional engineer having minimum 10 years documented experience designing firestop and smoke seal systems, licensed to practice at Place of the Work.

.2 Installer: A firm specializing in installing firestop and smoke seal systems, approved or certified as an installer by manufacturer.

1.10 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-ups: One example of each fire-resistant joint, penetration fire stop and smoke seal required on Project, including 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 Substantial Performance of the Work.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver Products to Place of the Work in original unopened packages.

.3 Store Products in an 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 AD Fire Protection.
.3 Hilti Canada.
.4 Nuco Inc.
.5 Specified Technologies Inc.
.6 Tremco.
.7 The Rectorseal Corporation.

.2 Substitution Procedures: Refer to Section 01 25 00.

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 appropriate required time rating.

.5 Provide firestop and smoke seal 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 firestopping assembly must meet or exceed fire resistance rating of floor or wall being penetrated.

.7 Provide 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: Firestop foams, boards, blocks, collars, wraps, puttys and plugs; to CAN/ULC-S115; ULC labelled; types as listed in tested assemblies.

.3 Firestop Insulation: To CAN/ULC-S702.1, 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): $\geq$ 72 kg/m^3.
.2 Combustibility (CAN/ULC-S114): Noncombustible.
.3 Melt Temperature: > 1 175 degrees C.
.4 Surface Burning Characteristics: To CAN/ULC-S102, as follows:
.1 Flame Spread Index $\leq$ 0.
.2 Smoke Developed Index $\leq$ 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; types as listed in tested assemblies.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 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 penetrating 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 impair sealant bond.

.3 Remove incompatible materials which affect bond by scraping, brushing, water cleaning, 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 Subcontractors 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 non-combustible smooth material to permit pipe to move without damaging firestopping and smoke seal.

.8 Maintain integrity of insulation and vapour retarders on insulated pipes and ducts at 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.

3.4 FIELD QUALITY CONTROL

.1 Perform field testing and inspection as specified in Section 01 40 00.

.2 Inspect penetration firestop systems to ASTM E2174.

.3 Inspect fire-resistant joint 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 and confirm completed installation is in strict accordance with 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 and other disfigurements 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 76 00.

.2 Protect firestop and smoke seal assemblies from damage.

.3 Maintain protection until Owner occupancy.

.4 Make Good damaged firestop and smoke seal assemblies just prior to Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-In-Place Concrete.

.2 Section 04 00 00 - Masonry.

.3 Section 06 20 00 - Finish Carpentry.

.4 Section 06 41 00 - Architectural Wood Casework.

.5 Section 07 26 00 - Vapour Retarders.

.6 Section 07 27 00 - Air Barriers.

.7 Section 07 27 36 - Sprayed Foam Air Barrier.

.8 Section 07 62 00 - Sheet Metal Flashing and Trim.

.9 Section 07 84 00 - Firestopping.

.10 Section 08 80 00 - Glazing.

.11 Section 08 90 00 - Louvers and Vents.

.12 Section 09 21 16 - Gypsum Board Assemblies.

.13 Section 09 51 23 - Acoustical Tile Ceilings.

.14 Section 09 66 13 - Portland Cement Terrazzo Flooring.

1.2 REFERENCES

.1 ASTM C919-19: Standard Practice for Use of Sealants in Acoustical Applications.

.2 ASTM C920-18: Standard Specification for Elastomeric Joint Sealants.

.3 ASTM C1193-16: Standard Guide for Use of Joint Sealants.

.4 ASTM C1521-19(2020): Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

.5 CAN/CGSB-19.13-M87: Sealing Compound, One Component, Elastomeric, Chemical Curing.

.6 CAN/CGSB-19.17-M90: One Component Acrylic Emulsion Base Sealing Compound.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 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 3 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver Products in manufacturer's sealed packages.

.3 Store Products in warm, dry conditions.

1.7 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.

1.8 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of two 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, 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.

.2 Manufacturers of exterior flashing sealants having Product considered acceptable for use:
.1 Henry (a Carlisle Company).
.2 Tremco.
.3 W. R. Meadows of Canada Limited.

.3 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

.1 Seal gaps between dissimilar Products, visible or otherwise.

.2 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, colours as selected by Consultant.

.2 Exterior Flashing Sealant (SEAL-EXT-FL): To ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A and O; one-part, moisture curing, low modulus polyurethane sealant; accommodating joint movement of plus or minus 25 percent; eg. Dymonic by Tremco, colour as selected by Consultant.

.3 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, Clear colour.

.4 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, colours as selected by Consultant.

.5 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, colours as selected by Consultant.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

.3 Backer Rod: Open cell polyethylene foam core wrapped in a closed cell polyethylene skin.

.4 Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

3 Execution

3.1 PREPARATION

.1 Clean and prime joints to requirements of manufacturer's instructions.

.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.

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 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 joint sealant 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 cleaner which will not damage adjacent surfaces.

.3 Make Good surfaces defaced or disfigured as a result of sealant application.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

.3 Section 09 90 00 - Painting and Coating.

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, Required Hardness, 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 E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.

.4 NFPA 80-2007: 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 33 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 33 00.

.2 Fire Test Certification Report: Certifying performance within specified fire rating.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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 The Williams Brothers Corporation.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Assemblies: To NFPA requirements for scheduled fire rated class.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel; 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 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; sizes as indicated on Drawings; and meeting the following characteristics:
.1 Door: 48 mm deep, 1.2 mm thick sheet steel, insulated with non-rigid mineral fibre insulation, completely filling door cavity.
.2 Box Frame: 1.5 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 lock opposite hinge; lock designed to accept both key and knurled knob included with each door.
.6 Manufacturer and Product Name: eg. Model WB-FR Standard Fire Rated Access Door With Drywall Bead by The Williams Brothers Corporation.

.2 Gypsum Board Ceiling Access Panel - Fire-Resistive: Suitable for horizontal installation in fire rated gypsum ceilings; sizes as indicated on Drawings; and meeting the following characteristics:
.1 Door: 1.6 mm thick sheet steel, recessed 38 mm to receive double layer of gypsum board infill.
.2 Frame: 1.6 mm thick sheet steel, hat-channel shape.
.3 Hinge: Full length piano hinge, 180 degree opening.
.4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
.5 Manufacturer and Product Name: eg. Model WB-ATR Fire-Resistive Ceiling Access Door by The Williams Brothers Corporation.

.3 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: 1.9 mm thick sheet steel, recessed design to receive gypsum board infill.
.2 Box Return Frame: 1.6 mm thick sheet steel, complete with 25 mm wide, 0.61 mm thick galvanized steel perforated flange.
.3 Hinge: Full length piano hinge, 110 degree opening.
.4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
.5 Manufacturer and Product Name: eg. Model WB-RDW Access Door for Drywall Surfaces by The Williams Brothers Corporation.

.4 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 latch.
- .5 Manufacturer and Product Name: eg. Model WB-NTG Recessed Drywall Access Door by The Williams Brothers Corporation.

.5 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, 1.9 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: 1.5 mm thick sheet steel, complete with 4 masonry strap anchors.
- .3 Closer: Automatic, spring-type.
- .4 Hinge: Continuous piano hinge, 180 degree opening.
- .5 Latch: Self-latching keyed cylinder paddle latch, opposite hinge.
- .6 Manufacturer and Product Name: eg. Model WB-FR Premium Ultra Fire-Rated Access Door by The Williams Brothers Corporation.

.6 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: 1.9 mm thick sheet steel.
- .2 Return Frame: 1.2 mm thick sheet steel, complete with 4 masonry strap anchors.
- .3 Hinge: Fully concealed, piano type.
- .4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
- .5 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 Baked Enamel Primer on Steel: Electrostatically-applied baked enamel primer over rust-inhibiting phosphate treatment; paintable; manufacturer's standard colour.

3 Execution

3.1 PREPARATION

.1 Coordinate installation of access panels in masonry walls with Section 04 00 00.

.2 Coordinate installation of access panels in gypsum board partitions and ceilings with Section 09 21 16.

.3 Coordinate exact 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 07 92 00 - Joint Sealants.

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 C1115-17: Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.

.6 ASTM C1281-16(2023): Standard Specification for Preformed Tape Sealants for Glazing Applications.

.7 ASTM E1300-24: Standard Practice for Determining Load Resistance of Glass in Buildings.

.8 CAN/CGSB-12.1-2017: Safety Glazing.

.9 CAN/CGSB-12.3-M91 (R2017): Flat, Clear Float Glass.

.10 CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

.11 GANA Glazing Manual.

.12 GANA GIB 01-0300: Proper Procedures for Cleaning Architectural Glass.

.13 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.14 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 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating structural, physical and environmental characteristics, thickness and size limitations, special handling and installation requirements.

1.4 CERTIFICATES

.1 Submit certificates as specified in Section 01 33 00.

.2 Certificate of Compliance: Manufacturer's standard certificate of compliance, attesting fire-rated glazing materials comply with CPSC requirements.

1.5 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 33 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 QUALITY ASSURANCE

.1 Conform to glazing installation methods and quality standards specified in GANA Glazing Manual. Select glazing compounds and sealants in accordance with glass manufacturers' instructions.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of float glass and tempered safety glass having Product considered acceptable for use:
.1 AFG Glass Inc.
.2 AGC Glass Company North America.
.3 Cardinal Glass Industries.
.4 Guardian Glass.
.5 Libbey-Owens Ford.
.6 Pilkington Glass North America, Inc.
.7 Prelco.
.8 Vitro Architectural Glass.

.2 Manufacturers of fire-rated ceramic glass having Product considered acceptable for use:
.1 Nippon Glass.
.2 Schott North America, Inc.

.3 Substitution Procedures: Refer to Section 01 25 00.

2.2 REGULATORY REQUIREMENTS

.1 Fire-rated Ceramic Glass: Each lite to bear a permanent, non-removable label designating 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.

2.4 MATERIALS

.1 Float Glass: To CAN/CGSB-12.3-M; glazing quality, 6 mm thick unless noted otherwise.

.2 Tempered Safety Glass: To CAN/CGSB-12.1; clear float glass fully tempered horizontally to achieve a net strength of not less than 4 to 5 times greater than regular annealed glass; impact safety rating meeting ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II; 6 mm thick unless noted otherwise.

.3 Fire-Rated Ceramic Glass: 5 mm thick fire-rated and impact safety-rated glass ceramic with surface-applied safety film; impact safety rating meeting ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II; Clear style, polished one side; Standard Grade; 88 percent visible light transmittance, 9 percent visible light reflectance; 90-minute fire rating when tested to CAN/ULC S104 and CAN/ULC-S106; eg. FireLite NT Standard by Technical Glass Products Inc.

2.5 ACCESSORIES

.1 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.

.2 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.

.3 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.

.4 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.

.5 Glazing Tape for Fire-rated Glass Applications: Fiberfrax Alumino-Silicate Fiber glazing tape by Unifrax Corporation.

.6 Setting Blocks: Elastomeric material, having a Shore A durometer hardness of 85, plus or minus 5.

.7 Setting Blocks for Fire-rated Glass Applications: Calcium silicate.

.8 Spacers: Elastomeric blocks or continuous extrusions, having a Shore A durometer hardness sufficient to maintain glass lites in place both during and after installation.

.9 Edge Blocks: Elastomeric material of sufficient hardness to limit glass lateral movement.

.10 Glazing Sealant: SEAL-GLZ as specified in Section 07 92 00.

.11 Cleaners, Primers and Sealers: Types recommended by sealant and gasket manufacturers.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 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 Protect glass edges from damage during handling and installation. Remove damaged glass Products from Place of the Work and dispose of in accordance with 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.

.3 Install setting blocks in sill rabbets, sized and located in accordance with GANA Glazing Manual. Set blocks in heel bead of glazing sealant.

.4 Do not exceed edge pressures stipulated by glass manufacturer for installing glass lites.

.5 Provide spacers for glass lites where length plus width is larger than 1 270 mm.

.6 Provide edge blocking necessary to prevent glass lites from moving sideways in glazing channel, in accordance with GANA Glazing Manual.

.7 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 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.

.8 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.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove glazing materials from finish surfaces.

.3 Remove non-permanent labels upon Substantial Performance of the Work.

.4 Clean glass surfaces to GANA GIB 01-0300.

3.5 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect 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 Remove and replace Products that have been damaged, including but not limited to having been broken, chipped, cracked or abraded; regardless of cause, before Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 05 12 00 - Structural Steel.

.2 Section 07 26 00 - Vapour Retarders.

.3 Section 07 27 00 - Air Barriers.

.4 Section 07 27 36 - Sprayed Foam Air Barrier.

.5 Section 07 62 00 - Sheet Metal Flashing and Trim.

.6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 AAMA CW-10-15: Care and Handling of Architectural Aluminum from Shop to Site.

.2 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.3 AMCA 500-L-07: Laboratory Methods of Testing Louvers for Rating.

.4 AMCA 501-03: Application Manual for Air Louvers.

.5 AMCA 511-07: Certified Ratings Program - Product Rating Manual for Air Control Devices.

.6 ASTM A123/A123M-17: 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 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.

.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 D3363-2020: Standard Test Method for Film Hardness by Pencil Test.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials and thicknesses, and air flow and water entrainment performance test results.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, sizes, configurations, anchorage details, connection details for component parts and finishes.

.3 Shop Drawings to include engineering calculations stamped, signed and dated by fabricator's design engineer.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate set of 50 x 50 mm size samples, illustrating full range of colour and finish selections.

1.6 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 33 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.

1.7 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional mechanical engineer experienced in air movement and control design, licensed to practice at Place of the Work.

.2 Fabricator and Installer: A firm specializing in fabricating and installing wall intake and exhaust louvers, having minimum 5 years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Conform to AAMA CW-10.

.3 Deliver Products to Place of the Work in clearly labelled protective cartons or wrappings.

.4 Store Products sufficiently off ground and covered with weatherproof, flame-resistant sheeting.

.5 Handle Products in a manner to prevent racking.

.6 Hoist Products from jambs only.

.7 Do not use heads, sills or blades to lift or transport Products.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 C/S Group.
.2 McGill Architectural Products.
.3 Ten-Plus Architectural Products Ltd.
.4 Ventex, Inc.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESIGN AND PERFORMANCE CRITERIA

.1 Design Products to withstand wind and snow loads in accordance with applicable regulatory requirements.

.2 Allowable Deflection for Structural Members: Maximum L/180 or 19 mm, whichever is less.

.3 Allowable Deflection for Blades: Maximum L/120 or 13 mm across the weak axis, whichever is less.

.4 Design louvered vent (LV-1) to have an average free area of 50 percent or greater when tested to AMCA 500-L.

.5 Design louvered vent (LV-1) to have the following properties when tested to AMCA 501:
.1 Free Area Velocity at Point of Beginning Water Penetration: 5.52 m/s.
.2 Maximum Recommended Air Intake Velocity: 4.51 m/s.
.3 Intake Pressure Drop: 44.7 Pa.
.4 Exhaust Pressure Drop: 32.3 Pa.

.6 Design louvered vent (LV-2) to have an average free area of 55.8 percent or greater when tested to AMCA 500-L.

2.3 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 or T6 temper.

.2 Sheet Aluminum: To ASTM B209/B209M, 3003-H14 alloy.

.3 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet; 1.2 mm thick.

.4 Fasteners: Stainless steel, 300 Series; prefinished to match louvre frame.

.5 Bituminous Coating: Fibred asphalt emulsion.

.6 Joint Sealant: As specified in Section 07 92 00, types as follows:
.1 Exterior Perimeters: Exterior weatherseal sealant, SEAL-EXT.
.2 Interior Perimeters: Interior general purpose sealant, SEAL-INT-GP.

.7 Air Sealant Foam: As specified in Section 07 27 36.

2.4 MANUFACTURED UNITS

.1 Louvered Vent (LV-1): Drainable type, fabricated as follows:
.1 Frame: Extruded aluminum, 50 x 100 mm size, flanged L- or A-frame as required by framing conditions; powder coated finish; to the following thicknesses:
.1 Heads: 1.78 mm.
.2 Jambs and Mullions: 3.18 mm.
.3 Sills: 2.03 mm.
.2 Blades: 1.78 mm thick extruded aluminum, 30 degree configuration, powder coated finish.
.3 Bird Screen: 1.27 mm OD aluminum wire, interwoven to 16 x 16 mm open weave, square pattern, set in 1.4 mm thick extruded aluminum frame, mill finish.
.4 Sill Flashing: 1.27 mm thick sheet aluminum, roll formed to required shape, single length in one piece per location; powder coated finish.
.5 Insulated Infill Panel: 1.2 mm thick aluminum sheet outer face, semi-rigid mineral fibre insulation to thicknesses indicated on Drawings, and 1.2 mm thick galvanized steel rear panel sealed at all edges; powder coated finish on sheet aluminum outer face.
.6 Sizes: As indicated on Drawings.
.7 Manufacturer Name and Product: eg. Model A4177 by C/S Group.

.2 Louvered Vent (LV-2): Flange frame, flange-mount type; complete with 13 x 13 galvanized steel mesh bird screen, 50 mm thick insulated blank-off panels, extended sills, and monochromatic paint finish; sizes as indicated on Drawings; eg. Model 2415 4" Deep Exhaust Louver by Ventex, Inc.

2.5 FABRICATION

.1 Fabricate Products free from distortion and effects detrimental to appearance and performance.

.2 Fasten louver frames and blades with stainless steel screws or heliarc welding.

.3 Neatly mitre louver frames at corners and reinforce with corner brackets.

2.6 FINISHES

.1 Powder Coated Finish on Aluminum: To AAMA 2605; 100 percent resin fluoropolymer coating, factory-applied to 0.075 mm dry film thickness, with 4H Hardness rating to ASTM D3363; colour as selected by Consultant.

.2 Monochromatic Paint Coating on Aluminum: To AAMA 2605; two-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.03 mm dry film thickness; eg. Duranar by PPG Industries, Inc.; 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 71 00.

.2 Verify dimensions of supporting structure at Place of the Work.

3.2 PREPARATION

.1 Apply heavy coat of bituminous coating on aluminum surfaces placed in direct contact with concrete, mortar, plaster, or dissimilar metals.

3.3 INSTALLATION

.1 Securely install Products straight, plumb and level, with uniform joints.

.2 Install louvered wall vents to AMCA 501.

.3 Cut and trim components during erection only with manufacturer's prior written approval. Make Good damaged finishes.

.4 Remove and replace members where site-cutting or trimming has impaired strength or appearance of assembly.

.5 Flash exterior louvers, vents and grilles to prevent water infiltration into building enclosure.

.6 Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.

.7 Provide perimeter joint sealant as specified in Section 07 92 00.

3.4 TOLERANCES

.1 Maximum Variation From Plane: Plus or minus 3 mm per 3 660 mm of length, but not exceeding 13 mm in any total building length.

.2 Maximum Offset From True Alignment Between Two Members: Plus or minus 1.5 mm, under both loaded and non-loaded conditions.

3.5 ADJUSTING

.1 Field touch-up scratches or damaged enamel finishes.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.

.2 Section 08 31 00 - Access Door and Panels.

.3 Section 09 51 23 - Acoustical Tile Ceilings.

.4 Section 09 81 00 - Acoustic Insulation.

.5 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM A641/A641M-19: 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: 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 C645-18: Standard Specification for Nonstructural Steel Framing Members.

.7 ASTM C754-20: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.8 ASTM C840-23: Standard Specification for Application and Finishing of Gypsum Board.

.9 ASTM C954-18: 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.

.10 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.

.11 ASTM C1047-19: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.12 ASTM C1264-19: Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.

.13 ASTM C1396/C1396M-17: Standard Specification for Gypsum Board.

.14 ASTM C1629/C1629M-23: Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.15 ASTM C1658/C1658M-19e1: Standard Specification for Glass Mat Gypsum Panels.

.16 ASTM E90-09(2016): 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 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 gypsum board having Product considered acceptable for use:
.1 CertainTeed Canada, Inc.
.2 CGC Inc.
.3 G-P Gypsum Corporation.

.3 Substitution Procedures: Refer to Section 01 25 00.

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 ceiling hangers, 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 1 460 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; to CAN/ULC-S101.

.4 Sound Rated Assemblies: Provide Products and construction identical to those tested in listed assemblies; to ASTM E90.

2.4 METAL FRAMING

.1 Metal Standard Duty 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 Heavy Duty Studs: To ASTM C645; 0.836 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.

.3 Metal Standard Duty 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 Heavy Duty 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 Track: 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 Members: 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: 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 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.

.12 Tie Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 1.21 mm OD steel wire.

2.5 BOARDS

.1 Moisture/Mould Resistant Gypsum Board (GB-MR): To ASTM C1396/C1396M; 12.7 mm thick gypsum panel with water- and mould-resistant gypsum core and paper facers, tapered edges; eg. Sheetrock Brand Ultralight Panels Mold Tough by CGC Inc.

.2 Fire-Rated Gypsum Board (GB-FR): To ASTM C1396/C1396M, Type C; fire-rated gypsum panel with water- and mould-resistant gypsum core and paper facers, tapered edges, ULC labelled; thicknesses as indicated on Drawings; eg. Sheetrock Brand Mold Tough Panels FireCode C by CGC Inc.

.3 Abuse-Resistant Gypsum Board (GB-AR): To ASTM C1629/C1629M, Type X; Level III - Extreme Duty; 15.9 mm thick; square edges; moisture-resistant core with fiberglass mat facers both sides; DensArmor Plus Impact-Resistant Interior Panel by G-P Gypsum Corporation.

.4 Gypsum Backing Board (GB-BB): To ASTM C1396/C1396M; 12.7 mm thick; paper-faced; square edges.

.5 Gypsum Ceiling Board (GB-CLG): To ASTM C1396/C1396M; 12.7 mm thick; paper-facers, eased edges; maximum 6.5 kg/m^2 weight; eg. Sheetrock Brand Ultralight Interior Ceiling Board Sag-Resistant 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, as follows:
.1 For Securement to Metal Framing: Type S, Fine Thread.
.2 For Securement to Gypsum Backing Board: Type G, Coarse-pitch High-thread.

.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: Ready-mixed drying type drywall compound, to ASTM C475/C475M; 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 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 homogeneous mixture with trowelling consistency.

A1-4 PROJECT MANUAL - 09 21 16 GYPSUM

.1 Add 2.5.6 : .6 Gypsum Board - Shaft Liner (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 Brand Glass-Mat Liner Panels by CGC Inc.

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 required spacings.
  .2 Supply concrete inserts and other devices to other related Sections for installation in advance.

3.2 METAL WALL FRAMING

.1 Install metal wall framing to ASTM C754 and 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 stud framing in straight walls and partitions 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 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 direct furring 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 similar construction.

.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 plane formed by 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 electrical and mechanical items 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 board Products to ASTM C840 and the CGC Gypsum Construction Handbook.

.2 Install gypsum ceiling board perpendicular to supports.

.3 Screw fasten boards to furring or framing.

.4 Install abuse-resistant gypsum board on heavy duty metal stud and track framing.

.5 Double Layer Applications: Use gypsum backing board for first layer, place 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, ready to receive final finishes specified in other Sections.

.3 Except as specified below, finish gypsum board to GA-214, Level 4.
.1 Provide Level 1 finish on concealed surfaces, such as in plenum spaces above ceilings, and behind cabinetry.
.2 Provide Level 5 finish on glass mat-faced gypsum surfaces designated to receive 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 a 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 09 21 16 - Gypsum Board Assemblies.

.2 Section 09 81 00 - Acoustic Insulation.

.3 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 ASTM A123/A123M-17: 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: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.4 ASTM C635/C635M-17: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.5 ASTM C636/C636M-19: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.6 ASTM E1264-19: 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 33 00.

.2 Verification Samples: Duplicate 140 x 290 mm size sample of each specified acoustic lay-in tile, indicating texture, pattern, colour and edge profile.

1.4 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Minimum two full bundles for each lay-in tile ceiling Product, colour and pattern; clearly marked to identify:
- .1 Manufacturer's name,
- .2 Product's name,
- .3 Product colour and pattern.

.3 Store bundles in original undamaged packages, in a warm, dry area.

1.5 QUALIFICATIONS

.1 Installers: A firm specializing in erecting suspended metal ceiling grid and installing lay-in tile ceilings, having minimum 3 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver Products undamaged original containers.

.3 Store Products in warm, dry area.

1.7 EXISTING CONDITIONS

.1 Where existing ceilings require patching, use existing matching acoustic tiles removed from other areas.

.2 Protect material designated for re-use.

.3 Arrange for Consultant to inspect and accept existing materials designated for reuse prior to installation.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 Armstrong World Industries.
- .2 CertainTeed Canada, Inc.
- .3 CGC Inc.
- .4 Rockfon.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Acoustic Lay-in Ceiling Tile (ACT): To ASTM E1264, Type III, Form 2, Pattern C E; 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: 19 mm.
- .3 Pattern: Medium texture, fissured.
- .4 Edge: Square.
- .5 Weight: 6.74 kg/m^2.
- .6 Finish: Factory-applied latex paint, White colour.
- .7 Fire Resistance (CAN/ULC-S102): Class A.
- .8 Noise Reduction Coefficient: 0.70.
- .9 Light Reflectance: 0.85.
- .10 Manufacturer and Product Name: eg. School Zone Fine Fissured - 1714 by Armstrong World Industries.

.2 Suspended Metal 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, 43 mm high; die cut and interlocking components; baked enamel finish; eg. Prelude XL by Armstrong World Industries.

.3 Accessories: Stabilizer bars, clips, splices, edge mouldings, and hold down clips required for suspended grid system; same material and finish as suspended grid.

.4 Support Channels and Hangers: Galvanized steel, to rigidly secure ceiling system with maximum deflection of L/360.

.5 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.

.6 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 35; 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 71 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 SYSTEM

.1 Install suspended ceiling grid system to ASTM C636/C636M and CISCA installation standards.

.2 Hang 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.

.3 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.

.4 Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers to span the extra distance.

.5 Install additional hangers and reinforcing to accommodate loads being carried.

.6 Provide suspension hanger at each corner of suspended fixtures, and at maximum 610 mm OC around perimeter of fixture.

.7 Locate ceiling grid system on room axis leaving equal border units according to reflected ceiling plan.

.8 Install main tees suspended at maximum 1 220 mm OC and maximum 600 mm from wall.

.9 Install cross tees and grid adapters perpendicular to main tees, and interlock with main tees.

.10 Frame around fixtures and openings.

.11 Install edge moulding at intersection of ceiling and vertical surfaces.

.12 Form expansion joints as detailed. Form to accommodate plus or minus 25 mm movement. Maintain visual closure.

3.3 LAY-IN CEILING TILE

.1 Fit lay-in tiles in place, free from damaged edges.

.2 Neatly cut lay-in tiles to accommodate necessary penetrations.

.3 Cut and rabbet lay-in 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 lay-in tiles tight to grid system within 6 000 mm of exterior door.

3.4 TOLERANCES

.1 Variation from Flat and Level Surface: $\leq$ 3 mm in 3 000 mm.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

.3 Section 09 65 19 - Resilient Tile Flooring.

.4 Section 09 68 13 - Tile Carpeting.

1.2 REFERENCES

.1 ASTM F1861-21: Standard Specification for Resilient Wall Base.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate 100 mm long sample sets, 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 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Three percent or 6 m^2, whichever is greater, of each Product, colour and pattern; clearly marked to identify:
- .1 Manufacturer's name,
- .2 Product's name,
- .3 Product colour and pattern.

.3 Package Products neatly in original containers, to prevent damage.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver and store Products undamaged in original wrapping or cartons.

.3 Store Products for minimum 3 days prior to installation in a warm, dry room; stacked 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 of flooring materials.

.2 Maintain ambient air relative humidity 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 Roppe Corporation.
.3 Tarkett Johnsonite.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Resilient Base (RB-1): 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 Base (RB-2): 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 Strip (TS): Thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; colours 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: Acrylic, waterproof type; as recommended by manufacturer.

.7 Sealers and Wax: As recommended by manufacturer.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify surfaces are dry, true, even and smooth.

.3 Verify surfaces are free of gaps, holes and depressions.

.4 Verify surfaces are free of paint, grease and oil.

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 substrate filler.
.3 Apply, trowel and float substrate filler to leave smooth, flat, hard surface.
.4 Prohibit traffic until filler is cured.
.5 Vacuum clean substrate.

.3 Prime substrates to ensure proper adhesion of Products.

3.3 INSTALLATION

.1 Install Products 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 of 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, seal and wax installed Products.

3.5 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect completed installation with suitable and durable materials.

.3 Maintain protection until Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 09 65 13 - Resilient Base and Accessories.

.3 Section 09 66 13 - Portland Cement Terrazzo Flooring.

.4 Section 09 68 13 - Tile Carpeting.

1.2 REFERENCES

.1 ASTM E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 ASTM F710-22: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.3 ASTM F1700-20: Standard Specification for Solid Vinyl Floor Tile.

.4 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.5 ASTM F2170-19a: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.6 ASTM F2678-16(2021): 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.

.7 ASTM F3191-23: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

.8 ASTM F3441-24a: Standard Guide for Measurement of pH Involving Resilient Flooring Installations.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 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 extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Three percent or 6 m^2, whichever is greater, of each resilient flooring Product, colour and pattern; clearly marked to identify:
- .1 Manufacturer's name,
- .2 Product's name,
- .3 Product colour and pattern.

.3 Package tile products neatly in original containers, to prevent damage.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver and store Products undamaged in original wrapping or cartons.

.3 Store Products for a minimum of three days prior to installation in warm dry room with boxes stacked not over four high.

1.7 AMBIENT CONDITIONS

.1 Maintain ambient air temperature of 20 degrees C three days prior to, during and 48 hours after installation of flooring materials.

.2 Maintain ambient air relative humidity 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 Gerflor.
.2 Polyflor Canada, Inc.
.3 Six Degrees Flooring Surfaces.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Luxury Vinyl Tile (LVT): To ASTM F1700, Class III, Types A and B, Embossed Surface; heterogeneous vinyl plank, as follows:
.1 Tile Thickness: 3.0 mm.
.2 Wear Layer Thickness: 0.7 mm.
.3 Plank Sizes: As selected by Consultant.
.4 Impact Insulation Class (ASTM E90): IIC 36.
.5 Colours and Patterns: Four colours, as selected by Consultant.
.6 Manufacturer and Product Name: eg. Expona Design by Polyflor Canada, Inc.

.2 Adhesive: Vinyl acrylic wet-lay, pressure-sensitive adhesive, containing between 55 to 65 percent solids, Off-White colour, Creamy consistency; eg. Ultrabond ECO 360 by Mapei.

.3 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: Acrylic, waterproof type; as recommended by flooring manufacturer.

.5 Sealers and Wax: As recommended by flooring manufacturer.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify surfaces are dry, true, even and smooth.

.3 Verify surfaces are free of gaps, holes and depressions.

.4 Verify surfaces are free of paint, grease and oil.

.5 Verify concrete slabs have cured for minimum 28 days.

.6 Verify concrete slabs have a pH level between 7 and 9, to ASTM F3441.

.7 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER $\leq$ 2.27 kg per 100 m^2 for 24 hours.

.8 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with flooring installation until tests indicate RH $\leq$ 75 percent.

.9 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

3.2 PREPARATION

.1 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test. Conform to ASTM F710.

.2 Prepare underlayment patching compounds and surrounding slab surface 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 to produce symmetrical tile patterns.

.2 Spread only enough adhesive to permit installation of Products before initial set.

.3 Set Products in place, 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 Where adjacent floor finish is dissimilar, terminate resilient tile flooring at centre line of door openings.

.8 Provide transition strip along junction of dissimilar flooring materials.

.9 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, seal and wax installed Products.

3.5 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect completed installation with suitable and durable protective coverings, or by keeping traffic off floor.

.3 Maintain protection until Owner occupancy.

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 09 68 13 - Tile Carpeting.

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 A3001-18: Cementitious Materials for Use in Concrete.

.3 TTMAC 09 66 00 Terrazzo Specification Guide - 2007.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating divider strips, control joint strips, expansion joints, and termination strips.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating divider strips, control joints, and expansion joint layouts, details of adjacent components and special details.

1.5 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate 300 x 300 mm size samples, illustrating colour, chip size and variation, mortar colour, and ground top surface of divider strip.

1.6 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: TTMAC Hard Surface Maintenance Guide, sufficient quantities for inclusion in operation and maintenance manual.

1.7 QUALIFICATIONS

.1 Applicator: A firm specializing in applying terrazzo flooring, having minimum 5 years documented experience and a member of TTMAC.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver, store and handle Products in a manner to avoid damage.

.3 Store Products in a clean, dry, heated location.

.4 Condition Products to ambient temperatures for minimum 24 hours prior to installation.

1.9 AMBIENT CONDITIONS

.1 Do not install wet mixed terrazzo when temperature is below 10 degrees C or above 32 degrees C.

2 Products

2.1 MATERIALS

.1 Portland Cement: To CSA A3001, Type GU; white colour for topping mix, grey colour for underbed, modified to obtain a higher compressive strength of 19.3 MPa, obtained from single source.

.2 Colour Pigments For Topping: Non-fading mineral type.

.3 Sand: Sharp, coarse, clean, screened, free of deleterious material.

.4 Water: Potable.

.5 Surface Aggregate: Crushed marble, granite, or quartz, to match existing terrazzo.

2.2 ACCESSORIES

.1 Welded Wire Reinforcement: To ASTM A1064/A1064M, flat sheets; 51 x 51 mm mesh size, 1.5 mm thick galvanized wire.

.2 Divider Strips: 1.9 mm thick zinc brass top strip, zinc coated steel bottom strip, depth to match existing.

.3 Control Joint Strips: Brass top strips, zinc coated steel bottom strip, neoprene filler strip between vertical strips; sizes to match existing.

.4 Base Caps, Base Divider Strips, and Separator Strips: To match divider strips, with 13 mm projecting base.

.5 Foam Filler: Closed cell urethane foam, capable of compression to 50 percent of its thickness with full recovery.

.6 Slip Sheet: 0.15 mm thick polyethylene sheet.

.7 Subfloor Filler: Latex type.

2.3 MIXES

.1 Underbed: One part Portland cement to 4-1/2 parts sand by volume. Add water to produce low slump mix.

.2 Floor and Base: Matrix and aggregate mix to match existing.

3 Execution

3.1 PREPARATION

.1 Remove loose and unsound materials and clean thoroughhly.

.2 Apply appropriate bonding agent to substrate.

3.2 INSTALLATION

.1 Install divider and control joint strips, straight and level in locations indicated.

.2 Place terrazzo topping mix over prepared substrate to thickness required to match existing. Conform to appropriate TTMAC Detail.

.3 Allow terrazzo to cure.

.4 After curing, grind patches using 80 grit or finer stones until area has similar finish to surrounding floor surface.

3.3 CLEANING

.1 Scrub and clean terrazzo surfaces with cleaner to requirements of manufacturer's instructions.

.2 Allow surface to dry.

.3 Apply appropriate sealer to terrazzo surface.

3.4 SCHEDULE

.1 Portland Cement Terrazzo Bonded to Concrete Slab - Interior Only: TTMAC Detail 410F.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 09 65 13 - Resilient Base and Accessories.

.3 Section 09 65 19 - Resilient Tile Flooring.

.4 Section 09 66 13 - Portland Cement Terrazzo Flooring.

1.2 REFERENCES

.1 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.2 ASTM F2170-19a: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.3 ASTM F3191-23: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

.4 ASTM F3441-24a: Standard Guide for Measurement of pH Involving Resilient Flooring Installations.

.5 CAN/CGSB-71.28-M88: Adhesive, for Direct Glue-Down Carpet Installation.

.6 CRI 104-2002: Standard for Installation Specification of Commercial Carpet.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating physical and performance characteristics, available sizes, patterns and colours, and method of installation.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate complete sets, 150 x 150 mm in size; illustrating colour and pattern selection for each specified carpet tile.

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; sufficient quantity for inclusion in operation and maintenance manual.

1.6 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Minimum 4 percent for each carpet tile flooring Product, colour and pattern; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name,
.3 Product colour and pattern.

.3 Package Products neatly in original containers, to prevent damage.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Deliver Products in original packaging, with each package having its register number properly marked on each bale.

.3 Protect Products from damage, dirt, stains and moisture.

1.8 AMBIENT CONDITIONS

.1 Maintain ambient air temperature at 21 degrees C for 48 hours before, during and after installation.

.2 Maintain substrate temperature at 10 degrees C.

1.9 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Installer's Extended Warranty: For a period of two years, covering against loose fitting, breaking or unraveling of seams or breaking away from sub-base, and failure of materials or workmanship which proves detrimental to the appearance or performance of the carpeting.

.3 Manufacturer's Extended Warranty: For a period of 10 years, covering against wear, colour fading and deterioration of backing materials.

2 Products

2.1 MANUFACTURERS

.1 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Carpet Tile: A combination of Off Line and On Line by InterfaceFLOR Commercial, or Motion II and Line 2 by Venture Carpets Inc., or Frenemy Stock & Stock Brights and Elemental Solids II by Mannington Commercial; minimum 3 colours as selected by Consultant.

.2 Carpet Adhesive: To CAN/CGSB-71.28-M, solvent free, latex based waterproof adhesive; eg. Eco Tech 9600 by Chembond Ltd.

.3 Seam Adhesive: Latex seam sealer or thermoplastic adhesive.

.4 Sub-Floor Filler: Premixed latex cementitious type.

.5 Resilient Transition Strips: As specified in Section 09 65 13.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify concrete slabs have cured for minimum 28 days.

.3 Verify concrete slabs have a pH level between 5 and 11, to ASTM F3441.

.4 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER $\leq$ 2.27 kg per 100 sm for 24 hour period.

.5 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with installation until tests indicate RH $\leq$ 75 percent.

.6 Determine absorptive nature of substrate by conducting porosity tests to ASTM F3191.

3.2 PREPARATION

.1 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test.

.2 Remove subfloor ridges and bumps.

.3 Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

3.3 INSTALLATION

.1 Install carpet tile to CRI 104 for Direct Glue-Down Installation Method.

.2 Lay carpet tile in patterns as recommended by manufacturer.

.3 Verify carpet tile pattern match to ensure minimal variation between dye lots.

.4 Lay carpet tile with joints and seams parallel to building lines to produce symmetrical tile patterns. Provide perimeter tile of similar size within any given area.

.5 Lay carpet tile continuously from wall to wall in each area, including beneath casework.

.6 Cut and fit carpet tiles around interruptions.

.7 Fit carpet tiles tight to intersection with vertical surfaces without gaps.

.8 Where adjacent floor finish is dissimilar, terminate carpet tile flooring at centre line of door openings.

.9 Provide transition strip along junction of dissimilar flooring materials.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove dirt, carpet scraps and threads from carpet surface.

.3 Clean carpet with beater-type vacuum cleaner.

.4 Remove soiled spots or adhesive from carpet with recommended spot remover.

.5 Remove loose pieces of face yarn with sharp scissors.

3.5 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect completed installation with suitable and durable protective coverings, or by keeping traffic off floor.

.3 Maintain protection until Owner occupancy.

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 C423-17: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.5 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

.6 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.7 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 60 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 Section 01 25 00.

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 @ 100 mm thick.
- .2 Facing: Unfaced.
- .3 Density: $\geq$ 40 kg/m^3.
- .4 Combustibility (CAN/ULC-S114): Noncombustible.
- .5 Thickness: As indicated on Drawings.
- .6 Manufacturer and Product Name: eg. QuietZone by Owens-Corning Canada Inc.

.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: $\geq$ 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): 0.09 percent.
- .7 Thickness: As indicated on Drawings.
- .8 Manufacturer and Product Name: eg. Rockwool AFB 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.

.2 Install Products without gaps and voids.

.3 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 76 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 scope of the Work as indicated on Drawings, and include all finishing, whether specifically mentioned or not, except as specifically excluded below:
- .1 Section 05 12 00 - Structural Steel: Shop priming.
- .2 Section 05 30 00 - Steel Deck: Shop priming.
- .3 Section 05 50 00 - Metal Fabrications: Shop priming.
- .4 Section 06 24 00 - High Pressure Decorative Laminate: Integral colour and pattern.
- .5 Section 06 41 00 - Architectural Wood Casework: Shop finishing.
- .6 Section 07 62 00 - Sheet Metal Flashing and Trim: Shop finishing.
- .7 Section 07 81 00 - Applied Fireproofing: Integral colour.
- .8 Section 07 84 00 - Firestopping: Integral colour.
- .9 Section 07 92 00 - Joint Sealants: Integral colour.
- .10 Section 08 31 00 - Access Doors and Panels: Shop priming.
- .11 Section 08 90 00 - Louvers and Vents: Shop finishing.
- .12 Section 09 51 23 - Acoustical Tile Ceilings: Shop finishing.
- .13 Section 09 66 13 - Portland Cement Terrazzo Flooring: Integral colour.
- .14 Section 10 11 00 - Visual Display Surfaces: Shop finishing.
- .15 Section 10 14 00 - Signage: Shop finishing.
- .16 Section 10 51 13 - Metal Lockers: Shop finishing.
- .17 Section 12 24 13.16 - Manual Roller Window Shades: Anodized coating.
- .18 Do not paint glass surfaces.
- .19 Do not paint plastic components.
- .20 Do not paint plated, polished or anodized metal components.
- .21 Do not paint stainless steel components.

1.2 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 00 00 - Masonry.

.3 Section 05 12 00 - Structural Steel.

.4 Section 05 30 00 - Steel Deck.

.5 Section 05 50 00 - Metal Fabrications.

.6 Section 06 10 00 - Rough Carpentry.

.7 Section 06 20 00 - Finish Carpentry.

.8 Section 08 31 00 - Access Doors and Panels.

.9 Section 09 21 16 - Gypsum Board Assemblies.

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's normal operating hours or 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 Consultant for changes in work schedule.

1.5 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 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 33 00.

.2 Selection Samples: A full range of colour selector samples for each type of coating required.

.3 Verification Samples: If requested by Consultant, prepare 1 000 x 1 000 mm size sample panels. Apply finish to actual substrate material or to an acceptable alternate material if required to be portable.

1.7 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Minimum 4 L of each Product, colour and sheen used.

.3 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 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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 an 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 Products at minimum 10 degrees C.

1.10 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.

.5 Do not apply finishes when relative humidity exceeds 85 percent RH; 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 specified paint and finish system.

.2 Single-Source Responsibility: Provide primers and undercoats from 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 only paints and coatings having 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 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 with sufficient differences in shade of undercoats to distinguish each separate coat.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 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 values.

3.2 PREPARATION

.1 Prepare surfaces to MPI Architectural Painting Specification Manual.

.2 Prepare existing surfaces designated to be re-finished 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 materials from surfaces using appropriate methods.

.6 Correct minor defects and deficiencies in surfaces which affect application of paints and coatings.

.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 Apply Products to existing surfaces designated to be re-finished to MPI Maintenance Repainting Manual.

.3 Protect adjacent surfaces and areas, including equipment, labels and signage from damage during painting operations. Use drop cloths, shields, masking, templates or other suitable protective means.

.4 Make Good damage caused by failure to protect surfaces.

.5 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work areas as required.

.6 Use methods best suited for substrate and type of material being applied.

.7 Do not use compressed air or aerosol methods of application without prior written approval of Consultant.

.8 Spread finishes evenly and flow on smoothly without runs or sags.

.9 Apply Products no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.

.10 Apply Products under adequate illumination.

.11 Sand lightly between coats to achieve required finish.

.12 Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

.13 Back prime interior wood work with enamel primer sealer paint.

.14 Back prime exterior wood work with exterior primer paint.

.15 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.

.16 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.

.17 Match approved samples for colour, texture and coverage. Remove, refinish or repaint work not complying with specified requirements.

3.4 FACILITY SERVICES

.1 Unless otherwise specified or noted, paint "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical 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 minimum 460 mm or beyond sight line, whichever is greater with primer and one coat of matt black (non-reflecting) paint.

.4 Paint inside of light valances gloss white.

.5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.6 Paint red or band fire protection piping and sprinkler lines. Keep sprinkler heads free of paint.

.7 Paint yellow or band natural gas piping.

.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. Paint conduits, mounting accessories and other unfinished items.

.9 Do not paint outdoor transformers and substation equipment.

.10 Colour code equipment, piping, conduit and exposed ductwork in accordance with colour schedule. Colour band and identify with flow arrows, names and numbering.

.11 In unfinished areas, leave exposed conduits, piping, hangers, ductwork and other facility service components in original finish. Touch-up scratches and marks.

.12 Touch-up scratches and marks on factory painted finishes and equipment with paint as supplied by equipment manufacturer.

.13 Do not paint over nameplates.

3.5 FIELD QUALITY CONTROL

.1 Inspect surfaces, preparation and paint applications.

.2 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent:
- .1 Brush or roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in painted 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).

.3 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 final coat on any surface exhibits a lack of uniformity of colour, sheen, texture and hiding across full surface area.

.4 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, equipment, surplus materials and debris.

.4 Remove combustible rubbish materials and empty paint cans each day and safely dispose of in accordance with authorities having jurisdiction.

.5 Clean equipment and dispose of wash water / solvents as well as other cleaning and protective materials, paints, thinners, paint removers and strippers in accordance with authorities having jurisdiction.

.6 Leave the Work clean and free from dirt and debris.

3.8 WASTE MANAGEMENT

.1 Paint, stain, 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 sewers, storm sewers or into the ground strictly adhere to the following procedures:
  .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 applicable regulatory requirements dealing with hazardous waste.
  .5 Empty paint cans are to be dry prior to disposal or recycling.
  .6 Close and tightly seal 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 76 00.

.2 Protect other surfaces from paint or damage.

.3 Make Good damage.

3.10 FINISH SCHEDULE

.1 Provide indicated paint and finish systems for identified substrates to 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 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 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. 3.1G - EPOXY-MODIFIED LATEX (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 Semi-Transparent Stained Fire Retardant Finish: INT. 6.2FF - FIRE RETARDANT, PIGMENTED, W.B., Premium Grade; Gloss Level G4.
.2 Semi-Transparent Stained Finish: INT. 6.2J - POLYURETHANE VARNISH (over s.b. stain), Premium Grade; Gloss Level G4.
.3 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 00 - Structural Steel.

.2 Section 05 20 00 - Steel Joists.

.3 Section 05 30 00 - Steel Deck.

.4 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ASTM E2924-14: Standard Practice for Intumescent Coatings.

.2 CAN/ULC S102-10: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 SSPC-PA 2-2015: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.3 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, including information on physical properties, installation instructions, and general requirements for each specified intumescent material.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Verification Samples: 300 x 300 mm size sample of each type of intumescent coating, applied to a rigid backing, in the 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 the operation and maintenance manuals.

1.6 QUALIFICATIONS

.1 Applicator: Person or firm experienced in the application of intumescent coatings, and having a minimum of 10 years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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 60 00.

.2 Do not install coating when ambient temperature is below 4 degrees C or above 43 degrees C.

.3 Maintain this temperature range 7 days before, during and 48 hours after installation of wall coatings.

.4 Ensure adequate ventilation is maintained during and after coating material 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 AD Fire Protection Systems Inc.
- .3 Carboline Company.
- .4 Isolatek International.

.2 Substitution Procedures: Refer to Section 01 25 00.

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 fire and building codes for flame spread, fuel contributed and smoke development ratings to CAN/ULC S102.

2.4 MATERIALS

.1 Ferrous Metal Primer: Two-component, high solids, low-VOC, corrosion-resistant epoxy; eg. Carboguard 880 by Carboline; Gray colour.

.2 Galvanized Metal Primer: Two-component polymeric epoxy amine, 99 percent solids by volume; eg. Rustbond by Carboline; Translucent Green colour.

.3 Intermediate Coat - Exterior Applications: Single-component intumescent, 67 percent solids by volume; eg. Nullifire S605 by Carboline, Pale Green colour.

.4 Intermediate Coat - Interior Applications: Single-component intumescent, 67 percent solids by volume; eg. Nullifire S606 by Carboline, Pale Pink colour.

.5 Finish Coat: Two-component polyamido-amine epoxy, 98 percent solids by volume; eg. Carboguard 1340 by Carboline; Clear Amber colour, Gloss finish.

.6 Tinted Top Coat: Two-component urethane, Semi-Gloss finish, colours as selected by Consultant; eg. Carbothane 133 VOC by Carboline.

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 an air temperature of 25 degrees Celsius.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 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 ferrous metal primer to a dry film thickness of 0.02 mm.

.3 Spray apply galvanized metal primer to a dry film thickness of 0.05 mm.

.4 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 Spray apply finish coating over cured intermediate coating to a minimum dry film thickness of 0.05 mm.

.4 Apply tinted top coating over cured finish coating, applied to a minimum dry film thickness of 0.125 mm.

.5 Terminate in straight lines, at masking tape line.

.6 Thoroughly air cure applied Products.

.7 Prevent contamination during application and prior to completion of curing process. Close area of application for a minimum of 24 hours after application.

.8 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 Field inspection will be performed by an independent inspector, as specified in Section 01 40 00.

.3 Verify dry film thicknesses with a 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 76 00.

.2 Protect intumescent coatings from damage and wear during construction with temporary protective coverings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - 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 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.

.2 ANSI A208.1-2009: Particleboard.

.3 ASTM A424/A424M-18: Standard Specification for Steel, Sheet, for Porcelain Enameling.

.4 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.6 PEI 1002: Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

.7 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.8 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 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, layouts, component dimensions and thicknesses, details of connections and fastening, trim and hardware, and shop-applied finishes.

1.4 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.

1.5 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up Panel: A 1 000 x 1 000 mm size mock-up panel; comprised of one markerboard and tackboard; demonstrating quality of each material, trim pieces and method of joining adjacent panels.

.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 Substantial Performance of the Work.

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 Section 01 25 00.

2.2 DESCRIPTION

.1 Use only matching components from a single manufacturer's series of Products.

2.3 REGULATORY REQUIREMENTS

.1 Test Products for surface burning characteristics to CAN/ULC-S102.

2.4 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper.

.2 Porcelain Enameled Sheet Steel: To ASTM A424/A424M, Type I, Commercial Steel.

.3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS), Types A, B, and C; galvannealed.

.4 Cork: Natural cork, Tan colour.

.5 Fibreboard: To CAN/ULC-S706.1, Type I; impregnated, sound absorbing type.

.6 Particleboard: To ANSI A208.1, Grade M-2.

2.5 MANUFACTURED UNITS

.1 Markerboard: Sandwich type construction, as follows:
- .1 Face Panel: 0.76 mm thick porcelain enameled sheet steel; writable and washable surface, acid-resistant; White colour.
- .2 Core: 11 mm thick fibreboard.
- .3 Back-up Balancing Sheet: 0.4 mm thick sheet 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 9300 by ASI Visual Display Products, Inc., comprised of:
- .1 Perimeter and divider trim,
- .2 Map rail, with integral tan cork insert, end stops and two combination roller map hooks for every 1 830 mm of map rail,

.3 Concealed mechanical joining system, including 25 mm wide integrally slotted PVC inserts laminated into ends of panels, and 2.0 mm thick galvanized steel splines.
.4 Marker tray, with contour fitting end castings; flat type.

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 waterproof adhesive.

2.7 FINISHES

.1 Anodized Coating on Extruded Aluminum: To AAMA 611, AA-A41 Clear etched and anodized satin finish, free from extruding draw marks and surface scratches.

.2 Porcelain Enamel Coating on Sheet Steel: To PEI 1002; with gloss factor between 6 - 8 when measured with 45 degree glossometer.

.3 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron alloy coating, with streak-free matte grey appearance.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify casework units designated to incorporate visual display surfaces have been installed.

3.2 INSTALLATION

.1 Install components to ensure a rigid, straight, square and plumb installation with horizontal lines level.

.2 Securely attach aluminum trims, ensuring fastenings are concealed.

.3 Adhere tackboards to wall surface with approved adhesive 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 to ensure a flush, butted joint, 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 first class condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 ALLOWANCES

.1 Contract Price includes a stipulated sum cash Allowance as specified in Section 01 21 00.

.2 Cash Allowance: Cost for supply and installation of:
.1 Interior door signage, and
.2 Interior wayfinding signage and directories.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, thicknesses, design style, font stryles and font sizes, finishes, methods of attachment and special details.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 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 Products

2.1 DESCRIPTION

.1 Braille: Raised bead type, to AODA requirements.

2.2 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 high;
.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 from manufacturer's complete colour selection;
.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 Consultant.

2.3 ACCESSORIES

.1 Fasteners: 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.

.2 Adhesive: As recommended by sign manufacturer.

2.4 FABRICATION

.1 Fabricate sign plates with letters and numbers centred within sign plate's length and height.

.2 Provide countersunk holes for screw fasteners.

3 Execution

3.1 INSTALLATION

.1 Install signs straight, plumb and level.

.2 Secure signs secured 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 signage adjacent to sign plates.

.10 Do not fasten signage through acoustically-rated or fire-rated doors.

3.2 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect installed Products with temporary removable film.

.3 Maintain protection until Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.2 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.

.4 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.

.5 ASTM D3363-2020: Standard Test Method for Film Hardness by Pencil Test.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating materials, layouts, dimensions, anchorage details, and details for metal trims and end panels.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate copies of manufacturer's standard colour charts, indicating available colour selections.

1.5 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Hooks, hinges, doors, bodies, and end panels, sufficient quantity to reconstruct 3 additional lockers, colour to match those installed; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name,
.3 Product colour.

1.6 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-ups: One full-height mock-up panel, consisting of minimum 3 locker bays, demonstrating components, anchoring and finishing details, colours, base construction, sloping top and end panels.

.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 Substantial Performance of the Work.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ASI Group Storage.
.2 Hadrian Manufacturing Inc.
.3 General Storage Systems.
.4 Buddsteel.
.5 Lincora Group.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

.1 Metal Lockers: Single-tier design; 305 mm wide, 1 830 mm high, 380 mm deep; ventilated; complete with metal top panels, end panels, fillers and jamb trims.

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 Sheet and Plate: To ASTM A240/A240M, Type 304.

.3 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304.

2.4 COMPONENTS

.1 Frame: Welded construction; 1.52 mm thick sheet steel, formed channel sections, complete with punched ventilation slots; powder coated finish.

.2 Compartment Doors: Welded construction; 1.89 mm thick sheet steel outer panel and 0.91 mm thick sheet steel full door size inner panel; rigid box construction; powder coated finish.

.3 Compartment Sides and Backs: 0.91 mm thick sheet steel; stiffening ribs on sides and flanges on backs; powder coated finish.

.4 Compartment Shelves: 1.52 mm thick sheet steel, flanged, complete with channel formation at front; powder coated finish.

.5 Compartment Tops: 1.52 mm thick sheet steel, flanged, complete with channel formation at front; powder coated finish.

.6 Plastic Compartment Bottoms: Injection moulded copolymer polypropylene; having minimum 90 kg load capacity; impact resistant; Black colour.

.7 Top Panels, End Panels and Miscellaneous Trim: 1.52 mm thick sheet steel; complete with necessary clips and other attachment devices; powder coated finish.

.8 Latching: Single-point, padlock type flange; in recessed stainless steel pocket.

.9 Coat Hooks: Zinc-plated metal coat hooks.

.10 Hinges: 1.52 mm continuous hinges integral to frame and secured to door using theft-proof fasteners; powder coated finish.

2.5 FABRICATION

.1 Verify site dimensions prior to fabrication.

.2 Fabricate Products true to dimensions, square, plumb and level.

.3 Accurately fit members with hairline joints. Secure intersecting members with appropriate fastenings.

.4 Fabricate finished work free from distortion and defects detrimental to appearances and performance.

.5 Incorporate ventilation slots at top and bottom of doors or frames.

.6 Close door on frame with closure strike the full height of door. Fit outer face of door flush with outside face of frame.

.7 Provide two rubber door grommets on lock side of frame.

.8 Form and factory punch bodies with necessary assembly holes.

.9 Flange tops and shelves on all four sides, with a channel formation at front of shelves.

.10 Provide two shelves and 3 coat hooks per compartment. Compartment tops and bottoms are not considered shelves.

.11 Provide recessed, mechanically-fastened number plate on door, numbered as directed by Consultant.

.12 Provide hidden nylon friction door stop to ensure proper door closure and quiet operation.

2.6 FINISHES

.1 Powder Coated Finish on Sheet Steel and Metal Components: To AAMA 2605; electrostatically sprayed polymer powder, factory-applied to 0.075 mm dry film thickness; graffiti- and abrasion-resistant with 4H Hardness rating to ASTM D3363; colours as selected by Consultant.

.2 Stainless Steel: To AISI No. 4 - Brushed.

3 Execution

3.1 INSTALLATION

.1 Install Products true to dimensions.

.2 Accurately secure joints and intersecting members with concealed attachment system.

.3 Install Products square, plumb and forming a rigid structure.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 ALLOWANCES

.1 Contract Price includes a stipulated sum cash Allowance, as specified in Section 01 21 00.

.2 Cash Allowance: Cost for supply and installation of manual roller window shades.

1.3 REFERENCES

.1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

.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 NFPA 701-2004: Methods of Fire Tests for Flame Propogation of Textiles and Films.

.5 CAN/ULC-S109-14 (R2019): Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.

.6 ANSI/WCMA A100.1-2018: American National Standard for Safety of Corded Window Covering Products.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 33 00.

.2 Product Data: Manufacturer's standard data sheets, indicating materials, components and accessories, component sizes, available fabrics and finishes, and installation instructions.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 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.

1.6 SAMPLES

.1 Submit samples as specified in Section 01 33 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 and colour.

1.7 SOURCE QUALITY CONTROL SUBMITTALS

.1 Submit source quality control submittals as specified in Section 01 33 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.

1.8 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.

1.9 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.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 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.

1.11 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 Decorations Ltee.
.2 Concord Shading Systems Inc.
.3 Elite Shades.
.4 Hunter Douglas Architectural.
.5 Legrand Canada.
.6 MechoShade Systems, Inc.
.7 Sun Glow Window Covering Products of Canada Ltd.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

.1 Roller Window Shades: Manual pull-down, spring-activated retracting 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; sizes as indicated on Drawings.

2.3 DESIGN CRITERIA

.1 Design manual roller window shades to operate without any exposed cords or chains, in accordance with ANSI/WCMA A100.1.

2.4 PERFORMANCE CRITERIA

.1 Fire Classification of Fabrics: Flame-retardant and fire-resistant to CAN/ULC-S109 and NFPA 701.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper; unless specified otherwise.

.2 Sheet Aluminum: To ASTM B209/B209M, 3003 alloy, H14 temper.

.3 Plastic: ABS type.

.4 Sun Control Fabric: Vinyl-coated polyester yarn, consisting of 79 percent vinyl and 21 percent dernier polyester core yarn; 3 percent openess factor, complete with antimicrobial coating; 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 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 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.

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, square, and parallel with window plane.

.2 Install Products rigidly coupled and adequately anchored.

.3 Maintain uniform clearances and accurate alignment levels.

.4 Conform to manufacturer’s Product data and accepted Shop Drawings.

.5 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.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean exposed surfaces using non-abrasive materials and methods.

3.6 DEMONSTRATION

.1 Refer to Section 01 79 00.

.2 Demonstrate proper operation and maintenance of roller shades.

END OF SECTION

PROJECT NAME: HDSB Nelson High School
Air Conditioning and Ventilation Upgrade

RDZ PROJECT NUMBER: 23214

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.

Where instructions are not provided, submit Supplementary Mechanical Bid Form by time of Bid closing, via e-mail addressed to:

RDZ Engineers Ltd.
Attention : Giovanni Rea
e-mail : Giovanni@rdzeng.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
20 05 20	Mechanical Vibration Control	
20 05 25	Mechanical Insulation	
20 05 55	Firestopping and Smoke Seal Systems	
23 30 00	Louvres	
23 30 00	Grilles & Diffusers	
23 30 00	Silencers	
23 36 00	VAV boxes	
23 70 00	Packaged Rooftop Unit	
23 70 00	Semi Custom Outdoor Air Handling Units	
23 82 19	Packaged Unit Ventilators (UV-1, UV-2, UV-4)	
23 82 19	Vertical Unit Ventilators (UV-3, UV-7, UV-8)	
23 82 19	Horizontal Unit Ventilators (UV-5, UV-6)	

END OF DOCUMENT

1 GENERAL

1.01 REFERENCES

.1 Architect's front end documents are a part of this Section.

1.02 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. Where requirements of this Section contradict requirements of front end documents, conditions of front end documents to take precedence.

.2 Be responsible for advising product vendors of requirements of this Section.

1.03 DEFINITIONS

.1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

.3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.

.4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.

.6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.

.7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.

.8 "barrier-free" – means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.

.9 "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.

.10 "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.

.11 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.

.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 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.

.15 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.

.16 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.

1.04 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 Sections MasterFormat.

.3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant’s report.

.5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

.6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.

.7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

.8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.

.10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical,and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by 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.

1.05 METRIC AND IMPERIAL MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.06 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.

1.07 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with Consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:

.1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);

.2 Air Movement and Control Association (AMCA);

.3 American Iron and Steel Institute (AISI);

.4 American National Standards Institute (ANSI);

.5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);

.6 American Society of Mechanical Engineers (ASME);

.7 American Society of Testing and Materials (ASTM);

.8 American Water Works Association (AWWA);

.9 Associated Air Balance Council (AABC);

.10 Building Industry Consulting Services, International (BICSI);

.11 Canadian Gas Association (CGA);

.12 Canadian General Standards Board (CGSB);

.13 Canadian Standards Association (CSA);

.14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);

.15 Electrical Safety Authority (ESA);

.16 Electronic Industries Association (EIA);

.17 Factory Mutual Systems (FM);

.18 Illuminating Engineering Society (IES);

.19 Institute of Electrical and Electronic Engineers (IEEE);

.20 International Standards Organization (ISO);

.21 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);

.22 National Building Code of Canada (NBC);

.23 National Electrical Manufacturers Association (NEMA);

.24 National Environmental Balancing Bureau (NEBB);

.25 National Fire Protection Association (NFPA);

.26 National Standards of Canada;

.27 NSF International;

.28 Occupational Health and Safety Act (OHSA);

.29 Ontario Building Code (OBC);

.30 Ontario Electrical Safety Code (OESC);

.31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);

.32 Technical Standards and Safety Authority (TSSA);

.33 Thermal Insulation Association of Canada (TIAC);

.34 Underwriters' Laboratories of Canada (ULC);

.35 Workplace Hazardous Materials Information System (WHMIS);

.36 Material Safety Data Sheets by product manufacturers;

.37 local utility inspection permits;

.38 Codes, standards, and regulations of local governing authorities having jurisdiction;

.39 additional codes and standards listed in Trade Sections;

.40 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.

.6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions. Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with Consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.

.11 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium time work to meet these requirements.

.12 Coordinate work inspection reviews and approvals with governing inspection department to ensure construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.

.13 Properly protect equipment and materials on site from damage and defacement due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.14 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products are to bear a CRN number.

.15 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.

1.08 PERMITS, CERTIFICATES, APPROVALS AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.

.3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.09 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:

.1 coverage is to be a minimum of $1,000,000.00 CDN inclusive of any one occurrence;

.2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;

.3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;

.4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;

.5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner’s Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant’s services.

1.10 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

.3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with Consultant.

1.11 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:

.1 piping requiring uniform pitch;

.2 piping 100 mm (4") dia. and larger;

.3 large ducts (main runs);

.4 cable tray and bus duct;

.5 conduit 100 mm (4") dia. and larger;

.6 piping less than 100 mm (4") dia.;

.7 smaller branch ductwork;

.8 conduit less than 100 mm (4") dia..

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.

.4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

1.12 COORDINATION OF 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, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.

.4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.13 PRODUCTS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

.3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.

.4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

.5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by 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. 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 products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.

.8 In addition to manufacturer’s products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.

.9 Indicate in Supplementary Mechanical Bid Form, 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.

.10 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant’s rejection of proposed equivalent product.

.11 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant’s discretion, at no additional cost to Contract.

.12 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.

.13 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with Consultant, and costs for review, to be borne by Contractor.

.14 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

1.14 SHOP DRAWINGS

.1 At start-up meeting, review with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.

.2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Coordinate exact requirements with Consultant.

.3 Submit for review, drawings showing 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.

.4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

.7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:

.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;

.2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.

.10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.11 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

.12 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 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with 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 from Owner and reviewed with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

.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, HOISTING AND RIGGING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with Consultant.

.2 Use scaffolds in such a manner as to interfere as little as possible with work of other trades.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with Consultant. No supports, clips, brackets or similar devices are to be welded, bolted or otherwise affixed to any finished member or surface without approval from Owner and review with Consultant.

.4 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

1.19 CHANGES IN THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation detailing 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 reviewed with Consultant prior to contract signing, then allowable maximum percentages for overhead and profit are as per HDSB's standards in front end documents (Article 8.1).

.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 Labour Estimating Manual, less 25%;

.4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labour 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 in writing to Consultant and, if accepted by Owner, Notice of Change to be issued.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.20 PROGRESS PAYMENT BREAKDOWN

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Owner’s approval and Consultant’s review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.21 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for 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.

1.22 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.

1.23 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

.1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.

.2 Confirm with Consultant what equipment can be used during construction.

.3 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.

.4 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 in order to maintain validity of warranties after turn over to Owner.

.5 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", filters cleaned or replaced, etc.

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 manufacturer's 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

.1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.

.2 Clean equipment and devices installed as part of this project.

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 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;

.4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;

.5 location of piping system air vents;

.6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant’s comments, to satisfaction of Consultant.

.4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.

.5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.

.6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.28 OPERATING AND MAINTENANCE 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 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

.2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;

.3 equipment manufacturer's authorized contact person name, telephone number and company website;

.4 Table of Contents sheet, and corresponding index tab sheets;

.5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer’s/supplier’s name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.6 operating data as follows:

.1 pressure test reports, and certificates issued by governing authorities;

.2 description of each system and its controls;

.3 control schematics for equipment/systems including building environmental controls;

.4 wiring and connection diagrams;

.5 if applicable, BAS architecture and all required operating data;

.6 description of operation of each system at various loads together with reset schedules and seasonal variances;

.7 operation instruction for each system and each component;

.8 description of actions to be taken in event of emergencies and/or equipment failure;

.9 valve tag schedule, and flow diagrams to indicate valve locations.

.7 maintenance data as follows:

.1 operation and trouble-shooting instructions for each item of equipment and each system;

.2 schedules of tasks, frequency, tools required, and estimated task time;

.3 recommended maintenance practices and precautions including warnings of any maintenance practice that will damage or disfigure equipment/systems;

.4 complete parts lists with numbers.

.8 performance data as follows:

.1 equipment and system start-up data sheets;

.2 equipment performance verification test results, and final commissioning report;

.3 final testing, adjusting and balancing reports.

.9 copies of warranties;

.10 items requested specifically in Section Articles.

.2 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.

.3 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.

.4 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.

.5 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 reviewed with Consultant and enhanced with bookmarks and internal document links.

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 in Divisions 00 and 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to Consultant.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer’s authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner’s staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

1.31 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. Sprinkler Test Certificate;

.5 final commissioning report and TAB report;

.6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;

.7 other data or products specified.

1.32 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.

.5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.6 Obtain in writing from Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:

.1 date instructions were given to Owner's staff;

.2 duration of instruction;

.3 names of persons instructed;

.4 other parties present (manufacturer's representative, consultants, etc.).

.7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.8 Submit to Consultant, copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.

1.33 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:

.1 deficiencies noted during job inspections have been completed;

.2 field quality control procedures have been completed;

.3 systems have been tested and verified, balanced and adjusted, and are ready for operation;

.4 maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner;

.5 tags and nameplates are in place and equipment identifications have been completed;

.6 clean-up is complete;

.7 spare parts and replacement parts specified have been provided and acknowledged by Consultant;

.8 as-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner;

.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

1.01 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.

1.02 SUBMITTALS

.1 Submit shop drawings/product data sheets for:

.1 pressure gauges and thermometers;

.2 electric motors (submit with equipment they are associated with).

.2 Submit weight loads for selected equipment (upon request).

.3 Submit copy of reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.

.4 As specified in Part 2 of this Section, submit a spare belt set, tagged and identified, for each belt driven piece of equipment.

.5 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

2 PRODUCTS

2.01 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 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.02 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 included as part of mechanical work.

2.03 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.

2.04 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.

2.05 PIPING HANGERS AND SUPPORTS

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:

.1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;

.2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.

.2 Hangers and supports for horizontal suspended piping as follows:

.1 adjustable steel clevis hanger – MSS Type 1;

.2 adjustable swivel ring band hanger – MSS Type 10;

.3 adjustable roller hanger – MSS Types 41, 43, and/or 45, with MSS Type 39 steel protection saddle.

.3 Supports for horizontal pipe on vertical surfaces as follows:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;

.2 heavy-duty steel pipe clip – MSS Type 26;

.3 single steel pipe hook – Myatt Fig. 156;

.4 epoxy coated steel pipe stays are not permitted.

.4 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.

.5 Floor supports for vertical risers as follows:

.1 copper tubing riser clamp – MSS Type 8;

.2 heavy-duty steel riser clamp – MSS Type 8.

.6 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.

.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 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;

.2 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;

.3 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;

.4 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;

.5 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.

2.06 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.

2.07 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 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.

2.08 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.

2.09 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.

2.10 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 aluminum rotor windings.

.7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.

.8 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.

.9 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.

.10 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.

2.11 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 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.6 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.

.7 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.

.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.

2.12 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
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
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
refrigerant hot gas	yellow	REFRIG. HOT GAS

.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.

2.13 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

3.01 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant’s approval.

.2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.

.3 Install pipes and ducts parallel to building lines and to each other.

.4 Neatly group and arrange exposed work.

.5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.

.6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.

.8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.9 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.

.10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.

.11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.

.12 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.

.13 Where mechanical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on products to protect against corrosion or provide products which will not corrode in the environment, i.e. aluminium ductwork, copper or stainless steel pipe, etc.

.14 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.

.15 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.

3.02 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

.5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder’s identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.

.6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.

.7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.

.9 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.

.10 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.

.11 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer's latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.

.12 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer's recommendations, ASTM D2855, and CSA requirements.

.13 Install PVC piping with gasketed joints in accordance with manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

3.03 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;

.2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.

.2 Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a waterstop plate in accordance with drawing detail. Provide waterproof sleeves in following locations:

.1 in mechanical room floor slabs, except where on grade;

.2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;

.3 in floors equipped with waterproof membranes;

.4 in roof slab;

.5 in waterproof walls.

.3 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around pipes, or where pipe is insulated, a 12 mm (½") clearance around pipe insulation.

.4 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

.1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;

.2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.

.5 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.

.6 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface concerned so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.

.7 "Gang" type sleeving will not be permitted.

.8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

3.04 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.

3.05 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.06 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.07 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.

.5 Do not attach fasteners to steel deck without written consent from Consultant.

3.08 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 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.

.5 Space hangers and supports in accordance with following:

.1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;

.2 copper and steel pipe – hang or support 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')

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
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')	

.3 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints.

.6 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.

.7 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

.8 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.

.9 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:

.1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

.2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;

.3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;

.4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;

.5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.

.10 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

.11 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.

.12 Do not support piping from steel deck without written consent from Consultant.

3.09 SUPPLY OF ACCESS DOORS

.1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.

.2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.

.3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.

.4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.

.5 Group piping and ductwork to ensure minimum number of access doors is required.

.6 Submit a sample of each proposed access door for review prior to ordering.

.7 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.10 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.

3.11 INSTALLATION OF PRESSURE GAUGES AND THERMOMETERS

.1 Provide pressure gauges in 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 piping at each side of a pressure reducing valve;

.5 wherever else shown and/or specified.

.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.

3.12 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.

3.13 MECHANICAL WORK IDENTIFICATION

.1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at every end of every piping or duct run;

.2 adjacent to each valve, strainer, damper and similar accessory;

.3 at each piece of connecting equipment;

.4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;

.5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;

.6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.

.2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;

.2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;

.3 at each access door location;

.4 at each piece of connected equipment, automatic valve, etc..

.3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

.4 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements 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 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);

.3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;

.4 frame and glaze one copy of chart and, unless otherwise directed, affix to a wall in each main Mechanical and/or Equipment Room;

.5 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;

.6 hand an identified CD of valve tag chart to Owner at same time O & M Manuals are submitted.

.7 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

3.14 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 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.

.6 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.

.7 Refrigerant Piping

.1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.

.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.

3.15 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

.1 Motor starters for mechanical equipment, except for starters integral with packaged equipment and starters factory installed in equipment power and control panels, will be provided as part of the electrical work.

3.16 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;

.7 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;

.8 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;

.9 120 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.

3.17 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

.1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform Owner and Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

.5 Pipe freezing 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. (1-800-661-9983) or Rigid Tool Co. RIGID "SuperFreeze".

3.18 CUTTING, PATCHING AND CORE DRILLING

.1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant’s approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by Consultant.

.2 Criteria for cutting holes for additional services:

.1 cut holes through slabs only; no holes to be cut through beams;

.2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;

.3 keep at least 100 mm (4") clear from beam faces;

.4 space at least 3 hole diameters on centre;

.5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;

.6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;

.7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.

.3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.

.4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation.

.5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

.6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.

.7 Firestop and seal openings in fire rated construction in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Do not leave openings open overnight unless approved by Owner and Consultant.

3.19 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:

.1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;

.2 exterior walls above grade – pack with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 exterior walls below grade (and any other wall where water leakage may be a problem) – seal with link type mechanical seals as specified.

3.20 FLASHING FOR MECHANICAL WORK PENETRATING ROOF

.1 Perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.

.2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Division 07.

3.21 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.

3.22 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.

3.23 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.

3.24 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.

3.25 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.

3.26 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 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.

2.04 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 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;

.6 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").

.7 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.

.8 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.

.9 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.

.10 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

1.01 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.

1.02 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.

1.03 SUBMITTALS

.1 Submit a product data sheet for each insulation system product.

.2 In accordance with Part 3 of this Section, submit a letter from fire rated duct wrap supplier to certifying duct wrap has been properly installed.

1.04 QUALITY ASSURANCE

.1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.

.2 Do not apply insulation unless leakage tests have been satisfactorily completed.

.3 Ensure surfaces to be insulated are clean and dry.

.4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.

.5 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

2 PRODUCTS

2.01 FIRE HAZARD RATINGS

.1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.02 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.

2.03 PIPE INSULATION MATERIALS

.1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.

.2 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories. Acceptable products are:

.1 Armacell AP/Armaflex SS;

.2 IK Insulation Group K-Flex "LS" Self-Seal Pipe Insulation.

.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.

2.04 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.

2.05 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".

2.06 INSULATION FASTENINGS

.1 Wire – minimum #15 gauge galvanized annealed wire.

.2 Wire with Mesh – minimum #15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.

.3 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.

.4 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.

.5 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.

.6 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.

.7 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact 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.

2.07 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

3.01 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise specified, do not insulate following:

.1 factory insulated equipment and piping;

.2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 manufactured expansion joints and flexible connections;

.4 acoustically lined ductwork and/or equipment;

.5 factory insulated flexible branch ductwork;

.6 piping unions, except for unions in "cold" category piping.

.2 Install insulation directly over pipes and ducts, not over hangers and supports.

.3 Install piping insulation and jacket continuous through pipe openings and sleeves.

.4 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.5 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.

.6 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.7 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.

.8 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.

.9 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.

.10 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

3.02 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

.2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to pipe at each roller hanger or support location. Pack saddle voids with loose mineral wool insulation.

3.03 PIPE INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:

.1 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;

.2 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;'

.3 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.4 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.5 refrigerant suction piping (between compressor and evaporator coil) inside building – 25 mm (1") thick;

.6 refrigerant hot gas piping (between compressor and condenser) 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.

3.04 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.

3.05 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.

3.06 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.

3.07 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.

3.08 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.

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

1.01 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.

1.02 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.

1.03 SUBMITTALS

.1 Submit to Commissioning Agent, at same time as submittal 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, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.

.3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

.4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

.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.

1.04 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.

1.05 COMMISSIONING AGENT

.1 Retain services of a qualified Commissioning Agent.

1.06 QUALITY ASSURANCE

.1 Commissioning work is to be in accordance with requirements of following:

.1 CSA Z320, Building Commissioning Standard and Check Sheets;

.2 ASHRAE Guideline 0, The Commissioning Process;

.3 ASHRAE Guideline 1.1, The HVAC Commissioning Process;

.4 ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems;

.2 Commissioning Agent is to meet following qualifications:

.1 be a member of Professional Engineers Association in Province of the work;

.2 be a member of Building Commissioning Association, and a Certified Commissioning Professional (CCP) as designated by Building Commissioning Association;

.3 have a minimum of 5 years of successful documented commissioning experience on projects of similar size and complexity as this Project;

.4 supply a qualified P. Eng. and a Building Commissioning Association Certified Commissioning Professional (CCP) or an ASHRAE Commissioning Project Management Professional (CPMP) on site to supervise commissioning process.

1.07 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.

1.08 TESTING EQUIPMENT

.1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2 PRODUCTS

Not Used

3 EXECUTION

3.01 COMMISSIONING

.1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.

.2 Prerequisites to successful completion of commissioning:

.1 submittal of signed start-up and test reports;

.2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;

.3 permanent electrical and control connections of equipment;

.4 successful completion and documentation of pre-functional performance testing;

.5 submittal of letters to 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.

3.02 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.

3.03 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 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".

.3 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.

.4 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.

3.04 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.

3.05 RESPONSIBILITIES OF COMMISSIONING AGENT

.1 During construction phase, Commissioning Agent is to:

.1 review Contractor’s shop drawings for commissioning related issues, and report any such issues to Consultant;

.2 as soon as possible after project start-up, prepare and issue a Commissioning Plan based on Contractor’s construction schedule;

.3 prior to tests, supply pre-functional performance test commissioning data sheets for equipment and systems to be commissioned to Contractor;

.4 monitor and inspect installation on a regular basis throughout construction stages, issue reports identifying any issues which may have an impact on commissioning process, and work with project team to expeditiously resolve any problems that may arise due to site conditions;

.5 arrange with Contractor for on-site commissioning meetings on an as-required basis, to be attended by Contractor and applicable subcontractors, Owner, and Consultant, chair meetings, and prepare and distribute meeting minutes to attendees;

.6 witness and validate tests, identify deficiencies, and issue progress reports;

.7 coordinate commissioning scheduling with Contractor;

.8 review final TAB report on site with Contractor, and check 100% of TAB results for fan equipment, 30% of TAB results for duct systems outward from fan equipment, and issue a report to Consultant;

.9 for smaller multiple items of equipment such as air terminal boxes, fan coil units, backflow preventers, and similar equipment, review completed commissioning data sheets submitted by Contractor and review data sheet information on-site with Contractor for 30% of quantity of each item of equipment;

.10 review pre-functional performance test commissioning data sheets submitted by Contractor, then witness and supervise functional performance testing and supervise and direct commissioning process, validate commissioning procedures, witness completion of commissioning data sheets by Contractor, and sign completed data sheets;

.11 perform a preliminary review of Contractor's O & M Manuals, before they are issued to Consultant, and issue any comments to Consultant;

.12 coordinate, with Contractor and Owner, training and instructions by Contractor and his equipment and system manufacturers/suppliers to Owner's operating and maintenance personnel, and comment on quality of training and instructions to Consultant;

.13 prepare and issue Systems Operation Manual to Owner prior to equipment and system training by Contractor.

.2 During post construction phase, Commissioning Agent is to:

.1 prepare and issue final report on commissioning, identifying any deficiencies that remain outstanding;

.2 recommend any training and/or instructions to be given to Owner's operating and maintenance personnel in addition to training and instructions already given;

.3 after Substantial Performance of the Work, witness system checks and validate documentation by Contractor as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th month of building operation but during a season opposite to 1st or 3rd month visits.

.4 ensure any deficient work resulting from system checks described above are corrected;

.5 3 months after Substantial Performance of the Work, attend a question and answer session(s) with Contractor to answer any questions and concerns related to commissioning work from Owner's operating personnel.

3.06 RESPONSIBILITIES OF CONTRACTOR

.1 During construction phase, Contractor is to:

.1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;

.2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;

.3 when requested by Commissioning Agent, arrange site commissioning meetings with Owner, Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;

.4 promptly correct reported deficient work, and report when corrective work is complete;

.5 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;

.6 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;

.7 complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;

.8 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by Commissioning Agent;

.9 in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant and Commissioning Agent a minimum of 5 working days' notice;

.10 perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.

.2 During post construction phase, Contractor is to:

.1 optimize system operation in accordance with building occupant’s needs and comments using System Operation Manual prepared by Commissioning Agent as reference;

.2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

.3 accompanied by Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.

.4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

.5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner’s operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

END OF SECTION

1 GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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.

2 PRODUCTS

Not Used

3 EXECUTION

3.01 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 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".

.2 TAB of air handling and exhaust systems is to include equipment and ductwork air temperatures, capacities and flows.

3.02 TESTING, ADJUSTING AND BALANCING

.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 for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;

.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;

.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;

.5 testing, adjusting and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;

.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;

.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;

.11 for belt-driven equipment, Agency is to report to 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;

.17 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

.2 Prepare reports as indicated below.

.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports. 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 Temperature Control Systems;

.5 Special Systems.

.4 Agency is to provide following minimum information, forms and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;

.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;

.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;

.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.

.5 After acceptance of final report, Agency is to perform post testing and balancing site visits in accordance with following requirements:

.1 post testing and balancing site visits are to be made:

.1 once during first month of building operation;

.2 once during third month of building operation;

.3 once between fourth and tenth months in a season opposite to first and third month visit.

.2 during each return visit and accompanied by Owner's representative, Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints;

.3 Agency is to schedule each visit with Contractor and Owner, and inform Consultant;

.4 after each follow-up site visit, Agency is to issue to Contractor and Consultant a report indicating any corrective work performed during visit, abnormal conditions and complaints encountered, and recommended corrective action.

END OF SECTION

1 GENERAL

1.01 APPLICATION

.1 This Section specifies material requirements for firestopping and smoke seal systems that are common to mechanical work Sections and it is a supplement to each Section and is to be read accordingly.

1.02 SUBMITTALS

.1 Submit a product data sheet and WHIMIS sheet for each firestopping and smoke seal product.

.2 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.

.3 Submit letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.03 QUALITY ASSURANCE

.1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and applicator's qualifications are to be submitted to Consultant for review.

.2 Comply with firestopping and smoke seal product manufacturer’s recommendations regarding suitable environment conditions for product installation.

2 PRODUCTS

2.01 FIRESTOPPING AND SMOKE SEAL SYSTEM MATERIALS

.1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN/ULC S115, and CAN/ULC S101 for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.

.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 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

.5 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.

.6 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.

.7 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.

.8 Supply products of a single manufacturer for use on work of this Division.

.9 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.

.10 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.

.11 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".

.12 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

3.01 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.

.8 Where work requires removal of existing firestopping materials and replacement of firestopping materials after cabling changes have been made, ensure that replacement material is same material and manufacturer of existing if any remains in place, or ensure that all existing material is removed before installation of replacement material.

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.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 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.

.2 Cast Iron

.1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.3 Copper - Victaulic Coupling Joint

.1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings.

2.02 CLEANOUTS

.1 Horizontal Piping

.1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

2.03 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.

2.04 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.

2.05 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.

3 EXECUTION

3.01 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

.1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:

.1 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;

.2 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

.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.

3.03 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.

3.04 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.

3.05 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.

3.06 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.

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 site applied thermal insulation for piping and equipment;
- .5 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.

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 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 Apollo Valve 143 Series;

.3 Watts Industries (Canada) Inc. #BF-03;

.4 Kitz Corp. 6112 Series;

.5 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 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 Armstrong International Inc. A1 Series;

.4 Watts Industries (Canada) Inc. #77SCI;

.5 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

3. EXECUTION

3.01 DEMOLITION

.1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 HEATING WATER PIPING INSTALLATION REQUIREMENTS

.1 Provide all required heating water 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.

.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 drawiTOngs. 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.

3.03 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 AUTOMATIC AIR VENTS

.1 Provide automatic air vent at the highest point of each heating water system; including glycol water heating system.

.2 Connect discharge pipe from the automatic air vent to the nearest floor drain in accordance with the local authorities Building Code.

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 FLUSHING AND CLEANING PIPING

.1 Flush and clean new piping in accordance with requirements specified in Section entitled HVAC Water Treatment.

3.07 TESTING, ADJUSTING AND BALANCING

.1 Testing, adjusting and balancing for liquid heat transfer systems 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 open all valves to the fully open position;
- .2 check expansion tanks to ensure that they are not air bound and that the systems are full, check all air vents to ensure that they are installed properly and are operating freely and that all air is removed from the circulating systems, check operation of pumps, and check all strainer baskets to ensure that they are clean;
- .3 set all temperature controls so that all heat transfer equipment is operating at full output;
- .4 check the operation of automatic valves and adjust as required.

.4 The Consultant will spot check at the site, the results of the testing and balancing agency's testing and balancing report. Attend the spot checks.

.5 A copy of the approved testing and balancing report will be forwarded to you by the Consultant. Include a copy of the report in each copy of operating and maintenance manuals.

END OF SECTION

1 GENERAL

1.01 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.

1.02 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

2.01 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.

2.02 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".

2.03 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.

2.04 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.

2.05 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.

2.06 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.

2.07 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.

2.08 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.

2.09 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.

2.10 AIR TURNING VANES

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.11 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.

2.12 BACKDRAFT DAMPERS

.1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:

.1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;

.2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;

.3 corrosion-resistant synthetic bearings;

.4 adjustable plated steel counterweights mounted internally in the airstream;

.5 concealed blade linkage located out of the airstream.

.2 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.;

.6 Alumavent.

2.13 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 Price Industries (E.H. Price);

.6 Alumavent.

2.14 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 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;

.4 Ruskin Co.;

.5 Price Industries (E.H. Price).

2.15 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.

2.16 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.

2.17 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.

2.18 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.

2.19 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.

2.20 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 from manufacturer's standard colour range.

.3 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Greenheck Fan Corp.

2.21 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.

2.22 SILENCERS

.1 Vibro-Acoustics silencers per the drawing schedule and as specified hereinafter, each certified to latest ASTM E477 "Standard Method of Testing Duct Liner Materials and Prefabricated Silencers For Acoustical and Airflow Performance" completely prefabricated and as follows:

.1 Materials

.1 Rectangular type silencers shall be constructed with a 22 gauge (0.78 mm) galvanized steel outer casing and 26 gauge (0.47 mm) galvanized perforated steel.

.2 Elbow silencers shall be constructed with an 18 gauge (1.24 mm) galvanized steel outer casing and 22 gauge (0.78 mm) galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" (1200 mm) shall have at least two half splitters and one full splitter.

.2 Acoustic Media:

.1 Film lined MoldBlock MediaTM silencers shall be Vibro-Acoustics® MoldBlock MediaTM containing 100% natural cotton fibers treated with an EPA registered, non-toxic borate solution, "flash dried" to provide resistance to mold, mildew and fungi. Media shall comply with UL181 and NFPA 90A. MoldBlock MediaTM shall be packed with a minimum of 15% compression during silencer assembly. Media shall not cause or accelerate corrosion of aluminum or steel.

.3 Acoustic Media Protection

.1 Film lined silencers shall be as above with acoustic media completely wrapped with Tedlar film to prevent shedding, erosion and impregnation of glass fibre. The wrapped acoustic media shall be separated from the perforated metal by a factory installed ½" (12 mm) thick acoustically transparent spacer. The spacer shall be flame retardant and erosion resistant. A mesh, screen or corrugated liner will not be acceptable as a substitute for the specified spacer.

.4 HTL Casings

.1 Where indicated on the silencer schedule, silencers shall have a high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL walls shall consist of media, airspace, mass and outer protective metal skin, as required to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. Provide breakout noise calculations as part of the silencer shop drawing submissions for each air handling and fan system with HTL silencers. Breakout noise shall be based on the sound power levels of the specified equipment.

.2 Manufacturer shall certify on shop drawings that silencer performance is per ASTM E477. Shop drawings submitted without same, will be rejected.

.3 Acceptable manufacturers are Vibro-Acoustics, J.P. Environmental Products Inc., Vibron and EH Price.

2.23 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 Tuttle & Bailey;

.7 Metalaire.

3 EXECUTION

3.01 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.

3.02 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.

.4 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.5 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.6 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.7 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.8 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.

.9 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.

.10 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.

.11 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.12 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.13 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:

.1 ductwork outside building or otherwise exposed to the elements;

.2 wherever else shown.

.14 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.

.15 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.16 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.17 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

3.03 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.

3.04 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.

3.05 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.

3.06 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.

3.07 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.

3.08 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.

3.09 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.10 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.11 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers.

.2 Install and secure dampers so they cannot move or rattle.

3.12 INSTALLATION OF FUSIBLE LINK DAMPERS

.1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr.) is suitable for fire barrier it is associated with.

.2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer’s instructions and details, and Code requirements.

.3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.

.4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.13 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer’s instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.14 INSTALLATION OF 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.

3.15 INSTALLATION OF ROOF MOUNTED DUCT SUPPORTS

.1 Supply supports for roof mounted ductwork.

.2 Accurately mark location and spacing of roof support assemblies. At each plastic base location, carefully scrape away loose roof ballast (gravel) and all other debris and dirt. Prime existing membrane with a primer which is compatible with existing roofing components. Set bases in adhesive in accordance with manufacturer's installation instructions. Scrape loose ballast back around and on bases. Install framing, and install ductwork on the cross-members. Secure ductwork to cross-members with galvanized steel banding.

3.16 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.

3.17 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.

3.18 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.

3.19 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.

3.20 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 SILENCERS

.1 Provide silencers where shown and as scheduled on the drawings.

.2 Secure and support each silencer rigidly in place, independent of the ductwork or casings connected thereto.

.3 Where silencers penetrate partition walls, seal the joint between the perimeter of the silencer and the wall, on both sides of the wall, with proper acoustic caulking.

3.22 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.

3.23 DUCT SYSTEM PROTECTION, CLEANING AND START-UP

.1 Temporarily cover all open ends of ducts during construction.

.2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

.3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.

.5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for heat and energy recovery ventilators, including accessories, and all required power and control wiring schematics.

.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 a spare filter set for each ventilator and store at site where directed prior to Substantial Performance of the Work.

.5 Submit a signed extended warranty direct from manufacturer to Owner covering the energy recovery wheel from material and workmanship defects for an additional 4 years after Contract warranty expires.

1.02 QUALITY ASSURANCE

.1 Energy recovery ventilator manufacturers are to be current members of 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;

.6 AHRI Standard 1060, Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment;

.7 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers;

.8 UL 1812, Ducted Heat Recovery Ventilators;

.9 CSA or ETL certification for all electrical components.

2 PRODUCTS

2.01 ENERGY RECOVERY VENTILATORS

.1 The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. Each unit will have an automatic by-pass damper system for economic operation under certain conditions. The unit shall have factory installed control board with functions for local, remote, and optional control modes.

.2 Unit capacities and performances to be as specified in equipment schedule.

.3 CABINET:

.1 The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached.

.4 BLOWERS:

.1 The unit shall be furnished with two (2) direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.

.2 The blower motors shall be a directly connected to the blower wheels and have permanently lubricated bearings.

.3 The blowers and motors shall be mounted for quiet operation.

.5 HEAT EXCHANGER:

.1 The heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.

.2 The element shall have protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.

.6 BYPASS DAMPER:

.1 The ERV shall have an automatic supply side by-pass damper to allow inbound ventilation air to by-pass the energy transfer core when outside weather conditions warrant.

.2 The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to an mechanical damper flap to allow fresh air to bypass the Lossnay® element.

.3 Supply and return air thermistor shall control the damper and may be interlocked with a Mitsubishi Electric PZ Series LCD remote controller.

.7 FILTER:

.1 The ERV shall be equipped with factory installed MERV14 air filters located at each intake face (both supply and exhaust sides) of the core to clean the air and prevent clogging.

.8 PRE-HEATER:

.1 A suitable pre-heater shall be supplied and installed to pre-heat and maintain the air entering the ERV to above 14°F.

.2 The pre-heater to be provided by same supplier as ERV.

.9 MOUNTING:

.1 Mounting of the ERV shall be as indicated in the plans and drawings. The ERV shall not require condensate pan or receptacle nor condensate drain or piping. Mounting may be horizontal or vertical and the unit may be inverted as required by ductwork connection.

.10 ELECTRICAL:

.1 The units will require a 208-230Volt, 1 Phase, 60Hz power supply.

.11 CONTROL:

.1 ERV Control board shall allow independent control by contact closure from third-party sensor-driven controllers, switches, or timers.

.2 Terminal strip ready complete with PAC-SA88 adaptor.

.12 ACCEPTABLE MANUFACTURERS

.1 Lossnay (Mitsubishi Electric);

.2 Renewaire;

.3 Greenheck Fan Corp.;

.4 Venmar CES Inc..

3 EXECUTION

3.01 INSTALLATION OF ENERGY RECOVERY VENTILATORS

.1 Provide energy recovery ventilators.

.2 For suspended units, provide galvanized steel mounting brackets with vibration isolators and suspend each unit, level, and plumb, by means of hanger rods. Provide supplementary support steel as required.

.3 Coordinate power wiring connection and provision of a disconnect switch for each ventilator in accordance with electrical work Specification where power wiring is specified.

.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 ½ day on-site energy recovery ventilator operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full energy recovery ventilator internal inspection, construction details, operation, maintenance, abnormal events, and setting up controls.

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;

.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 all rooftop 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 Rooftop 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 initial start up and shall continue for a period of one (1) year not to exceed eighteen (18) months from shipment. Manufacturer's warranty shall include parts only.

.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 PACKAGED ROOFTOP UNITS

.1 Trane packaged rooftop units in configuration and performances as indicated on drawings and drawing schedules. Unit shall be factory assembled, internally wired, fully charged with R-410A, and 100% run tested to check cooling operation, fan and blow rotation, and control sequence before leaving the factory. Unit to have field convertible airflow. Units shall include all specified components installed and tested at the factory. Field fabrication of units and their components will not be accepted.

.2 <u>UNIT CASING</u>

- .1 Cabinet: Galvanized steel with baked enamel finish.

.2 Unit casing shall be zinc coated, heavy gauge, steel. Casing panels are weather resistant pre-painted metal with galvanized substrate and meet ASTM B117, 672 hour salt spray test.

.3 Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.

.4 Unit shall include a removable single side maintenance access panels. Lifting handles in maintenance access panels can be removed and reinstalled by removing fasteners while providing a water and air tight seal.

.5 Unit's base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

.6 Exposed vertical panels and top covers in the indoor air section are insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material.

.7 Base pan shall have no penetrations within the perimeter of the curb other than the raised 1 inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.

.8 Base of the unit is insulated with 1/8 inch, foil-faced, closed-cell insulation.

.9 Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

.10 Unit base shall contain provisions for forklift and/or crane lifting on three sides of unit.

.3 AIR FILTERS

.1 MERV 13 filters.

.4 FANS AND MOTORS

.1 Supply fan shall be a direct drive plenum fan with backward-curved fan wheel with an external rotor direct drive variable speed motor.

.2 Supply fan speed adjustments can be made using the control user interface or mobile app.

.3 Provide Fan Fail indication. The indication will be registered at the on-board user interface, mobile service app., or building management system.

.4 Variable speed direct drive motors are premium efficiency.

.5 Motors are thermally protected.

.6 Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position. Outdoor motors shall be 3 phase.

.7 Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

.5 GAS FIRED HEATING SECTION

.1 The heating section shall have a progressive tubular heat exchanger with corrosion-resistant aluminized steel tubes and burners as standard on all models.

.2 On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition.

.3 Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided.

.4 Heating section shall be factory run tested prior to shipment.

.5 Induced draft combustion blower shall be used to pull the combustion products through the firing tubes. System shall use direct spark ignition (DSI).

.6 After three unsuccessful ignition attempts, entire heating system shall be locked out until manually reset at the thermostat/zone sensor.

.7 Induced draft blower to pull the gas mixture through the burner tubes.

.8 Compact cabinet features a tubular heat exchanger in low, medium and high heat capacities. Corrosion-resistant aluminized steel tubes and burners are standard on all models.

.9 Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

.10 Units shall be suitable for use with natural gas or propane (field-installed kit).

.11 Through the base gas piping- the units shall include a standard through the base gas provision. This option shall have all piping necessary including black steel, manual gas shut off valve, elbows, and union. The manual shutoff valve shall include a 1/8 NPT pressure tap.

.6 EVAPORATOR COIL

.1 Evaporators shall aluminium microchannel that provide optimal heat transfer performance due to flat, streamlined tubes with small ports, and metallurgical tube-to-fin bond.

.2 Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

.3 Unit shall include a condensate overflow switch to shut the unit down in the event that a clogged condensate drain line prevents proper condensate removal from the unit.

.7 CONDENSER SECTION

.1 Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

.2 Condensers shall be microchannel.

.3 Provide tool-less factory installed corrosion resistant louvered hail/vandalism guards to protect condenser coils from hail or physical damage.

.8 REFRIGERATION SYSTEM

.1 All units have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Suction gas-cooled motor with voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads standard with scroll compressors. Crankcase heaters are standard on all compressors.

.2 Compressors shall have thermostatic temperature motor winding control for protection against excessive temperatures caused by over/under voltage operation or loss of charge. Also provide high and low pressure switches.

.3 Thermal Expansion valves are standard for all models.

.4 All units have dual compressors.

.5 Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

.6 Three stages of cooling available on 6 to 17.5 tons units and four stages of cooling available on 20 and 25 ton units.

.9 OUTDOOR AIR SECTION

.1 Units shall be available with barometric relief.

.2 Barometric relief shall provide a pressure operated damper that shall be gravity closing.

.3 Barometric relief shall prohibit entrance of outside air during the equipment “off” cycle.

.4 Provide spring return motor for outside air damper closure during unit shut down or power interruption.

.5 Provide microprocessor unit-mounted control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic.

.6 Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

.7 Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

.10 SYSTEM CONTROL

.1 True / Multi-Zone VAV;

.2 Terminal Strip Ready.

.11 ROOF CURB

.1 Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

.2 Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

.12 ACCEPTABLE MANUFACTURERS

.1 Trane;

.2 Daikin;

.3 Johnson Controls.

2.02 SEMI CUSTOM AIR HANDLING UNITS

.1 Engineered Air outdoor air handling units in configuration and performances as indicated on drawings and drawing schedules. Unit shall be factory assembled, internally wired, consist of filter sections, supply air fan section, high efficiency indirect gas heating section, DX cooling section, condensing section, motorized dampers, control panel, temperature sensors, and all other components required for a complete packaged installation.

.2 UNIT CASING

.1 Unit casing shall be of minimum 18 gauge satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.2 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.

.3 Casings shall be supported on 150mm (6") minimum structural steel channel supports, designed and welded for low deflections. Integral lifting lugs shall be provided for hoisting.

.4 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include the prevention of infiltration of rain and snow into the unit, and louvres on air intakes and hoods on exhaust openings with 1" (25mm) galvanized inlet screens; rain gutters over all access doors; all joints caulked with a water resistant sealant; roof joints turned up 2" (50mm) with three break interlocking design; outer wall panels extend a minimum of 1/4 inch (6mm) below the floor panel; drain trap(s) for field installation. Provide draining louvres at fresh air intake designed to prevent penetration of moisture.

.5 Units mounted on roof curbs shall incorporate a welded floor-to-base construction. Floors are of three break upstanding design with welded corners and free of penetrations. Unit underside joints are caulked and tarred.

.6 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of 18 inches (457 mm) high, and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 1" (25mm) upturn on inner perimeter, to provide a complete seal against the elements. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

.3 ACCESS DOORS

.1 Provide hinged access doors. Doors shall be fully lined with closed cell, automotive bulb gasket and lever lock roller type or Ventlock handles, operable from both sides. Removal of screwed wall panels will not be acceptable.

.2 Hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. In sections that doors open inward, provide a door handle on the interior of the unit as well.

.4 INSULATION

.1 All units shall be internally insulated with 2" thick 1 ½ lb/ft3 density, neoprene coated fibre glass thermal insulation, secured to metal panels with a fire retardant adhesive and welded steel pins at 16" (400mm) o/c. All longitudinal insulation joints and butt ends shall be covered by a sheet metal break to prevent erosion of exposed edges. Drain pans and all floor areas shall be insulated on the underside.

.5 FILTERS

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters.

.2 2" (50 mm) Extended Media (Pleated) Disposable Filters: Filters shall be extended surface pleated complete with 100% synthetic media that does not support microbial growth. Frame shall be a high wet strength beverage board with a cross member design that increases filter rigidity and prevent breaching. Frame shall be recyclable. Filters shall have an expanded metal support grid bonded to the air-exiting side of the filter to maintain pleat uniformity and prevent fluttering. Metal support grid shall be recyclable. The filters shall be MERV 8 per ASHRAE 52.2. and rated U.L. 900 Class II. A permanent re-usable metal enclosing frame shall be provided for side loaded applications.

.3 Final filters shall be 4” (102mm) MERV 13 and follow the standards as per above.

.6 FAN SECTIONS

.1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.

.2 Air foil fans shall be equipped with greaseable, self aligning ball type pillow block bearings. The ratio of blast area to nominal outlet area for double width fans shall be 75% or greater.

.3 Drives shall be adjustable on fans with motors 5 HP (3.73 kw) or smaller. On fans with larger motors, fixed drives shall be provided. All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.

.4 Motor, fan bearings and drive assembly shall be located inside the fan plenum to minimize bearing wear and to allow for internal vibration isolation of the fan-motor assembly, where required. Motor mounting shall be adjustable to allow for variations in belt tension.

.5 Fan-motor assemblies shall be provided with vibration isolators. Isolators shall be bolted to steel channel welded to unit floor which is welded to the structural frame of the unit. The isolators shall be vertical spring type isolators with levelling bolts, bridge bearing waffled pads with minimum 1" (25mm) static deflection designed to achieve high isolation efficiency. Fans shall be attached to the discharge panel by a heavy glass fabric, neoprene impregnated, with a double locking fabric to metal connection.

.6 Fan motors shall be rated for fan duty, open drip proof, high efficiency (equal to CSA 390 M 1985) T-frame, and 575 Volt, 3 Phase, 60 Cycle

.7 COOLING SECTION

.1 Unit MUST conform to regulations set out in the Canadian Energy Efficiency Act for large air conditioners (condensing units). Packaged units shall be tested to CSA Standard C746-98 and must bear an EEV (energy efficiency verification) label provided by CSA.

.2 Where specified as factory packaged air conditioning unit, factory assembled split systems do not conform to the Canadian Energy Efficiency Act and will not be considered.

.3 Coils shall be constructed of copper tube, aluminium fin, copper headers with sweat connections.

.4 Fins constructed of aluminum shall be rippled for maximum heat transfer and shall be mechanically bonded to the tubes by mechanical expansion of the tubes. The coils shall have a galvanized steel casing. All coils shall be factory tested with air at 300 psig (2070 kPa) while immersed in an illuminated water tank.

.5 Refrigerant evaporator type coil shall be equipped with minimum 3 distributors connected to the coil by copper tubes. Provide a hot gas bypass valve on lead circuit. Solenoid valves, expansion valves, and related accessories are to be installed in the factory by the unit manufacturer.

.6 Refrigerant coil shall be alternate tube circuited in order to distribute the cooling effect over the entire coil face at reduced load conditions. Maximum face velocity for the DX cooling coil shall not exceed 500 FPM. Coils exceeding the specified face velocity will not be accepted. Coils shall be CSA certified.

.7 Provide a minimum of 3 hermetic type compressors, 3600 RPM, set on resilient neoprene mounts and complete with line voltage break internal overload protection, internal pressure relief valve and crankcase heater.

.8 Packaged units shall operate down to 50° F (10° C) as standard. Multiple refrigeration circuits shall be separate from each other. Refrigeration circuits shall be complete with liquid line filter-driers, combination sight glass moisture indicators and service ports fitted with Schraeder fittings. Units with 9, 10 and 12 Ton hermetic compressors shall also incorporate load compensated thermal expansion valves with external equalizers. The complete piping system shall be purged and pressure tested with dry nitrogen, then tested again under vacuum. Each system shall be factory run and adjusted prior to shipment.

.9 Controls for hermetic compressor units shall include compressor contacts, supply fan contacts and overload protection control circuit transformer, cooling relays, ambient compressor lockout, high pressure controls and automatic reset low pressure controls.

.1 Provide five-minute anti-cycle timers.
.2 Provide inter stage time delay timers.

.8 INDIRECT GAS FIRED AUXILIARY HEAT

.1 Heating units shall have an indirect natural gas heating section that is C-ETL, approved for both sea level and high-altitude areas. The entire assembly shall be approved and labelled by a nationally recognized certification agency.

.2 Operating natural gas pressure at unit(s) manifold shall be 7” w.c.

.3 Gas fired units shall be approved for operation in -40°F locations.

.4 Heat exchanger shall be a primary drum and multi-tube secondary assembly constructed of titanium stainless steel with multi-plane metal turbulators and shall be of a floating stress relieved design. Heat exchanger shall be provided with condensate drain connection. The heat exchanger casing shall have 1" (25mm) of insulation between the outer cabinet and inner liner.

.5 Blower assemblies close coupled to duct furnace type heat exchanger are not acceptable.

.6 Units with optional high efficiency heat exchanger shall be tested and certified to ANSI standards to provide a minimum of 91% efficiency throughout the entire operating range as required by ASHRAE 90.1. The manufacturer shall be routinely engaged in the manufacture of this type of high efficiency equipment.

.7 The burner assembly shall be a blow through positive pressure type with an intermittent pilot ignition system to provide a high seasonal efficiency. Flame surveillance shall be with a solid state programmed flame relay c/w flame rod. The burner and gas train shall be in a cabinet enclosure. Insulation in the burner section shall be covered by a heat reflective galvanized steel liner. Atmospheric burners, or burners requiring power assisted venting are not acceptable.

.8 Unit discharge air control shall include 15:1 turndown (HT burner). The high turndown burner minimum input shall be capable of controlling at 6.7% of its rated input without on-off cycling. Manufacturer shall provide a factory test proving indirect gas fired burner capable of 15:1 turndown ratio while maintaining minimum 91% efficiency throughout the range.

.9 Installation and venting provisions must be in accordance with C.G.A. Standard B149.1, ANSI Z223.1-NFPA54, and local authorities having jurisdiction.

.10 The condensate line from the unit must be piped directly under unit, through the roof curb. A neutralizer tank shall be provided by the manufacturer, to be connected by the contractor to the condensate line in an indoor space.

.9 CONTROLS PANEL

.1 Air handling units shall be factory wired and tested, and shall be certified by ETL, with C.S.A. approved components.

.2 Wiring shall be in accordance with the Canadian Electrical Code, Part 1, and pertinent sections of Part 2 of the Code pertaining to specific equipment type and purpose.

.3 All electrical circuits shall undergo a dielectric strength test (CSA C22.2-0) and shall be factory tested and checked as to proper function.

.4 Pre-wired air handling units shall bear an approved bilingual label with all the necessary identification marks, electrical data, and any cautions as required by the Canadian Electrical Code, Part 2.

.5 Provide a system of motor control, including all necessary terminal blocks, motor contacts, motor overload protection, grounding lugs, control transformers, auxiliary contacts and terminals for the connection of external control devices or relays.

.6 Automatic controls shall be housed in a control panel mounted in or on the air handling unit, which will meet the C.S.A. standard of the specific installation.

.7 A non-fused disconnect shall be factory mounted on the surface of the unit.

.10 HRW TOTAL ENERGY WHEEL

.1 Provide an ARI certified (sizes AEW10-1200 to AEW10-3500) Recovery Air total energy wheel as manufactured and supplied by Engineered Air. The performance of the total energy wheel shall be certified to the ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program in accordance with ARI Standard 1060-2001. The effectiveness shall be reflective of the component performance only without the benefit of packaged equipment. Wheel material will not exceed a flame spread rating of 0 and a smoke developed rating of 40 when tested in accordance with UL 723 (2018) ASTM E84.

.2 The total energy wheel shall be constructed of sheet aluminium with alternate layers corrugated and with adjacent layers glued to each other for stability. Two ply lubricated polyester/cotton thread c/w a tensile strength of 4.35 lbs (1.98 kg) with a type “Z” twist direction shall be glued to the sheet aluminium for additional strength. The sheet aluminium shall be tension wound onto a central hub. All aluminium surfaces shall be coated with a “zeolite” 4Å molecular sieve coating to provide water vapour transfer from one air stream to the other.

.3 Where latent heat transfer is not required, a Recovery Air sensible wheel shall be constructed of sheet aluminium with alternate layers corrugated and with adjacent layers glued to each other for stability. Two ply lubricated polyester/cotton thread c/w a tensile strength of 4.35 lbs (1.98 kg) with a type “Z” twist direction shall be glued to the sheet aluminium for additional strength. The sheet aluminium shall be tension wound onto a central hub.

.4 The wheel shall be cleanable by vacuuming without damage to the aluminium or desiccant. Alternate reclaim devices shall meet or exceed the performance noted in the schedules without exceeding the fan power requirements specified.

.5 Wheels shall be held securely together with metal spokes extending radially from the hub to the peripheral banding. Wheels of 1800 mm diameter and smaller are provided in one piece construction. Wheels of 2100 mm and 2400 mm diameter shall be constructed with four removable pieces, and 2700 mm to 3500 mm wheels shall be constructed with eight removable pieces.

.6 The wheel shall be supported by two pillow block bearings which in turn are supported by a steel support. The bearings shall be located to maximize the free area of the rotor as much as possible. The bearings shall be replaceable without removing the wheel from the air handling unit.

.7 Wheels shall be provided with non-contact adjustable labyrinth seals around the perimeter of the wheel and across the face at the division between the supply and exhaust sectors to eliminate drag, wear, and ensure longevity.

.8 The unit shall be provided with a purge system to allow a percentage of outdoor air through the exhaust air sector to reduce the exhaust air entering the supply air stream.

.9 The wheel shall be driven by a continuous V-belt around the outer perimeter of the wheel connected to an inverter driven, three phase, AC motor for variable speed applications. Access to the motor and the drive shall be from the face of the wheel.

.10 The CenCon c/w ER-XM module shall be complete with proportional and integral control and discharge air sensor to maintain set point temperature and provide rapid response to incremental changes in the discharge air temperature.

.11 The controller shall provide temperature and frost control operation c/w accurate supply air temperature control and summer/winter operation.

.12 Energy recovery control function shall be incorporated into the control of the system discharge air setpoint. The controller shall utilize the heat recovery device to its full ability prior to enabling additional heating or cooling devices.

.13 Controller shall provide frost prevention. When the exhaust air temperature drops below the frost threshold, the controller setpoint shall be overridden to maintain a specific setpoint in the exhaust airstream. This setpoint is calculated based on the dewpoint of the return air to ensure maximum heat recovery is maintained while not allowing frost to accumulate on the heat recovery device.

.14 On-Off Control: (for applications where frost prevention is NOT necessary). Ambient controls are used to start/stop the Total Energy Wheel. When the ambient temperature is below the heating set-point or above the cooling set-point, the wheel runs at full speed; otherwise, the wheel stops rotating for ventilation mode.

.11 ROOF CURB

.1 Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

.2 Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

.12 ACCEPTABLE MANUFACTURERS

.1 Engineered Air;

.2 Haakon;

.3 Ventrol.

3. EXECUTION

3.01 INSTALLATION OF PACKAGED ROOFTOP UNITS AND OUTDOOR AIR HANDLING UNITS

.1 Provide rooftop 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

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section. Include motor data sheets and all required information.

.2 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 Units are to be CSA or ETL listed and labelled, factory assembled and tested, shipped to site in one-piece, and are to be in accordance with requirements of following Codes and Regulations:

.1 CAN/CSA-C22.2 No. 236, Heating and Cooling Equipment;

.2 UL/ANSI 1995, Heating and Cooling Equipment;

.3 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment;

.4 AHRI 390 – Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps;

.5 ANSI S12.60 – Acoustical Performance Criteria, Design Requirements, And Guidelines For Schools;

.6 applicable Provincial Codes and Regulations.

2 PRODUCTS

2.01 PACKAGED VERTICAL UNIT VENTILATORS (UV-1, UV-2, UV-4)

.1 Single packaged vertical unit ventilator factory assembled and tested, equal to Systemair model Sophomore IQ Series with performance as indicated on drawing schedule.

.2 UNIT CABINET:

.1 16-gauge frame supports, all internal metal pans, and components;

.2 Seams: Sealed, requiring no caulking in field;

.3 <u>Interior Design</u>:

.1 Fresh air intake & condensing fan relief;

.1 Ensures wall penetrations will be above 35-inches (minimum) from the finished floor level.

.4 <u>Outer Cabinet Doors & Sides</u>:

.1 Two fully insulated, full-sized hinged panels: Held closed by two tamper-resistant cam locks on each panel;

.2 Front Doors: Allow access to all internal components;

.3 18-gauge steel cabinet and panels;

.4 Attached to the frame without visible screws, rivets, or fasteners;

.5 Cabinet Paint:

.1 Powder coat, baked, enamel-textured finish:

.2 Cabinet Color: Gray, unless otherwise indicated by Architect.

.6 Non-fibrous Insulation within a Single Wall:

.1 Thermally/acoustically insulated with a minimum of 1-inch (25-mm) of thick, fiber-free, low density, foam;

.2 High sound absorption;

.3 Low thermal conductivity;

.4 Excellent emission properties;

.5 Microbiological resistance;

.6 High fire resistance;

.7 Low VOC emission properties, must meet or exceed ISO 16000 Class A requirements;

.8 Tested to ISO 846:2019 (A/B/C);

.9 UL94 V0/HF-1 flame rating;

.10 CAN/ULC S102 flame rating;

.11 Flame Spread Index, UL 723: Not over 25; Tested to ASTM E84 and ASTM E662.

.12 Smoke Developed Index, UL 723: Not over 50; Tested to ASTM E84 and ASTM E162.

.13 Blowing agents:

.1 Low Global Warming Potential (GWP);

.2 Accepted within the regulations outlined in the EPA SNAP Rule 21 and 22 programs.

.3 AIR DISTRIBUTION:

.1 24-inches x 12-inches Duct Collar Supplied with Unit Ventilator;

.2 Recommended external ducting and ceiling diffusers External Static Pressure (ESP): 0.1-inch−0.5-inches;

.3 Return Grilles designed to reduce generated sound with matching colour, standard, punched, and supplied with unit.

.4 AIR FILTRATION, AIR TREATMENT, AND DAMPERS:

.1 Two (2) 2-inch MERV-13 pleated disposable filters to filter 100 percent of both recirculated and outside fresh air.

.5 HOT WATER HEATING COIL:

.1 Constructed of seamless drawn copper tubes mechanically expanded into die-formed fin collars of aluminum, tempered, corrugated fin stock to ensure the positive bond for optimal heat transfer, and the prevention of electrolytic action.

.2 Supplied with a manual air vent, and a drain plug.

.3 Sized to provide the required heating capacity as per the schedule.

.4 Supply and return connections stubbed out the top of the unit on the left side with 1-inch nominal tubing.

.5 Hot Water Freeze Protection:

.1 Discharge Air Sensor Factory-equipped with unit to prevent the hot water from freezing due to an abnormal drop in discharge air temperature.

.6 Water Control Valves and Piping Components:

.1 The manufacturer supplies and installs a “Two-Way Modulating” spring return control valve, an isolation valve, a positive shut-off manual circuit balancing valve, and a wye strainer.

.7 Accessories:

.1 Unions at coil connections;

.2 Drain tap;

.6 SINGLE PACKAGED AIR CONDITIONING:

.1 Refrigerant Components to be Factory-equipped with unit ventilator and requires no field fabrication or installation of coils, line-sets, or condensing units.

.2 Designed and charged with R410A.

.3 Factory-equipped with one direct expansion valve and matched with the compressor.

.4 Provides required cooling capacity and performances as indicated in drawing schedules.

.5 Direct Expansion (DX) Coil Factory-equipped with Unit Ventilator:

.1 Mounted in evaporator coil section;

.2 Connected to correctly sized condensing coil in the condenser coil section;

.3 Orientation: Provides optimal heat transfer;

.4 Constructed with seamless drawn copper tubes mechanically expanded into die-formed fin collars of aluminum, tempered, corrugated fin stock to ensure the positive bond for optimal heat transfer, and prevention of electrolytic action;

.5 Commercially clean and dehydrated;

.6 Endplates: Galvanized steel construction.

.7 STANDARD DRAIN PAN:

.1 Constructed of stainless steel metal;

.2 Front-to-back and side-to-side slope to the primary drain outlet to eliminate any standing water in the pan.

.8 COMPRESSOR FACTORY-EQUIPPED WITH UNIT VENTILATOR:

.1 Hermetically sealed, two-staged, scroll type compressor;

.2 Sized correctly to match the coils performance as indicated on drawing schedule;

.3 Mounted on rubber isolators to reduce vibration transmission;

.4 Internal Overload Protectors: Protects compressor from excessive motor temperature and current;

.5 High-Pressure Switch: Disables compressor from excessive system pressure;

.6 Low pressure cut out: Provided to disable compressor if refrigerant pressure is below an acceptable threshold;

.7 Compressor Crankcase Heater: Factory-equipped with each unit to prevent migration and mixing of refrigeration with the oil in the crankcase.

.8 Two-stage cooling sequence:

.1 First stage: 67 percent of compressor capacity.

.2 Second stage: 100 percent of compressor capacity.

.9 DAMPERS:

.1 <u>Ventilation Damper:</u>

.1 Insulated galvanized damper;

.2 Operated by zero maintenance and concealed linkage;

.3 Outside blade edge: Pressure-sensitive type for low leakage;

.4 Jamb seals: Pressure-sensitive type for low leakage;

.5 Dampers equipped with a Belimo spring return damper actuator with minimum torque of 18-inch-pound;

.6 Protected from overload at all angles of rotation

.7 Provides proportional damper control in response to input of 2−10 VDC

.8 Actuators: Equipped with a brushless DC motor controlled by a microprocessor:

.9 Modulates dampers to allow outside air to mix with return air:

.1 During occupied period, outside air fixed at 450 CFM.

.2 During economizer cycle, opens fully during economizer cycle to allow up to 100% of total supply air to enter through outside air damper.

.10 SUPPLY AND CONDENSING FANS:

.1 Supply Fan:

.1 Supply Motor and Fan Assembly: Consists of two-fan bodies to supply the specified airflow;

.2 Orientation: Allows mixed air to be drawn through both the heating and cooling coils;

.3 Fan body: Double-inlet centrifugal type blower;

.1 Both fans driven by one electronically commutated motor (ECM) capable of variable speed operation.

.4 EC Motor: Programmable to deliver the specified airflow at the rated ESP;

.1 Permanent Split Capacitor motors are not permitted.

.2 Provides efficient fan operation.

.3 Isolated from supply fans by zinc-plated double wire.

.4 Mounting brackets and rubber anti-vibration mounts: Dampens the noise induced by vibrations.

.5 Fan Assembly slider sits on felt insulation.

.2 Condensing Fan:

.1 Motor & Fan Assembly designed to cool condensing coil and to relieve stale room air at the same rate as outside air enters the space;

.2 Fans: Two backward curved centrifugal fans

.1 Driven by integral electronically commutated motors (ECM);

.2 Capable of variable speed operation;

.3 Permanent Split Capacitor motors are not permitted.

.3 Fan assembly capable of exhausting up to 100% airflow equal to incoming outdoor air.

.11 ELECTRICAL:

.1 Main Power Supply: Connects to unit through a wire raceway direct to either a terminal block or an unfused disconnect (provided by the manufacturer).

.2 Standard electrical supply voltage: 208 VAC 3 phase 60 Hz.

.3 Service Disconnect Supplied with Unit Ventilator:

.1 Line Voltage Service Disconnect: Maximum 80 amperes;

.2 Door Switch: Provides control voltage interrupt to disable mechanical components after removal of service panel;

.3 Disconnect Switch: Lockable in OFF position.

.4 All Internal Functions: Fuse-protected by a Time-delay Fuse rated properly for amperage load.

.12 CONTROLS:

.1 Terminal Strip Ready.

.2 Optional:

.1 Freezestat;

.2 Occupancy Sensor.

.13 ACCESSORIES:

.1 Full IQ Sound Package;

.2 Piping Package with isolation valve, Y strainer, 2-way modulating control valve, manual balancing valve ad blowdown valve.

.14 ACCEPTABLE MANUFACTURERS ARE:

.1 Systemair;

.2 Engineered Air;

.3 Airedale.

2.02 VERTICAL AND HORIZONTAL UNIT VENTILATOR (UV-3, UV-5, UV-6, UV-7, UV-8)

.1 Vertical unit ventilator factory assembled and tested, equal to Temspec model VUD with performance as indicated on drawing schedule. Unit complete with hydronic heating coil and DX cooling coil with remote condensing unit.

.2 Horizontal unit ventilator factory assembled and tested, equal to Temspec model HCD with performance as indicated on drawing schedule. Unit complete with hydronic heating coil and DX cooling coil with remote condensing unit.

.3 HOT WATER COIL:

.1 The coil shall have ½" copper tube of minimum wall thickness 0.016" and shall have aluminum fins. The coil supply and return headers shall be copper pipe, stubbed out for sweat connection. The coil shall be factory pressure tested at not less than 350 p.s.i. A manual air vent shall be factory installed and ball valves fitted. The coil capacity shall be as shown in the schedule.

.4 DIRECT EXPANSION EVAPORATOR COIL:

.1 The coil shall have 3/8" copper tube and aluminum fins. The coil capacities shall be as shown in the schedule. A galvanized steel pitched drain pan shall be provided. The pan shall have a 'P' trap.

.5 CABINET:

.1 VUD 1600

.1 The unit cabinet shall be 14ga corrosion resistant steel, braced and reinforced for rigidity. The finish shall be textured powder coat, color as per the Architect's instruction. The cabinet shall be fully lined with 1" coated glass fiber insulation. The return air grille shall be heavy duty steel.

.2 VUD 2000

.1 The unit cabinet shall be 14ga corrosion resistant steel, braced and reinforced for rigidity. The finish shall be textured powder coat, color as per the Architect's instruction. The cabinet shall be fully lined with 1" coated glass fiber insulation. The return air grille shall be heavy duty steel.

.3 HCD 1200

.1 The unit shall have a horizontal configuration with supply air discharge into high level duct work. The unit cabinet shall be 18ga corrosion resistant steel, braced and reinforced for rigidity. The finish shall be textured powder coat, color as per the Architect's instruction. The cabinet shall be fully line with ½" coated glass fiber insulation.

.4 HCD 1600

.1 The unit shall have a horizontal configuration with supply air discharge into high level duct work. The unit cabinet shall be 14ga corrosion resistant steel, braced and reinforced for rigidity. The finish shall be textured powder coat, color as per the Architect's instruction. The cabinet shall be fully line with 1" coated glass fibre insulation.

.6 SUPPLY AIR FAN/MOTOR:

.1 The fan shall be a direct centrifugal type with a three speed PSC motor mounted on rubber isolation grommets. The motor voltage shall be 208V/1/60Hz.

.2 Dual fans provided for model VUD 2000.

.7 MIXING AIR DAMPERS:

.1 The outdoor and return air dampers shall have airfoil section aluminum extruded blades. The dampers shall have neoprene blade tip and jamb seals. Leakage shall not exceed 4 c.f.m. per sq. ft. at 3" W.G. differential pressure, as determined by a recognized testing laboratory.

.8 ACCESS PANELS:

.1 Provide hinged access panels incorporated in one side of the HCD units to allow full access to all internal components.

.9 FILTERS:

.1 The filters shall be of the manufacturer's standard disposable type.

.10 LINE VOLTAGE WIRING:

.1 All internal line voltage wiring shall be by the unit manufacturer. A suitably rated remote circuit breaker shall be provided and installed by the electrical contractor.

.11 DDC CONTROLS:

.1 Control items shall be furnished by the contractor for factory mounting and shall function as described in the Controls Specification.

.12 ACCESSORIES:

.1 Unit manufacturer shall provide a colour matched top plenum extension for model VUD units, size to suit the ceiling height. The plenum shall have an internal perforated elbow and shall be acoustically lined.

.2 Unit manufacturer shall provide a colour matched raised base, height as shown on the plans, for model VUD units.

.3 Rear Plenum: (for model VUD units)

.1 Constructed of heavy 18-gauge steel with 1-inch (25-mm) flange for unit mount and painted in textured powder coat, finished to match cabinet colour;

.2 Factory-insulated with 1-inch (25-mm) acoustic material and includes a full uninsulated back;

.3 Assemble with field mounting to the unit required;

.4 Depth: 14-inches

.4 Sound Package;

.5 Piping Package with isolation valve, Y strainer, 2-way modulating control valve, manual balancing valve ad blowdown valve.

.13 ACCEPTABLE MANUFACTURERS:

.1 Temspec;

.2 Engineered Air.

2.03 ROOF MOUNTED CONDENSING UNIT

.1 Engineered Air, CSA approved and UL listed, package type, weather-proof, roof mounting, air cooled condensing unit with scroll compressor meeting ASHRAE 90.1 efficiency levels, factory assembled on heavy-gauge galvanized steel base. The refrigerant shall be R410A. The unit shall be shipped with a holding charge of dry nitrogen.

.2 Model, capacity, performance and characteristics are as indicated on drawings and drawing schedules. The unit shall meet the performance detailed in the schedule. Construction and ratings shall be in accordance with latest AHRI Standard, ANSI/ASHRAE 15, CSA-B52 and ASME Code.

.3 UNIT CABINET

.1 The unit shall be assembled on a rugged steel base. Unit casing and all structural members and rails shall be fabricated of pre-painted steel designed to withstand a 1000-hour ASTM B117 salt spray test.

.2 The condensing section shall be open on the sides and bottom to allow airflow through the coils. Single circuited units under 20 tons shall be equipped with full-face louvers for added protection and safety.

.4 REFRIGERATION

.1 Compressors shall be heavy duty Copeland scroll type, refrigerant gas cooled. Compressors shall be complete with thermal overload protection, low and high pressure control safeties and a liquid line shut off valve.

.2 On dual circuited units, each compressor shall also include gauge ports, an oil sight glass, crank case heater, anti-slug protection, and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.

.3 Provide liquid and suction line service valves.

.4 Compressors shall be mounted on resilient rubber isolators to decrease noise transmission.

.5 Provide hot gas bypass on one refrigerant circuit.

.5 CONDENSER

.1 Condenser fans shall be direct drive, propeller type designed for low tip speed, vertical air discharge, and include service guards. Fan blades shall be constructed of steel and riveted to a steel centre hub. Condenser fan motor shall be direct drive, permanently lubricated “PSC” motors with inherent thermal overload.

.2 Condenser coils on single circuited system under 20 tons shall be constructed with 3/8" copper tubing mechanically bonded to aluminum fins for maximum heat transfer. Dual circuited systems over 15 tons shall feature condensers fabricated from cast aluminum micro-channel coils. Each condenser coil shall be factory leak tested with high-pressure air under water. Each refrigerant circuit shall provide 15 degrees of liquid subcooling.

.3 Single circuited units shall be provided with standard head pressure controls which cycle the condenser fan motors to maintain condensing pressures for operation down to 0°F ambient.

.4 On dual circuited systems, one condenser fan shall be controlled to maintain positive head pressure and an ambient thermostat shall be supplied to prevent the refrigeration system from operating below 45ºF ambient.

.6 ELECTRICAL AND CONTROLS

.1 All wiring shall comply with UL requirements. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring.

.2 Power and starting components shall include: circuit breaker for each compressor; fusing for the control circuit; compressor starting contactors; unit power terminal block for field connection to a single power supply and control power transformer.

.3 Provide unit with terminal strip for connection to field installed controls. Provide 4 stages of cooling.

.4 Provide factory installed phase failure protection.

.5 Electrical power requirement of unit shall match base building power available at site. Unit shall not be provided with Transformers or other power conversion devices to convert voltage to suit equipment electrical requirement.

.6 Acceptable manufacturers are Engineered Air, Daikin, and Trane.

3 EXECUTION

3.01 INSTALLATION OF UNIT VENTILATORS

.1 Provide unit ventilators.

.2 Secure each horizontal unit ventilator in place from structure by means of galvanized steel hanger rods, and vibration isolation elements supplied with units. Provide additional structural steel for unit support installation as required.

.3 Unless otherwise shown or specified, secure each vertical fan coil unit in place on floor, complete with vibration isolation pads supplied with units.

.4 Provide shut-off valves and install a control valve in piping for each coil. Refer to drawing detail and piping schematic.

.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 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.

3.02 INSTALLATION OF ROOF MOUNTED CONDENSING UNIT

.1 Provide a package type condensing unit on the roof where shown. Secure the assembly in place, level and plumb, on vibration isolation on the roof support system provided.

.2 Connect the condensing unit and the indoor evaporator with refrigerant piping in accordance with the piping shop drawing schematic.

.3 Provide all required refrigerant and oil.

.4 When system installation is complete, check all equipment connections, start-up the equipment, test operation, and make any required adjustments under direct supervision of a qualified member of the equipment supplier's personnel and, when equipment is ready for acceptance, forward to the Consultant a letter stating that the equipment has been checked, started, tested and is ready for acceptance.

.5 When the letter has been received, the Consultant will visit the site to witness performance and acceptance tests on the equipment. Arrange for the equipment supplier's personnel to be present during the tests. Pay all costs associated with the equipment supplier's personnel at the site.

END OF SECTION

PROJECT NAME: Halton District School Board
Nelson High School
Air Conditioning and Ventilation Upgrade

RDZ PROJECT NUMBER: 23178

Following Supplementary Controls 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 Controls 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 Controls Bid Form by time of Bid closing, via e-mail addressed to:

RDZ Engineers Ltd.
Attention: Giovanni Rea
e-mail: Giovanni@rdzeng.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
25 09 23	Motorized Dampers	
25 09 23	Motorized Damper Actuators	
25 09 23	Temperature Sensors	
25 09 23	Control Valves	
25 09 23	Control Valve Actuators	
25 09 23	Room Sensors	
25 09 23	Pressure Transmitters	
25 09 23	Outside Air Sensors	

END OF SECTION

1. GENERAL

1.01 SUMMARY

.1 The approved Building Automations System Contractor per 2.1, referred to herein as the Contractor, shall provide a Direct-Digital Control System as indicated on the project documents in accordance with the drawings and as described in these specifications.

.2 Where existing legacy controls exist, the Contractor shall be responsible for the removal and preservation of existing controls and accessories, and to engineer, permit, provide and install a fully functioning Building Automation System which meets the requirements detailed herein.

.3 Where an Owner or Owner's representative provided points / object and equipment list is not provided as part of the bid package, the Contractor shall be responsible to verify existing site conditions and/or review all available drawings so to ensure all existing and/or currently proposed equipment at the facility is identified in accordance with 1.3.2, and is made part of the complete Direct-Digital Control System.

.4 The work administered by this Section of the technical specifications shall include all engineering, programming, labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required for a complete and fully functional Controls Systems.

1.02 DESIGN INSTRUCTIONS

.1 Design shall meet the functional intent of an "open", and interoperable Building Automation System, comprised of a network of stand-alone digital controllers. Incorporating the Niagara 4 Framework®.

.2 The Building Automation System is to include, but not limited to, the monitoring and/or control of **ALL** of the following equipment instances at each specified site:

.1 Boilers
.2 Fluid Cooler
.3 Air handling units
.4 Make up air units
.5 HVAC Equipment
.6 Energy recovery units
.7 Heat-pumps
.8 Exhaust fans
.9 Variable Frequency Drives
.10 Pumps
.11 Motors
.12 Valves
.13 Unit Heaters
.14 Radiant Heaters
.15 Electric Duct Heaters
.16 Exterior Lighting
.17 Utility Consumption and Demand Metering

.3 The system shall be modular in nature and designed for future flexibility so to accommodate the addition of functionality, control points or expansion of facility.

.4 The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the B-BC shall have no effect on the field controllers, including those involved with global strategies.

.5 Coordinate the specifications and equipment schedules in related sections for manufacturer furnished DDC systems to ensure the minimal hardwired points and sequences can be met. OEM DDC Systems, that meet the minimum hardwired points are preferred and approved for use with the following equipment ONLY; boilers, main air handling equipment, heat pumps and, fluid cooler. The supplier of the equipment is responsible for the configuration, programming, start-up, and testing of that product to meet the sequence of operation and specifications. The supplier shall also provide any licensing, hardware, and software required for interface to the DDC system.

1.03 DEFINITIONS

.1 Definitions of terms used in this section may differ from those given in general and supplementary conditions and take precedence over them.

BAS	Building Automation System
B-BC	BACnet Building Controller
B-AAC	BACnet Advanced Application Controller
B-ASC	BACnet Application Specific Controller
BACnet / BACnet Standard	Building Automation and Controls Network - ANSI/ASHRAE Standard 135-2012
BACnet/IP	BACnet Annex J – describes how BACnet devices can make use of IP directly for communicating across IP-based terminals
BBMD	BACnet Broadcast Management Device, see BACnet Annex J
BIBB	BACnet Interoperability Building Blocks: A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task
BTL	BACnet Testing Laboratory: A recognized, independent third party laboratory certified to test product for compliance to BACnet standards. BTL Certified products are indicated by a registered seal affixed to the product.
B/I	Binary Input
B/O	Binary Output
COV	Change of Value
cUL	Underwriters Laboratory Canada
DDC	Direct Digital Control
D/I	Digital Input
D/O	Digital Output
Embedded Control	Some OEM's (Original Equipment Manufacturer) equipment have a factory installed controller. These controllers must follow these standards. Examples can be found in chillers, boilers, variable frequency drives, etc. Proprietary communication protocols will not be allowed.
Gateway	A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them (ASHRAE/ANSI 135-2004). Gateways are NOT to be included unless approved by the Owner.

GUI	Graphical User Interface
HVAC	Heating, Ventilation and Air-Conditioning
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
LAN	Local Area Network (an individual school or site)
MS/TP	Master Slave Token Passing: Data link protocol as defined by the BACnet Standard. Operates over a serial field bus network (RS485)
NEMA	National Electrical Manufacturers Association
PICS	Protocol Implementation Conformance Statement: All devices conforming to the BACnet protocol shall have a documented statement that identifies all portions of BACnet that are implemented in the device.
P.I.D.	Proportional Integral Derivative
Shall	indicate a requirement that, in the view of the Board, must be complied with
UPS	Uninterruptible Power Supply Unit
VFD	Variable Frequency Drive
VLAN	Virtual Local Area Network: Dedicated for Facilities Services equipment
WAN	Wide Area Network (board wide)

1.04 REFERENCE STANDARDS

.1 Where edition date is not specified, consider that references to the manufacturer's data, and published codes, standards and specifications are made to the latest edition or revision, approved by the issuing organization.

.2 Reference Standards and specifications are quoted to establish minimum standards. Work in which quality exceeds the specified minimum will be considered to conform.

.3 The requirements of the Contract Documents govern over the requirements of reference standards and specifications.

.4 Standards, specifications, associations and regulatory agencies are generally referred to throughout the Contract Documents by their abbreviated designations, as listed below:

.1 AMCA American Movement and Air Control Association
.2 ANSI American National Standards Institute
.3 ARI Air Conditioning and Refrigeration Institute
.4 ASME American Society of Mechanical Engineering
.5 ASTM American Society for Testing and Materials
.6 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
.7 CGA Canadian Gas Association
.8 CGSB Canadian General Standards Board
.9 CSA Canadian Standards Association
.10 NFPA National Fire Protection Association
.11 SMACNA Sheet Metal and Air Conditioning Contractors' National Association
.12 ULC Underwriters' Laboratories of Canada

1.05 SYSTEM ARCHITECTURE AND DESCRIPTION

.1 The Building Automation System as detailed in this Section shall be based on a hierarchical architecture incorporating the Niagara 4 Framework® through Tier 1 and 2 inclusive. Systems not developed on the Niagara 4 Framework® platform are unacceptable.

.2 All Niagara 4 Framework® components shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification.

.3 All devices supplied under this specification, excluding sensors, shall be connected to the site LAN and shall communicate natively using the following BACnet/IP, BACnet MS/TP, Peer to Peer, or Ethernet (ISO 8802-3), as defined in the ANSI/ASHRAE Standard 135, latest or Peer-to-Peer using Niagara's Fox Protocol or SNMP.

.4 Program databases, data acquisition and all control sequence logic shall reside in the respective B-BC, B-AAC and B-ASC controller. Each device shall, to the greatest extent possible, perform its programmed sequence. Operation of each device shall not be dependent on a connection to a server or master controller.

.5 The B-BC and any B-AAC or B-ASC shall be capable of updating firmware without the replacement of any hardware, microprocessors or chips.

.6 Each school / site shall be furnished with a single B-BC, which is responsible for and capable of providing fully distributed control including user access control and all necessary site computations at the site, independent of or under the Enterprise Management System and it must be stand-alone, multi-tasking, multi-user with a real-time digital processor. All controlled objects, sequences and associated operational parameters shall be both operator definable and modifiable through the embedded User Interface.

.7 The B-BC shall provide a web-based graphical user interface for programming, monitoring, and control, independent of any Enterprise Management System, be accessible remotely from a central site(s) and locally. The web-enabled user interface shall operate on an industry standard web-browser without the requirement of additional plugins.

.8 Each Mechanical or Electrical System and/or major piece of mechanical or electrical equipment shall have 1 dedicated B-AAC controller with sufficient I/O capacity such that it shall be connected to ALL field devices and points associated with that system, space and/or piece of equipment. B-ASC use shall be limited to VAV box applications provided the full functional intent can be met within the singular device.

.9 Mechanical and Electrical Systems i.e., VFD's, fluid cooler, boilers, unitary equipment, etc. units that are equipped with manufacturers furnished controls shall be BTL certified. Gateways are not to be used unless prior written approval has been acquired. A single B-AAC can be used in combination with the manufacturer supplied controls, only where the manufacturer's controls are unable to meet the functional intent, it shall be implemented in accordance with Section 25 09 93.

.10 The use of multiple application controllers used to control a single piece of equipment is strictly prohibited, except those specifically noted in 1.6.9.

.11 The system shall include real time monitoring of the following utilities; electricity (main feed), natural gas (main), and water (main). Meters supplied under this division shall communicate BACnet Natively. For existing meters, utility owned, coordinate integration requirements with the respective utility provider.

.12 The B-BC shall be connected to the HDSB Facilities VLAN, , to be supplied by the School Board at the School Board's expense.

.13 Site workstations, otherwise referred to as Caretaker PC, will be provided by the School Board.

1.06 HARDWARE AND SOFTWARE LICENSING

.1 The School Board shall be named license holder of all controllers and components, software and firmware supplied under this specification. The School Board shall receive ownership of all project specific configuration documentation, data files, and application-level software developed for the site.

.2 The School Board shall have unrestricted access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the building automation system

.3 All software provided shall be full featured and not limited or trial version.

1.07 USER CONTROL OVER CONFIGURATION

.1 The intent of this specification is to provide a system which shall allow the Board to independently do its own modifications to all objects, operational parameters and sequences.

1.08 INTELLECTUAL PROPERTY AND PROPRIETARY MATERIAL

.1 The Board shall sign a software and hardware licensing agreement, upon review and agreement of terms and conditions, as a condition of contract. Such license will grant use of all programs and application software to the Board and its representatives, as defined by the agreement, and shall protect the manufacturer's rights to disclosure of intellectual property contained within such software.

1.09 SYSTEM PERFORMANCE

.1 The System shall conform to the following minimum:

.1 The system shall report values with minimum end-to-end accuracy listed in Table 1.

Table 1 - Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	1% of range
Ducted Air Temperature	1% of range
Outside Air Temperature	±1°C (±2°F)
Water Temperature	1% of range
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see note 2)
Carbon Dioxide (CO^2)	±50 ppm
Electrical (kW, kVA, kWh, A, V, pF)	±1% of reading (see note 3)

Note 1: 10% - 100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

.2 Control Stability and Accuracy shall maintain measured variable at set-point within tolerances listed in Table 2.

Table 2 – Control Stability and Accuracy		
Controlled Variable	Control Accuracy	Range of Medium Accuracy
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1°C (±2°F)	
Duct Temperature	±1.5°C (±3°F)	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-5- in. w.g.) differential

1.10 WORK COVERED BY THE CONTRACT DOCUMENT

.1 The Scope of Work for the Building Automation Systems Contractor shall include, but is not limited to the following:

.1 Furnish and install all necessary controllers, control and/or ancillary devices, sensors, wiring, software, licenses, and programming to deliver a complete and functional building automation system, which meets the functional intent of the systems design.

.2 The naming and addressing of all objects and devices to be in accordance with the specifications.

.3 Configure the web-based user interface embedded in the B-BC in accordance with the specifications.

.4 Coordinate equipment specifications for related sections necessary to meet the functional intent including variable frequency drives, dampers, valves, actuators, and peripheral devices considered to have wet surfaces such as pressure taps, thermal wells, flow switches, flow meters, etc. Preference is given to these devices being furnished by the Original Equipment Manufacturer, where applicable.

.5 Review and coordinate with other related sections so to ensure all mechanical and electrical systems and components to be integrated have the necessary hardware and software to meet the points and sequences specified.

.6 Coordinate with the School Board, the setup and communication of the B-BC on the School Board’s supplied VLAN, in accordance with the specifications.

.7 Coordinate with the School Board and the respective utility provider, the installation and setup of utility metering equipment or the integration of any existing meters, in accordance with the specifications.

.8 Identify and label all controllers and associated devices including but not limited to connected I/O points, address’, network id, etc.

.9 Attain, where required, all necessary permits and inspections

.10 Commissioning of new BAS.

.11 Submit the required documentation as described herein, including, but not limited to submittals, project record, start-up, commissioning, testing, acceptance documentation and system warranty.

.12 Operator Training.

1.11 PRODUCTS FURNISHED BUT NOT INSTALLED BY THE BUILDING AUTOMATION CONTRACTOR

.1 Hydronic Piping:
- .1 Control Valves
- .2 Flow Switches
- .3 Temperature Sensor Wells and Sockets
- .4 Flow Meters.

.2 Ductwork Accessories:
- .1 Automatic Dampers
- .2 Air Flow Switches

1.12 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED BY THE BUILDING AUTOMATION CONTRACTOR

.1 Fire Alarm Systems

.2 Utility Monitoring Systems

.3 Variable Frequency Drives

.4 Boiler, Fluid Cooler, Heat Pumps Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)

.5 Packaged Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)

1.13 RESPONSIBILITY MATRIX BY DIVISION CONTRACTOR

Work / Item / System	Furnish	Install	Control Wiring	Power
Control System Communication Wiring	25 09 23	25 09 23	25 09 23	n/a
Controls Equipment, panels, enclosures, and accessories	25 09 23	25 09 23	25 09 23	26
Interface to OEM furnished controllers supplied under Division 23	23	23	25 09 23	26
DOAS, Air Handling, HVAC Manufacturer furnished space mounted control (i.e., thermostat)	n/a	n/a	n/a	n/a
Fluid Cooler Level, Make-up Water and Sump Heater Control Devices (local control only)	23	23	23	23
Starters, operator switches	23	26	25 09 23	26
Automatic Damper (not OEM installed)	25 09 23	23	23 09 23	n/a
Automatic Damper Actuators	25 09 23	25 09 23	25 09 23	n/a
Hydronic Valves	25 09 23	23	25 09 23	n/a
Hydronic Valve Actuators	25 09 23	25 09 23	25 09 23	n/a
Thermo-wells (including accessories considered “wet”)	25 09 23	23	n/a	n/a
Hydronic Flow Switches and	25 09 23	23	25 09 23	n/a

Transducers				
Variable Frequency Drives not OEM Furnished	23	26	25 09 23	26
Fire Alarm control monitoring relay	28	28	25 09 23	26
Power Distribution Monitoring System	Utility	Utility	25 09 23	26
Natural Gas Utility Monitoring System	Utility	26	25 09 23	n/a
Water Meter Monitoring System	Owner	25 09 23	25 09 23	n/a
Fume Hood Controls (to be local control only)	23	23	23	26

1.14 QUALITY ASSURANCE

.1 The Controls Contractor shall be responsible for inspection and quality assurance for all materials and workmanship provided.

.2 The Controls Contractor shall have an established working relationship with the proposed BAS manufacturer of not less than 3 years.

.3 The Controls Contractor shall have successfully completed all control system training and certification as required by the manufacturer.

1.15 PERMITS, INSPECTIONS AND TESTING

.1 Contractor will arrange for submission to the Electrical Safety Authority (ESA) for review of this project, and pay all associated fees. Provide Certificate(s) of Acceptance from ESA and other Authorities having jurisdiction upon completion of the Work.

.2 Where modification to mechanical or electrical equipment control wiring is necessary to meet the requirements of the specifications, the contractor is responsible for arranging any testing required by the Authority Having Jurisdiction to maintain the required certification and ensure the safe operation of the equipment modified.

1.16 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed equipment may be subject to performance verification as specified herein if required by Owner or Owner’s Representative(s).

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 If requested, Contractor shall arrange for services of independent testing agency.

.4 Maintain building comfort condition when equipment removed from service or testing purposes.

.5 Promptly provide School Board, or School Board’s Representative(s) with test reports.

.6 Should test results reveal that originally installed equipment meets specified performance requirements, School Board will pay costs resulting from performance verification procedure.

.7 Should test results reveal equipment does not meet specified performance, equipment will be rejected and the following shall apply:

.1 Remove rejected equipment. Replace with equipment that meets requirements of Contract Documents, including specified performance requirements.

.2 Replacement equipment may be subject to performance verification as well; use same testing procedures as performed on originally installed equipment.

.3 Contractor shall pay costs resulting from performance verification procedure.

1.17 SUBMITTALS

.1 All submittals and documentation including complete BAS System Engineering Design Submittal & Drawings, Project Record Documents, Application Engineering Documents and Owner's & Maintenance Manuals shall be submitted electronically in the form of an Adobe Portable Document Format (.pdf). All Control Schematics, Wiring Diagrams, Riser Diagrams, &c. shall be formatted for A3 11" x 17". Floor Plans shall be submitted in CAD format (.dwg). All other documentation may be formatted for 8.5" x 11".

.2 Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents.

.3 Complete BAS Engineering Design Submittal & Drawings shall be prepared in accordance with Section 1.20 using the following guidelines:

.1 Submittal documentation and drawings shall consistently use the same abbreviations, symbols, nomenclature and identifiers. Each control system element shall be assigned a unique identifier pursuant with the Contract Documents

Submit the following:

.2 A complete bill of materials of all equipment, controllers, devices, sensors, actuators, valves, etc., necessary to meet the requirements detailed herein is to be provided, indicating unique equipment identifier/tag, unique device/controller identifier/tag, manufacturer and model number.

.3 Riser diagram of Local Area Network (LAN) shall outline execution and details of all network cabling, BAS & Network Hardware including the following:

.1 All BAS/DDC Hardware with controller number, MAC Addresses where required, unique identifier/tag, location, equipment and service.

.2 All Network Hardware with unique identifier, location and service

.3 Network cabling configuration and execution specification

.4 Location of all cabling termination points and End of Line (EOL) terminators

.5 Location of all network interface jacks

.6 A separate riser diagram shall be provided for each network segment

.4 Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include for every BAS component including but not limited to the following:

.1 Gateways or BBMD associated networking peripherals

.2 Control Valves

.3 Dampers

.4 Actuators

.5 Variable Frequency Drives

1.18 SUBSTANTIAL COMPLETION REQUIREMENTS

.1 Contractor shall provide checklist for completion before Substantial Completion Field Review. Provide written declaration that work is complete. The following items shall be complete before Substantial Completion Field Review:

.1 Mechanical and Electrical systems capable of operation with Building Automation System, in operation with alarms functional.

.2 Tests on systems and equipment completed and certificates of approval obtained from regulating Authorities.

.3 Fire stopping completed, if required.

.4 Valve tagging completed and equipment, ductwork and piping identified.

.5 Escutcheons installed.

.6 Extended warranty form mailed to manufacturer and copy provided to Owner.

.7 Ensure access doors suitable located and equipment accessible.

.8 Ensure electrical connections to mechanical equipment are complete and motor rotation correct.

.9 Equipment cleaned inside and out, lubricated and paint touched-up.

.10 Commissioning, Testing, Demonstration and Acceptance.

.11 Complete program back-up and system files provided and verified for functionality.

1.19 PROJECT RECORD

.1 Upon completion of installation and systems commissioning, submit record documents for review. “As-Built” Project Record Documents should include:

.1 Project Record Application Engineering Drawings shall include all BAS System Engineering Design Submittal with Drawings updated to reflect actual field conditions, architecture and execution.

.2 Electronic Operating & Maintenance (O&M) Manual including:

.1 Operator’s Manual with Manufacturers’ complete operating instructions.

.2 Documentation of all project specific Application and DDC programs.

.3 All necessary system Administrator-Level passwords and/or required access credentials.

.4 Information required for programming BAS.

.5 Complete Final Point Schedule including all hardware and software data points and documentation of calibration and configuration values for all Inputs, Outputs, Variables and PID Loops at the conclusion of systems commissioning and functional testing.

.6 Routine preventative maintenance procedures, corrective diagnostic troubleshooting procedures and calibration processes.

.7 Final Bill of Material with all installed parts, manufacturers, manufacturers’ part numbers and ordering information.

.3 Sequence of Operation shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. No operational deviation from specified Sequences of Operation as outlined in Contract Documents shall be permitted without prior written approval. Sequences of Operation shall include and conform to the following:

.1 Refer to equipment and control devices by their specific unique identifiers/tags pursuant with the Contract Documents and BAS Submittal package.

.2 Clearly represent actual Application Programming methodology and functional control operation. Do not merely provide a copy of Contract Document specified Sequence of Control.

.3 Include description of functional system operation under normal and failure conditions.

.4 BAS Control Schematics and Wiring Diagrams shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. BAS Control Schematics and Wiring Diagrams shall include and conform to the following:

.1 Floor plan showing exact location, MAC addresses where required, including unique identifiers of all hardware supplied under this section.

.2 Control Schematic flow diagram of each system (air, water, gas, & etc.) being controlled showing actual physical configuration and control device/sensor location of all fans, coils, dampers, valves, pumps, heat exchangers, control devices, &c. including each hardware point type, controller and associated ancillary devices.

.3 Controller termination details showing every controller point termination.

.4 Wiring Diagrams of all packaged equipment, motor starters, relay wiring, equipment interlock, safety circuits, & etc. clearly indicating all interconnecting wiring and termination of all conductors and cables including labels of all cables and points.

.5 Control Enclosure details for every enclosure including panel identifier, location, physical lay-out, dimensions, instrumentation, labels, & etc. Also include detail wiring (I/O, network and power) and power source for each panel, transformer and controller.

2. PRODUCTS

2.01 APPROVED MANUFACTURERS

.1 The following controls hardware and software, in no particular order of preference, are approved for use:

Manufacturer	Tier 2 Product Line	Manufacturer Assigned Vendor
Alerton	AIE Niagara 4	HTS Engineering Ltd (115 Norfinch Drive, North York, ON)
Distech Controls	EC-BOS Niagara 4	Energy Controls & Mechanical Services Inc. (Kitchener)

2.02 SOLE VENDOR SITE DESIGNATION

.1 Any minor site additions or upgrades, requiring manufacturer specific products as detailed herein will be that of the Approved Manufacturer for the site, per 2.3.

.2 The Board reserves the right to change the status of an Approved Manufacturer at any time should they not meet the performance or requirements detailed herein.

2.03 BUILDING CONTROLLER (B-BC)

.1 The B-BC shall be BTL certified, communicate BACnet Natively and incorporate the Niagara 4 Framework®.

.2 The B-BC shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "*", it shall be understood to mean that parameter is open to all possible values. Note that this will result in the following entries in the license.dat file:

Specific Feature	license.dat file entry value
Owner	"HDSB"
Project	"HDSB"
BrandId	"*" preferred, "Distech" or "Alerton" acceptable
accept.station.in	"*"
accept.station.out	"*"
accept.wb.in	"*"
accept.wb.out	"*"
Expiration	
All expiration instances	"never"
Limit	
[1]All .limit instances	"none"
Export	
BACnet	"true"
obix	"true"
Import	
rdbSqlServer	"true"
web	
ui	"true"
ui.wb	"true"
ui.wb.admin	"true

[1] With the exception of limitations defined by hardware configuration

.3 The B-BC shall function in a real-time, multi-tasking networked operating environment. It must complete all necessary site computations based on information from any object in the internetwork and locally execute global strategies and supervisory control for all field devices supplied under this specification, without additional hardware or software and independent of or under a B-AWS. It shall be capable of executing application control programs to provide the following:
.1 Calendar Functions
.2 Scheduling
.3 Trending and Data Management
.4 Alarm Monitoring and Routing
.5 Real-Time Clock and Network Time Synchronization
.6 Network and User Management functions for all devices on the LAN

.4 The B-BC shall be equal to a JACE 8000 and be supplied with the following hardware features as a minimum:
.1 two (2) Ethernet ports
.2 two (2) RS-485 BACnet MS/TP port
.3 one (1) USB port
.4 Wi-Fi connectivity
.5 expansion capability
.6 a battery backup and/or non-volatile memory. If battery backup or non-volatile memory is not available an Uninterruptable Power Supply must be provided to maintain program file and data base for a minimum 24 hours.

.5 The B-BC shall contain sufficient memory to support its own operating system, User Interface, all specified control strategies and objects, energy management applications, data storage and trending, alarm annunciation, and network management.

.6 The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

.7 The B-BC must enable access to the complete BAS system installed under this section, via web-browser. Access includes but is not limited to comprehensive programming capabilities for all controllers and real-time operational values via an embedded web-browser Graphical User Interface (GUI). The GUI shall support the latest version of standard web-browsers, without the requirement of additional plugins or software, and must be configured in accordance with these specifications.

.8 The B-BC shall provide alarm management to monitor, buffer, and direct alarms and messages to operator devices and memory files, to be assigned in accordance with these specifications. Each B-BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.

.9 The B-BC shall have the ability to collect and archive any data, for any property of any object on the LAN, in accordance with these specifications. The embedded UI shall be capable of configuring the collection of data. The data shall be accessible in either the following formats, XML or CSV from the WAN Server Supervisory Software or through a standard web-browser.

.10 The B-BC shall be capable of maintaining an Audit log that tracks and archives all activities performed.

.11 The B-BC shall provide, a minimum of four (5) levels of local access privileges. The highest level, Administrator Level, shall allow the BAS administrator to perform application, database, and user management functions. Each login credentials shall be assigned to a pre-defined level of access.

.12 The B-BC shall provide WAN access privileges, including a comprehensive list of accessibility/functionality items, to be enabled or disabled for each user according to the level of access granted. Operators shall be able to perform only those commands available for the access level assigned to their login credentials. Login credentials are to be looked up using the Lightweight Directory Access (LDAP) through the BAS server.

2.04 ADVANCED APPLICATION CONTROLLERS (B-AAC)

.1 B-AAC's shall be BTL Certified.

.2 B-AAC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.

.3 Each B-AAC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

.4 The B-AAC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.

.5 Controllers that perform scheduling shall have a real-time clock.

.6 The B-AAC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.

.7 Each B-AAC shall be supplied with a minimum 3 spare Universal I/O's.

2.05 APPLICATION SPECIFIC CONTROLLERS (B-ASC)

.1 B-ASC use is limited to VAV box and will not be accepted for use in any other application.

.2 B-ASC's shall be BTL Certified.

.3 B-ASC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.

.4 Each B-ASC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

.5 The B-ASC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.

.6 Controllers that perform scheduling shall have a real-time clock.

.7 The B-ASC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.

.8 Each B-ASC shall be supplied with a minimum 3 spare Universal I/O's.

2.06 AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Each control valve must be suitable in all respects for the application, including system pressure, and must have design output and flow rates with maximum pressure drops as follows:
   .1 condenser water valves: 5 psi;
   .2 heating water valves: 2.5 psi.

.2 Unless otherwise indicated, control valves for proportional operation are to have equal percentage characteristics, and control valves for open/shut 2-position operation are to have straight line flow characteristics. All valves are to have position indicators. Valves for outdoor applications must be suitable in all respects for the application.

.3 Heating valves are to be normally open unless otherwise specified.

.4 Cooling valves are to be normally closed unless otherwise specified.

.5 Unless otherwise specified, control valves in hydronic piping systems are to conform to requirements specified in Section entitled HVAC Piping and Pumps.

.6 Unless otherwise specified, valves in steam/condensate piping are to generally conform to requirements specified in Section entitled Steam and Condensate Piping and Pumps but must be equipped with stainless steel plugs and stems, removable screwed stainless steel seat rings, and spring loaded Teflon V-ring packing.

.7 All control valve operators are to be spring return type for fail safe operation, sized to tightly shut the control valves against differentials imposed by system, equipped with position indicators, and suitable in all respects for environment in which they are located.

.8 Electric valve operators are to be equal to Belimo "EF Series" enclosed reversible gear type operators that can accept modulating control signals as required. Each is to be 1-phase AC, 120 or 24 volt as required or indicated, overload protected, and complete with an enclosure to suit the mounting location.

2.07 CONTROL DAMPERS AND OPERATORS

.1 T. A. Morrison & Co. Inc. "TAMCO" 100 mm (4') deep, flanged, AMCA low leakage certified aluminium dampers. Dampers for modulating and mixing applications are to be parallel blade type. Dampers for open-shut service are to be opposed blade type. Maximum blade length is to be 1 m (4'). Dampers greater than 2 sections wide are to be complete with a jackshaft. Each damper is to be complete with:

.1 extruded 6063T5 aluminum frame and airfoil blades, each with an integral slot to receive a gasket;

.2 extruded TPE frame gaskets and extruded EPDM blade gaskets;

.3 slip-proof aluminium and corrosion resistant plated steel linkage of a metal thickness to prevent warping or bending during damper operation, concealed in frame, equipped with seal-sealing and self-lubricating bearings consisting of a Celcon inner bearing fixed on hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in frame.

.2 For standard damper(s), Series 1000 as above.

.3 For insulated damper(s), Series 9000 as above but with all 4 sides of frame insulated with polystyrene, and blades thermally broken and insulated with expanded polyurethane foam.

.4 For stainless steel dampers, as above but constructed of type 316 stainless steel and equipped with Teflon blade bearings.

.5 Each damper motor is to be shaft mounted, spring return, fail safe in the normally open or normally closed position, sized to control damper against maximum pressure or dynamic closing pressure, whichever is greater, to suit sizes of dampers involved, and to provide sufficient force to maintain damper rated leakage characteristics. Each operator is to be complete with a damper position indicator, and external adjustable stops to limit length of stroke in either direction, and is to be mounted on a corrosion resistant adjustable bracket. Operating arms are to have double yoke linkages and double set screws for fastening to damper shaft. Operators for dampers to be connected to building fire alarm system or to freeze protection devices are to be equipped with additional relays to permit dampers to respond and go to required position in less than 15 seconds upon receipt of a signal. Operator enclosures are to be suitable in all respects for environment in which they are located.

.6 Electric damper operators are to be equal to Belimo EF Series 24 volt or 120 volt AC spring return, direct coupled electric motor operators for either modulating or 2-position control as required. Each operator is to be overload protected and complete with an enclosure to suit the mounting location.

2.08 CONTROL SYSTEM COMPONENTS

.1 Components specified below are required for control of equipment and systems in accordance with drawing control diagrams and sequences of operation. Not all required components may be specified.

.2 Sensor/transmitter input devices must be suitable in all respects for the application and mounting location. Devices are as follows:

.1 unless otherwise specified, temperature sensors are to be resistance type, either 2-wire 1000 ohm nickel RTD or 2-wire 1000 ohm platinum RTD with accuracy (includes errors associated with sensor, lead wire, and A to D conversion), equipped with type 316 stainless steel thermowells for pipe mounting applications;

.2 room sensors, associated with each “Room Controller” detailed in Section 25 09 93, are to be communicating type complete with integral override button, configurable set-point / offset adjustment and without a display. Only the following room sensors, associated with occupant comfort, are approved for use:

DisTech Controls - Allure EC-Smart-Comfort-SO
Alerton - Microtouch Wall Sensor

.3 outside air sensors designed and constructed for ambient temperatures and to withstand environmental conditions to which they are exposed, complete with a NEMA 3R enclosure, solar shield, and a perforated plate surrounding sensor element where exposed to wind velocity pressure;

.4 insertion duct mounting sensors type with lock nut and mounting plate, designed to mount in an electrical box (weather-proof with gasket and cover where outside) through a hole in duct;

.5 for ducts greater than 1.2 m (4') or for ducts where air temperature stratification occurs, averaging type sensors with multiple sensing points, and for plenums for applications such as mixed air temperature measurement to account for air turbulence and/or stratification, an averaging string of sensors with capillary supports on the sides of duct/plenum;

.6 factory solid-state relative humidity sensors with an element that resists contamination, weather-proof with a NEMA 3R enclosure for outside air applications, supplied with a type 304 stainless steel probe with mounting bracket and hardware for duct mounting, each complete with a factory calibrated humidity transmitter which is accurate (including lead loss and analog to digital conversion) to 3% between 20% to 80% RH at 25°C (77°F) and equipped with non-interactive span and zero adjustments, and a 2-wire isolated loop powered, 4-20 mA, 0 to 100% linear proportional output;

.7 carbon dioxide sensors for air quality control purposes having a maximum 20 second response time, suitable for operating conditions from 0°C to 50°C (32°F to 122°F) and 0 to 100% RH non-condensing, complete with a calibration kit (to be handed to Owner) and characteristics as follows:

.1 measurement range: 0 to 2000 ppm;
.2 accuracy: per article 1.9 of this section;
.3 repeatability: ±20 ppm;
.4 drift: ±100 ppm per year;
.5 output signal: 0 to 10 VDC proportional over the 0 to 2000 ppm range.

.8 Pressure transmitters are to be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input. Pressure transmitters are to transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal. Differential pressure transmitters used for flow measurement are to be sized to the flow sensing device and supplied with a tee fitting and shut-off valves in the high and low sensing pick-up lines to allow permanent ease of use connection for balancing, etc. Transmitter housing is to suit mounting location. Standalone pressure transmitters are to be mounted in a minimum NEMA 1 (NEMA 2 in sprinklered area) by-pass valve assembly panel with high and low connections piped and valved, air bleed units, by-pass valves, and compression fittings. Transmitters are to be as follows:

.1 low differential water pressure, 0 to 5 kPa (0 to 20" wc): equal to Setra or Mamac industrial quality transmitter capable of transmitting a linear 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as per article 1.9 of this section.

.2 medium to high differential water pressure, over 5 kPa (20" wc): equal to Setra or Mamac transmitters as specified above for low pressure transmitters but with a pressure range of from 2.5 kPa (10" wc) to 2070 kPa (300 psi), a reference accuracy of ±1% of full span (includes non-linearity, hysteresis, and repeatability);

.3 building differential air pressure: equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as per article 1.9 of this section.

.4 low differential air pressure, 0 to 1.25 kPa (0" to 5" wc): equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as per article 1.9 of this section.

.5 medium differential air pressure, over 1.5 kPa (5" wc): equal to Setra or Johnson Controls Inc. transmitters as specified above for low pressure air transmitters but performance requirements as follows:

.1 zero and span: (c/o F.S./Deg. F); .04% including linearity, hysteresis, and repeatability;
.2 accuracy: 1% F.S. (best straight line); static pressure effect: 0.5% F. S.;
.3 thermal effects: <+0.33 F.S./°F over 40°F to 100°F (calibrated at 70°F).

.9 Air and water flow monitoring stations and probes are to be Air Monitor Corp., Tek-Air Systems Inc., Ebtron, or Dietrich Standard products as follows:

.1 Fan Inlet Air Flow Measuring Station: At fan inlet and near exit of inlet sound trap, air flow traverse probes are to continuously monitor fan air volume and system velocity pressure, and traverse probes are to be as follows:

.1 each probe is to be of a dual manifold, cylindrical, anodized type 3003 extruded aluminium construction probe with sensors located along the stagnation plane of approaching air flow, and the static pressure manifold is to incorporate dual offset static tops on opposing sides of averaging manifold so as to be insensitive to flow angle variations for as much as ±20° in approaching air stream;

.2 each probe is not to introduce a measurable pressure drop, nor is sound level within duct to be amplified by its singular or multiple presence in air stream, and each probe is to contain multiple static and total pressure sensors places at equal distances along its length in accordance with ASHRAE Standards for duct traversing.

.2 Single Probe Air Flow Measuring Sensor: Duct mounting hot wire anemometer type which utilizes 2 temperature sensors, one is a heater element temperature sensor and the other is to measure downstream temperature, with temperature differential related directly to air flow velocity. Sensor insertion length is to be adjustable up to 200 mm (8"), and transmitter is to produce a 4 to 20 mA or 0 to 10 VDC signal linear to air velocity.

.3 Duct Flow Measuring Stations: #14 gauge galvanized steel casing with duct connection flanges of a size to mate with connecting ductwork, and complete with an air directionalizer and a 98% free area parallel cell 20 mm (¾") honeycomb profile suppressor across entering air stream to equalize velocity profile and eliminate turbulent and rotational flow from the air stream prior to measuring point, mechanically fastened to casing so as to withstand velocities of up to 1828 m (6000') per minute. Additional requirements as follows:

.1 total pressure measurement side (high side) is to be designed and spaced to requirements of Industrial Ventilation Manual, 16th Edition, page 9-5, and self-averaging manifolding is to be constructed of brass and copper components;

.2 static pressure sensing probes (low side) is to be bullet-nose shaped, per detailed radius, as illustrated in Industrial Ventilation Manual referred to above, page 9-5;

.3 main take-off point from both total pressure and static pressure manifolds is to be symmetrical, and manifolds are to terminate with external ports for connection to control tubing;

.4 each station is to be equipped with a label on casing indicating unit model number, size, area, and specified air flow capacity;

.5 each station is to have a self-generated sound rating of less than NC 40, and sound level within duct is not to be amplified nor is additional sound to be generated.

.6 Static Pressure Traverse Probe: Duct mounting, complete with multiple static pressure sensors located along exterior surface of cylindrical probe.

.7 Shielded Static Air Probe: Indoor type or outdoor type as required, each with multiple sensing ports, an impulse suppression chamber, and air flow shielding.

.8 Water Flow Monitoring: Equal to Onicon microprocessor-based electromagnetic water flow meters with an accuracy of 0.25%.

.10 Power (amps) monitoring is to be performed by a combination of a current transformer and a current transducer with transformer sized to reduce full amperage of monitored circuit to a maximum 5 ampere signal which will be converted to a 4 to 20 mA DDC compatible circuit for use by building automation system. Current transformer and current transducer are as follows:

.1 equal to Veris Industries split core current transformer with an operating frequency of from 50 to 400 Hz, 0.6 Kv class, 10 Kv BIL insulation, and 5 ampere secondary;

.2 equal to Veris Industries current to voltage or current to mA transducer with an accuracy of ±5%, a minimum load resistance of 30 kOhm, an input of 0 to 20 amperes and an output of 4 to 20 mA, and a 24 VDC regulated power supply.

.11 Duct mounting smoke detectors supplied as part of electrical work for mounting as part of control system work.

.12 Double contact switches to monitor equipment status and safety conditions, and generate alarms when a failure or abnormal condition occurs. Status and safety switches are to be as follows:

.1 current sensing switches: equal to Veris Industries self-powered dry contact output switches for sensing run status of motor loads, each calibrated to indicate a positive run status only when motor is operating under load, and each consisting of a current transformer, a solid-state current sensing circuit, adjustable trip point, solid-state switch, SPDT relay, and a LED to indicate on or off status;

.2 air filter status switches: equal to Johnson Controls Inc. or Cleveland Controls automatic reset type differential pressure switches, each complete with SPDT contacts rated for 2 amperes at 120 VAC, a scale range and differential pressure adjustment appropriate for the service, and an installation kit which includes static pressure taps, tubing, fittings, and air filters;

.3 air flow switches: equal to Johnson Controls Inc. or Cleveland Controls pressure flow switches, bellows actuated mercury switch or snap-acting micro-switch type with an appropriate scale range and pressure adjustment;

.4 air pressure safety switches: equal to Johnson Controls Inc. or Cleveland Controls manual reset switches, each complete with SPDT contacts rated for 2 amperes at 120 VAC and an appropriate scale range and pressure adjustment;

.5 water flow switches: equal to Johnson Controls Inc. Model P74;

.6 low temperature limit switches: manual reset type equal to Johnson Controls Inc. Model A70, each complete with DPST snap acting contacts rated for 16 amperes at 120 VAC, a minimum 4.5 m (15') sensing element for mounting horizontally across duct/plenum with sensing reaction from coldest 450 mm (18") section of element, and where sensing element does not provide full coverage of air stream, additional switches are to be supplied as required.

.13 Control relays as follows:

.1 control pilot relays: equal to Johnson Controls Inc. or Lectro modular plug-in design with snap-mount mounting bases, retaining springs or clips, DPDT, 3 PDT or 4 PDT as required for the application, with contacts rated for 10 amperes at 120 VAC;

.2 lighting control relays: latching type with integral status contacts rated for 20 amperes at 120 VAC, each complete with a split low voltage coil that moves the voltage contact armature to On or Off latched position, each controlled by a pulsed tri-state output (preferred) or pulsed paired binary outputs, and each designed so power outages will not result in a change-of-state and so multiple same state commands will simply maintain commanded state.

.14 Electronic signal isolation transducers equal to Advanced Control Technologies for installation whenever an anolog output signal from building automation system is to be connected to an external control system as an input (i.e. equipment control panel), or is to receive as an input signal from a remote system, and to provide ground plane isolation between systems.

.15 Each manual override station is to be complete with contacts rated minimum 1 ampere at 24 VAC and is to provide following:

.1 integral H-O-A switch to override controlled device pilot relay;

.2 status input to building automation system to indicate whenever switch is not in the Auto position;

.3 status LED to illuminate whenever output is On;

.4 override LED to illuminate whenever H-O-A switch is in either the Hand or Off position.

.16 Electronic transducers equal to Johnson Controls Inc. transducers with an output of from 3 to 15 psig, an input of from 4 to 20 mA or 10 VDC, manual output adjustment, a pressure gauge, and an external replaceable supply air filter.

.17 Thermostats:

.1 Wall mounting adjustable set-point thermostats, each suitable in all respects for equipment (and operating sequence) they are provided for, equipped with a thermometer, a cover and any required mounting and connection accessories.

.2 Line voltage thermostats are to be 115 volt.

.3 Low voltage thermostats are to be 24 volt electronic type.

.4 Set-point adjustment for thermostats in public spaces is to be concealed behind cover. Set-point adjustment for other thermostats is to be accessible through cover.

.5 Covers are to be removable, tamper-proof covers with temperature set-point and thermometer displays.

.6 Guards for thermostats are to be clear, ventilated polycarbonate covers with allen key locking hardware.

.18 Humidistats:

.1 Direct or reverse acting (to suit system), proportional type, adjustable humidity controllers, each corrosion resistant, suitable in all respects for the application and complete with a nylon element, replaceable cartridge type air filter, internally adjustable limit stops for maximum and minimum settings, a cover, and required mounting and connection accessories.

.2 Electric humidistats are to be line voltage (115 volt), or 24 volt electronic type.

.3 Wall mounting humidistats are to be complete with a tamper-proof display type cover.

.4 Duct mounting humidistats are to be complete with a display type cover, duct sampling chamber with 300 mm (12") long extruded pick-up tube for duct mounting, a moulded mounting base, and a ventilated cover.

.5 Hardware to permit building automation system control and monitoring of input/output points in accordance with Section entitled Building Automation System, points schedule, and drawing control diagrams and operation sequences. All such hardware is to be suitable in all respects for interface with the building automation system.

2.09 SYSTEM WIRING MATERIALS

.1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in appropriate Section(s) of Electrical Work specification.

3. EXECUTION

3.01 INSTALLATION

.1 The BAS contractor is responsible to verify that equipment can be installed in accordance with the manufacturer's instructions and as detailed within these specifications, as such the contractor shall inspect the site and report any discrepancies, conflicts or omissions to the Owner or it's representative, for resolution prior to the commencement of work.

.2 Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

3.02 OBJECT AND POINT NAMING

.1 Where the first four segments of the object / point name are configured by virtue of the Niagara Network Device Addressing, only the 5th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.

.2 All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh and eighth characters = Device number

.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

.5 Last segment = Point name abbreviation
Example: S1156_2_15_HP10_RmTemp (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10 = heat-pump 10, RmTemp = Room Temperature)

.3 Object name segment shall be delimited by (_) character, however must be consistent by Vendor across all Board sites

.4 Where a BACnet object or point name is not explicitly detailed in Schedule A of these Specifications, the Owner shall supply the required information including, but not limited to, device name, instance number, point name, units, meta tag, etc.,

3.03 CONTROLLER AND DEVICE ADDRESSING

.1 Where the first four segments of the Controller and Device Addressing are configured by virtue of the Niagara Network Device Addressing, only the 4th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.

.2 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

Device Instance
.1 First five characters = School's unique identifier
.2 Sixth character = Network number
.3 Seventh and Eighth character = Device number
.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier
Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10)

BACnet Network Number
.1 First five characters = School's unique identifier
.2 Sixth character = Network number
.3 Seventh = Network and Type
Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

MAC Addresses

0. B-BC

1. Maintenance Connection

2. Reserved

3. – 127. Master Range

128. – 254. Slave Range

255. Broadcast

.3 Object name segment shall be delimited by (_) character, however must be consistent by Vendor across all Board sites

3.04 CONTROLLER / DEVICE NAMING

.1 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

Device Instance
.1 First five characters = School's unique identifier
.2 Sixth character = Network number
.3 Seventh and Eighth character = Device number
.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier
Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10)

BACnet Network Number
.1 First five characters = School's unique identifier
.2 Sixth character = Network number
.3 Seventh = Network and Type
Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

MAC Addresses

4. B-BC

5. Maintenance Connection

6. Reserved

7. – 127. Master Range

129. – 254. Slave Range

256. Broadcast

.2 Object name segment shall be delimited by (_) character, however must be consistent by Vendor across all Board sites

3.05 SCHOOL'S UNIQUE IDENTIFIER

.1 The School's Unique Identifier will be provided by Owner and must be used in the first segment, for all device, network, object, and point names.

3.06 CONTROLLER / EQUIPMENT IDENTIFIER

.1 The Controller / Equipment Identifiers are restricted to dedicated B-AAC and B-ASC controllers. Identifiers are limited those listed below. Where an identifier is not listed below the Owner shall supply the required information.
.1 AC# = Air Conditioning Unit
.2 AHU# = Air Handling Unit
.3 Blr# = Boiler
.4 BPB# = By-Pass Box (constant volume)
.5 Chiller# = Chiller
.6 CU# = Condensing Unit
.7 HVAC# = HVAC Unit
.8 HVAC#VAV# = HVAC Unit (associated with) Variable Air Volume Box
.9 HP# = Heat pump
.10 HWLoop# = Heating Water Loop
.11 HpLoop# = Heat-pump Loop
.12 HX# = Heat Exchanger
.13 MAU# = Make-up Air Unit
.14 Tower# = Cooling Tower
.15 UV# = Unit Ventilator
.16 VRF# = Variable Refrigerant Flow Condensing Unit
.17 VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit
.18 VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit

.2 Where a dedicated B-AAC or B-ASC is not configured specific to a system or unit, controller identifier is to be approved by Owner.

3.07 POINT NAME ABBREVIATION

.1 The Object / Point Name convention must be followed for the objects / points as listed in Schedule A of this Section, note abbreviations are case sensitive.

.2 Where an identifier is not listed below the Owner shall supply the required information.

3.08 PROGRAMMING

.1 Sequences of Operation are to be programmed in accordance with Section 25 09 93

.2 Programs for like equipment i.e, heat-pump, unit heater, etc. shall be consistent by controls vendor across the facility and all Board sites.

3.09 HISTORY AND TRENDING

.1 A minimum of 7 days history shall be maintained within the B-BC for the points identified in Schedule A of this Section.

.2 Data stored in the B-BC shall be uploaded to the B-AWS..

.3 Default Graphical trends, Navigation button per 3.9, shall be pre-configured.

3.10 SCHEDULING

.1 Scheduling feature shall include seven-day schedule, plus holiday or event schedule, each with start time and stop time. Schedules shall be individually editable for each day and holiday.

.2 The scheduling feature shall allow for each individual equipment to be assigned to one of the Schedule Groups which includes, but is not limited to:
- .1 Administration
- .2 Gymnasium
- .3 First Floor Classrooms
- .4 Second Floor Classrooms
- .5 Kindergarten
- .6 Library
- .7 Daycare
- .8 Theatre
- .9 Cafeteria
- .10 Refuge

.3 The Areas, associated schedule, and equipment grouping will be provided by Owner.

.4 Timed override feature shall allow a temporary change of the scheduled equipment. An override command shall be selectable by an individual unit, all units assigned to a given schedule group, or to all units in a building. Timed override shall terminate at the end of the event. Timed override feature shall be allowed by a password level.

3.11 DEMAND LIMITING

.1 Programming or schedules shall incorporate a delay such that there is a delay between the start-up of each Schedule Group.

.2 Equipment within the Schedule Group shall incorporate a delay such that there is a delay between the start-up of individual equipment within the Schedule Group.

3.12 ALARMS

.1 Logical and consistent alarm strategy must be used as defined within these specifications. The alarm strategy detailed herein applies to those objects identified in Schedule A of this section. It is expected that additional alarms be added when applicable, Owner to determine class.

.2 Alarms, not classified as Emergency or Communication / Network, shall have the following values adjustable: threshold, limit and time delay.

.3 Alarm actions, defined by Alarm Class, shall be annunciated as follows:
- .1 Emergency (E): email, header button red, graphic with flashing alarm object, Alarm Portal B-BC record
- .2 High Priority (H): graphic with flashing alarm object, header button red, Alarm Portal B-BC record
- .3 General (G): Alarm Portal B-BC Record

.4 The complete object / point name shall be included in every alarm message, refer to “Object and Point Naming” within this specification section.

.5 The minimum shall be recorded by the B-BC for each alarm:
.1 Time and Date
.2 Complete object / point name
.3 Acknowledge time, date, and user who issued acknowledgement

3.13 USER ACCESS

.1 Set up the following 5 password levels to include the specified capabilities.

.1 Level 1: (The Board’s BAS Administrator)

.1 Level 2 capabilities.
.2 All administrative rights
.3 View, add, change and delete user names, passwords, password levels.
.4 All unrestricted system capabilities including all network management functions.

.2 Level 2: (TBD)

.1 Level 3 capabilities.
.2 Configure system software.
.3 Modify control unit programs.
.4 Modify graphic software.
.5 Unrestricted except for viewing or modifying user names, passwords, password levels.

.3 Level 3: (Approved Facilities Staff and Board’s HVAC Maintenance Technicians)

.1 Level 4 capabilities.
.2 Temporary override of designated objects and/or points.
.3 Temporary set-point value change.
.4 Change selected equipment schedules.

.4 Level 4: (Approved Facilities Staff)

.1 Level 5 capabilities.
.2 Acknowledge alarms.
.3 Change selected equipment schedules.

.5 Level 5: (Read Only)

.1 Display all graphic data.
.2 Trend point data.

.2 Level 1 and 5 will be accounts which reside locally within the B-BC.

.3 Level 2 through 4 will be will use LDAP for login credential authentication.

3.14 GRAPHICAL USER INTERFACE

.1 Provide a colour graphic home screen, floor plans, system flow diagrams for each system and summary screens, designed and sized for iPAD, with all points indicated on the points list in Schedule A of this Section, and in accordance with these specifications.

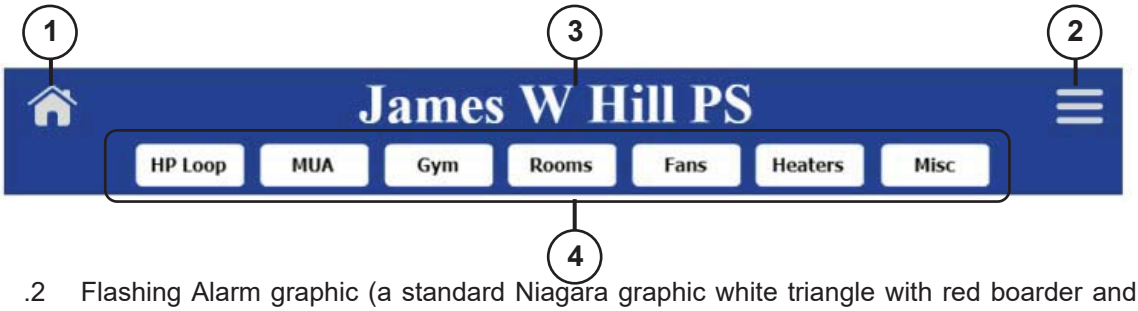
.2 All graphics shall be rendered as N4 HTML 5 views. Any graphic page that depends on JAVAbased animated widgets, or in any way depends on any browser-side-applet shall not be acceptable.

.3 The Graphical User Interface shall not use Red as graphical representation for any of the following: stop, alarm, or fault. Red is used explicitly for graphical representation of heat command and/or enable, with the only exception in text format in charts, the word “fault” can be coloured red.

.4 Graphics not explicitly detailed within this section shall be reviewed and approved by Owner.

.5 Common for all Graphics:

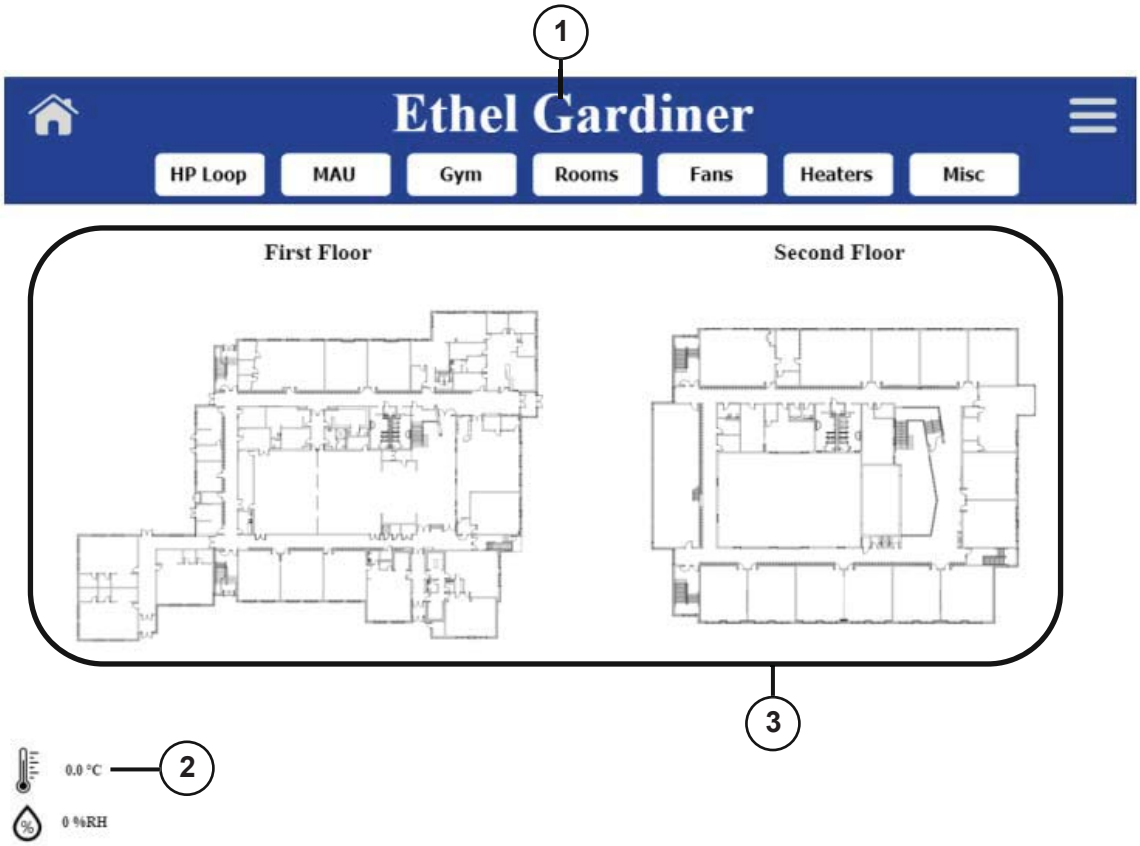
.1 The Header is one PX file for the entire project. All links, labels, etc. shall be edited from only one instance of the Header. The following aspects of the Header should appear exactly the same across all Board Facilities: Dimensions, Font Size, Colour(s), Equipment Navigation Buttons’ Size, Font, and Colour(s). The following shall be exactly the same 1 - Home Button, 2 - Three Line Menu Navicon. The following aspects are dynamic: 3 - Page title, and 4 - Equipment Navigation Buttons (function and name).



.2 Flashing Alarm graphic (a standard Niagara graphic white triangle with red boarder and black exclamation mark) shall be consistent for all alarm annunciations, across all Board facilities, regardless of vendor.

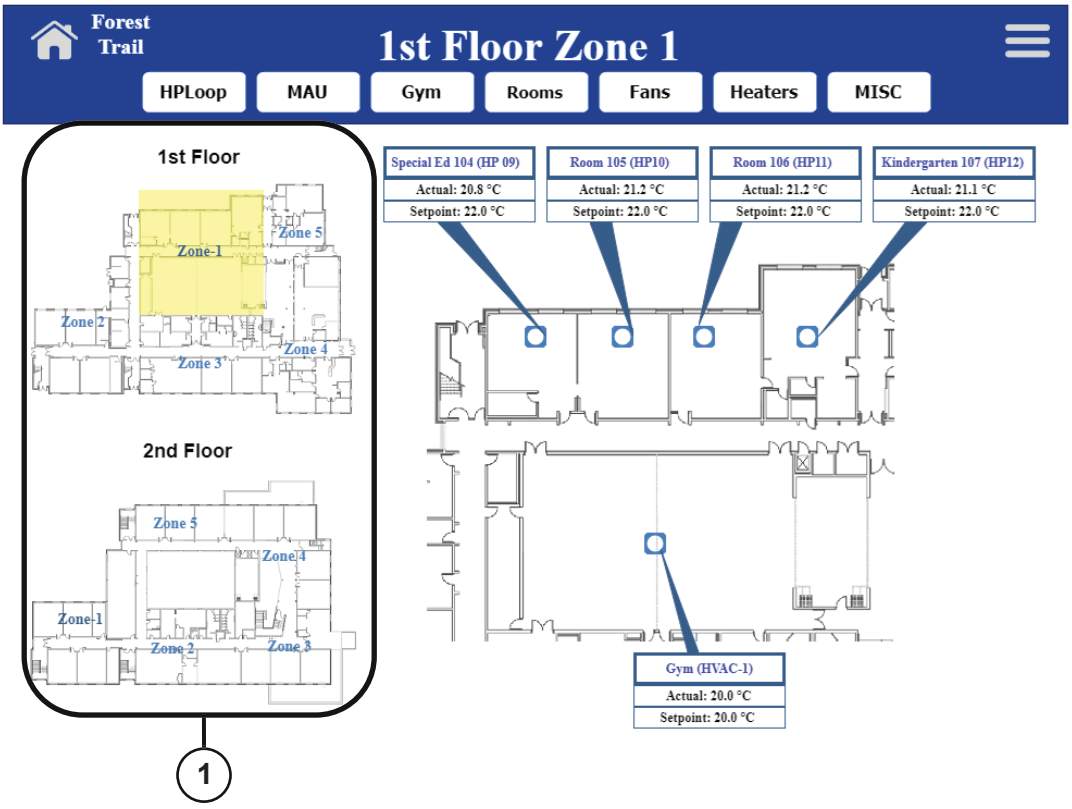
.3 Page Title shall be representative of the Navigation name used to link to the page and is to include information identifying area or equipment.

.6 Home Page
The Home Page shall be comprised of the following: 1 – School / Facility name as page title, 2 - Outdoor Air Temperature, 3 - Complete Facility Floor Map (individual floors labelled accordingly).



.7 Zone

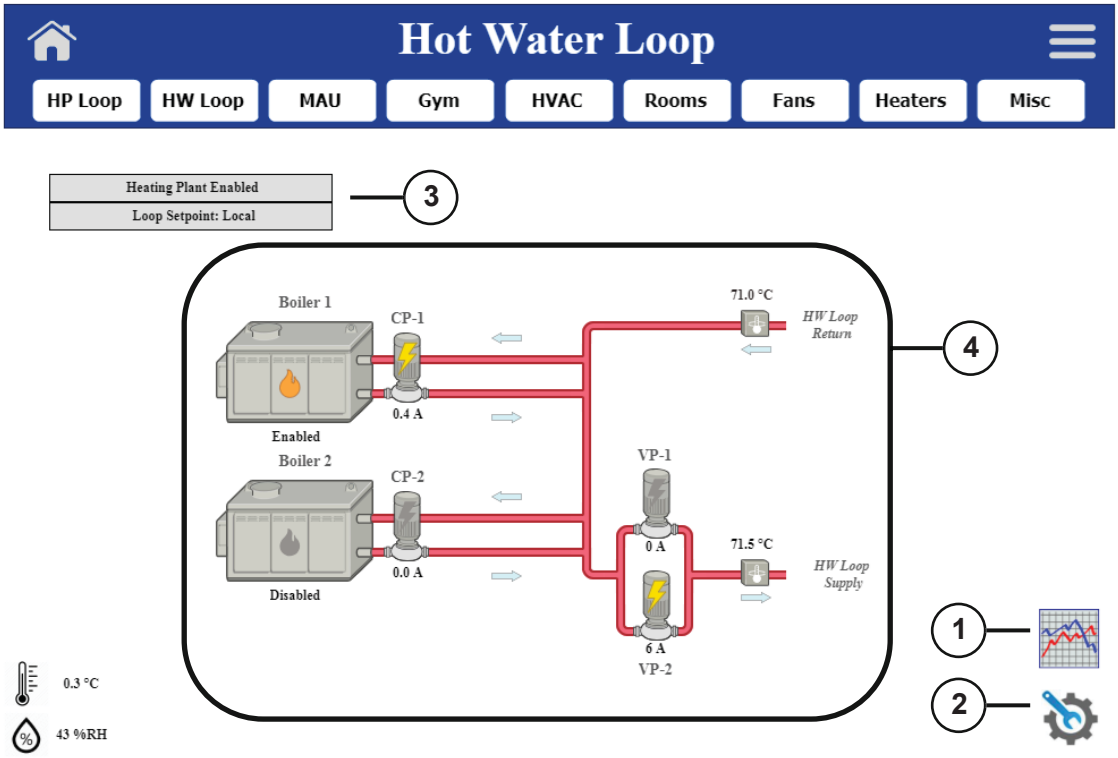
The Zone Page(s) which are scaled portions of the floor plan shall be comprised of 1 – Keyplan indicating respective zone, individual space temperatures and set-points, navigation button to respective equipment.



.8 HWLoop Page

Only include HWLoop Navigation button on Header where Heating Water Loop is present at facility.

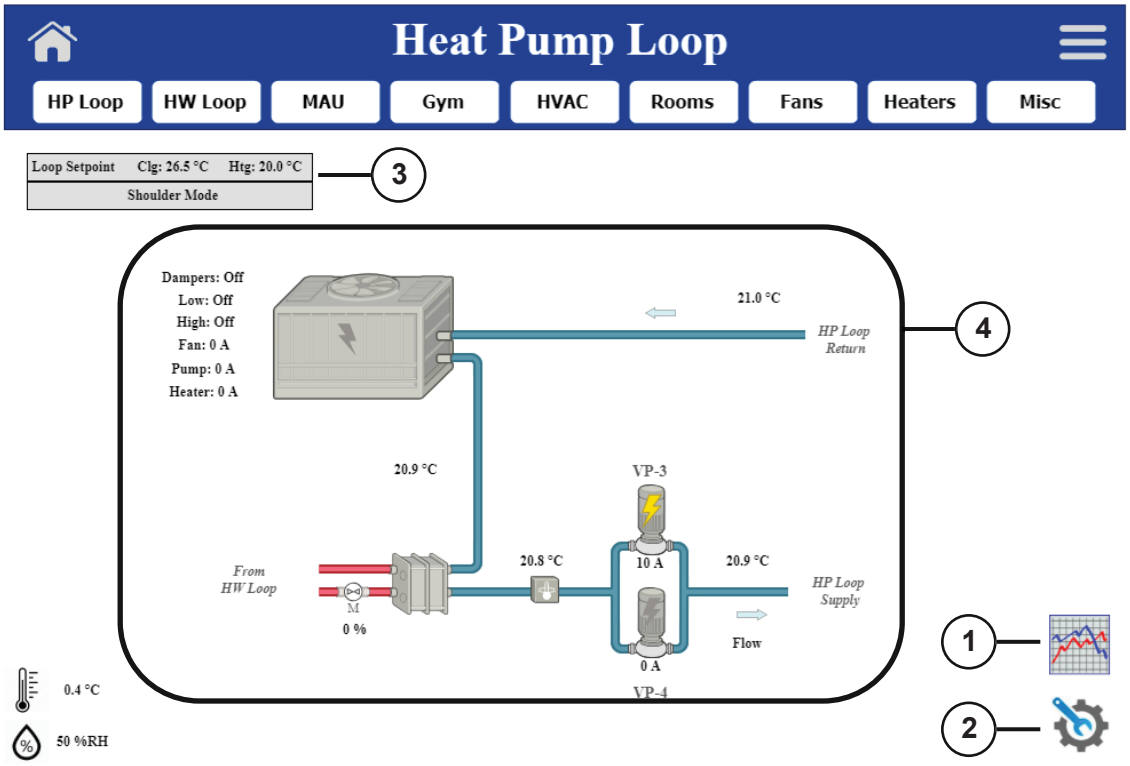
The HWLoop (Heating Water Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), boiler(s) supply water temperature (°C), and loop set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the loop water temperature set-point, and 4 – graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command (red = on, white or no colour = idle). The following status values shall be presented: pump(s) status (amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), zone supply water temperature (°C), zone return water temperature (°C).



.9 HPLoop Page

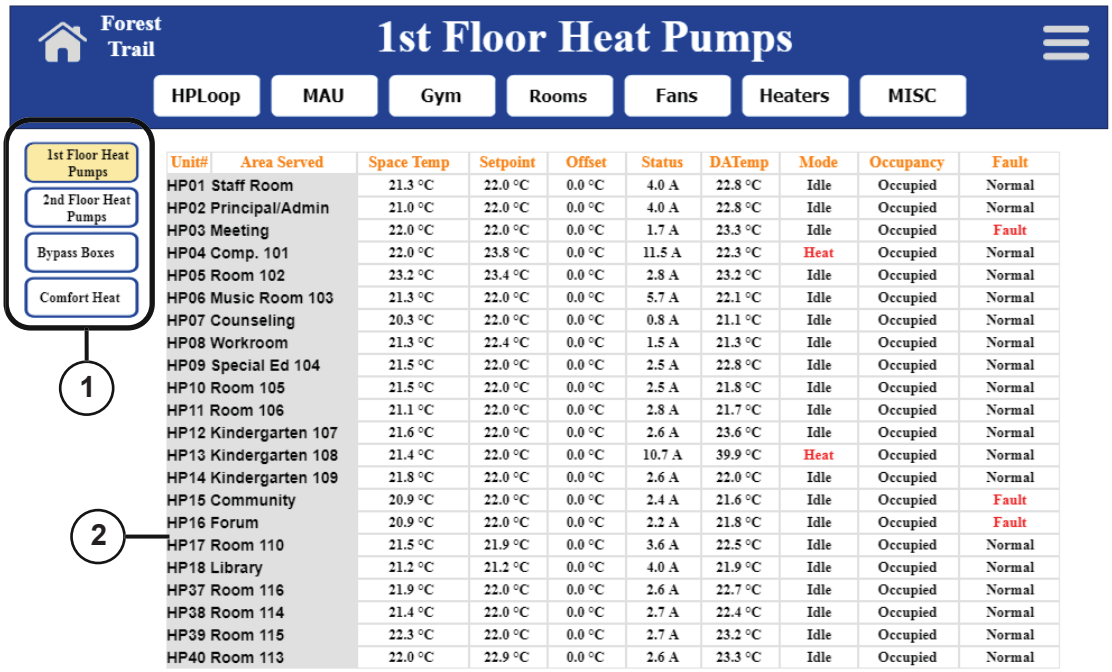
Only include HPLoop Navigation button on Header where Heat-pump Loop is present at facility.

The HpLoop (Heat-pump Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), and set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the mode, and return water temperature set-point (°C), and 4 – graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command for dedicated Heat-pump loop boilers only (red = on, white or no colour = idle), damper(s) position. The following status values shall be presented: fan status (Amperage), cooling tower pan heater status (Amperage), pump(s) status (Amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), cooling tower damper(s) status (open or closed), cooling tower low speed fan command, cooling tower high speed fan command, cooling tower percentage speed command where VFD installed.



.10 Rooms Page

The Rooms page shall be comprised of the following: 1 - Navigation Buttons (left side of Chart) to include but not limited to: equipment by floor (example VAV Boxes 1st Floor), Comfort Heat, By-Pass Boxes, Unit Ventilators, HVAC Units. 2 – Navigation to respective equipment. Chart with live data under the following headers: Unit# (navigation to unit referenced), Area Served, Space Temp, Set-point, Offset, Status, DATemp, Mode, Occupancy, Fault.

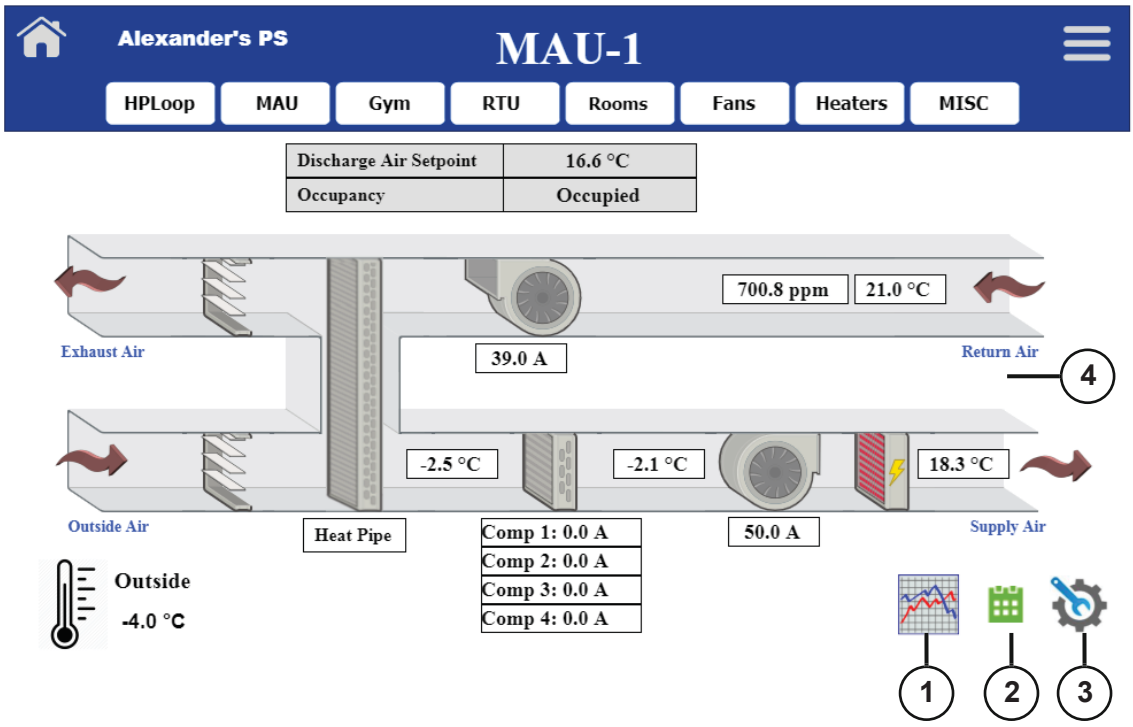


Unit#	Area Served	Space Temp	Setpoint	Offset	Status	DATemp	Mode	Occupancy	Fault
HP01	Staff Room	21.3 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP02	Principal/Admin	21.0 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP03	Meeting	22.0 °C	22.0 °C	0.0 °C	1.7 A	23.3 °C	Idle	Occupied	Fault
HP04	Comp. 101	22.0 °C	23.8 °C	0.0 °C	11.5 A	22.3 °C	Heat	Occupied	Normal
HP05	Room 102	23.2 °C	23.4 °C	0.0 °C	2.8 A	23.2 °C	Idle	Occupied	Normal
HP06	Music Room 103	21.3 °C	22.0 °C	0.0 °C	5.7 A	22.1 °C	Idle	Occupied	Normal
HP07	Counseling	20.3 °C	22.0 °C	0.0 °C	0.8 A	21.1 °C	Idle	Occupied	Normal
HP08	Workroom	21.3 °C	22.4 °C	0.0 °C	1.5 A	21.3 °C	Idle	Occupied	Normal
HP09	Special Ed 104	21.5 °C	22.0 °C	0.0 °C	2.5 A	22.8 °C	Idle	Occupied	Normal
HP10	Room 105	21.5 °C	22.0 °C	0.0 °C	2.5 A	21.8 °C	Idle	Occupied	Normal
HP11	Room 106	21.1 °C	22.0 °C	0.0 °C	2.8 A	21.7 °C	Idle	Occupied	Normal
HP12	Kindergarten 107	21.6 °C	22.0 °C	0.0 °C	2.6 A	23.6 °C	Idle	Occupied	Normal
HP13	Kindergarten 108	21.4 °C	22.0 °C	0.0 °C	10.7 A	39.9 °C	Heat	Occupied	Normal
HP14	Kindergarten 109	21.8 °C	22.0 °C	0.0 °C	2.6 A	22.0 °C	Idle	Occupied	Normal
HP15	Community	20.9 °C	22.0 °C	0.0 °C	2.4 A	21.6 °C	Idle	Occupied	Fault
HP16	Forum	20.9 °C	22.0 °C	0.0 °C	2.2 A	21.8 °C	Idle	Occupied	Fault
HP17	Room 110	21.5 °C	21.9 °C	0.0 °C	3.6 A	22.5 °C	Idle	Occupied	Normal
HP18	Library	21.2 °C	21.2 °C	0.0 °C	4.0 A	21.9 °C	Idle	Occupied	Normal
HP37	Room 116	21.9 °C	22.0 °C	0.0 °C	2.6 A	22.7 °C	Idle	Occupied	Normal
HP38	Room 114	21.4 °C	22.0 °C	0.0 °C	2.7 A	22.4 °C	Idle	Occupied	Normal
HP39	Room 115	22.3 °C	22.0 °C	0.0 °C	2.7 A	23.2 °C	Idle	Occupied	Normal
HP40	Room 113	22.0 °C	22.9 °C	0.0 °C	2.6 A	23.3 °C	Idle	Occupied	Normal

.11 MAU Page

The MAU (make-up air unit) page shall be comprised shall be comprised of: 1 - Trend navigation button (trend defaulted to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, a chart with the discharge air set-point and occupancy, and 4 – template graphic depicting the equipment. The following shall be graphically presented on the equipment: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), exhaust air temperature (°C), discharge air temperature (°C), downstream HRV/ERV air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status

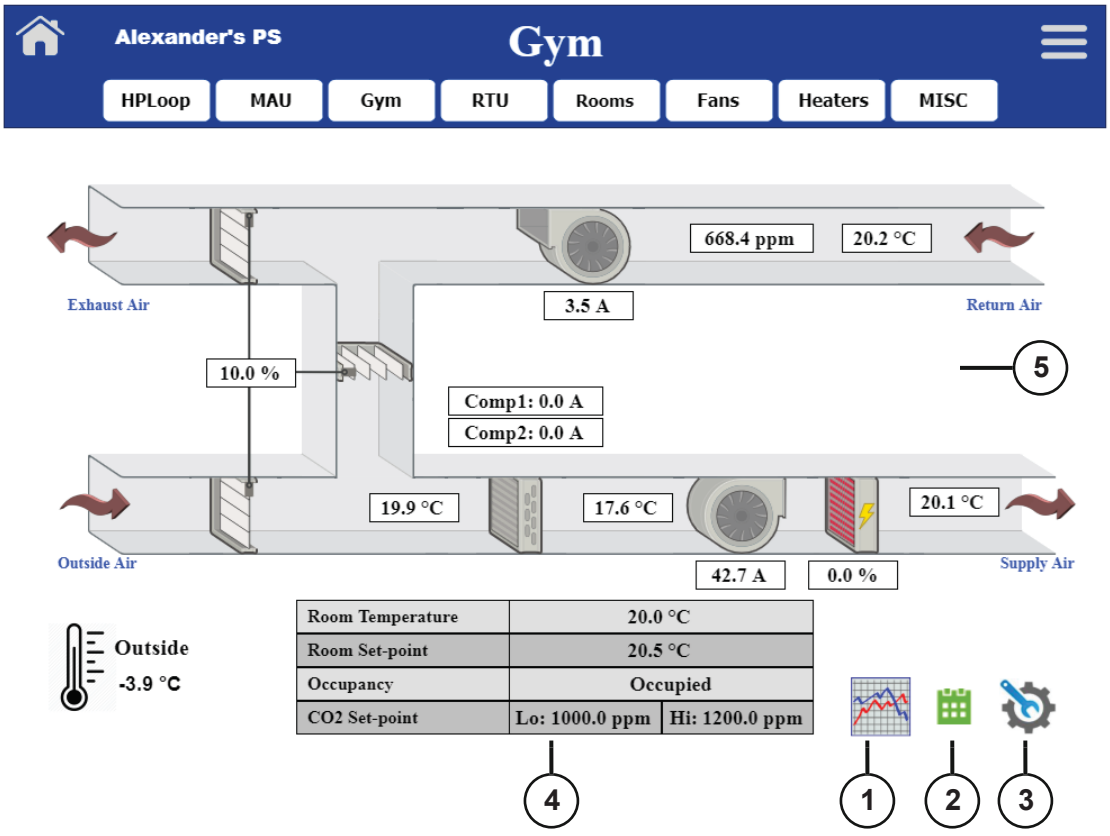
Where more than one make-up air unit exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



.12 Gym Page

The Gym page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status, Where more than one piece of equipment conditions a single gymnasium, the Room Temperature, Room Set-point and Occupancy shall be a single object and programmed as such.

Where more than one gymnasium exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.

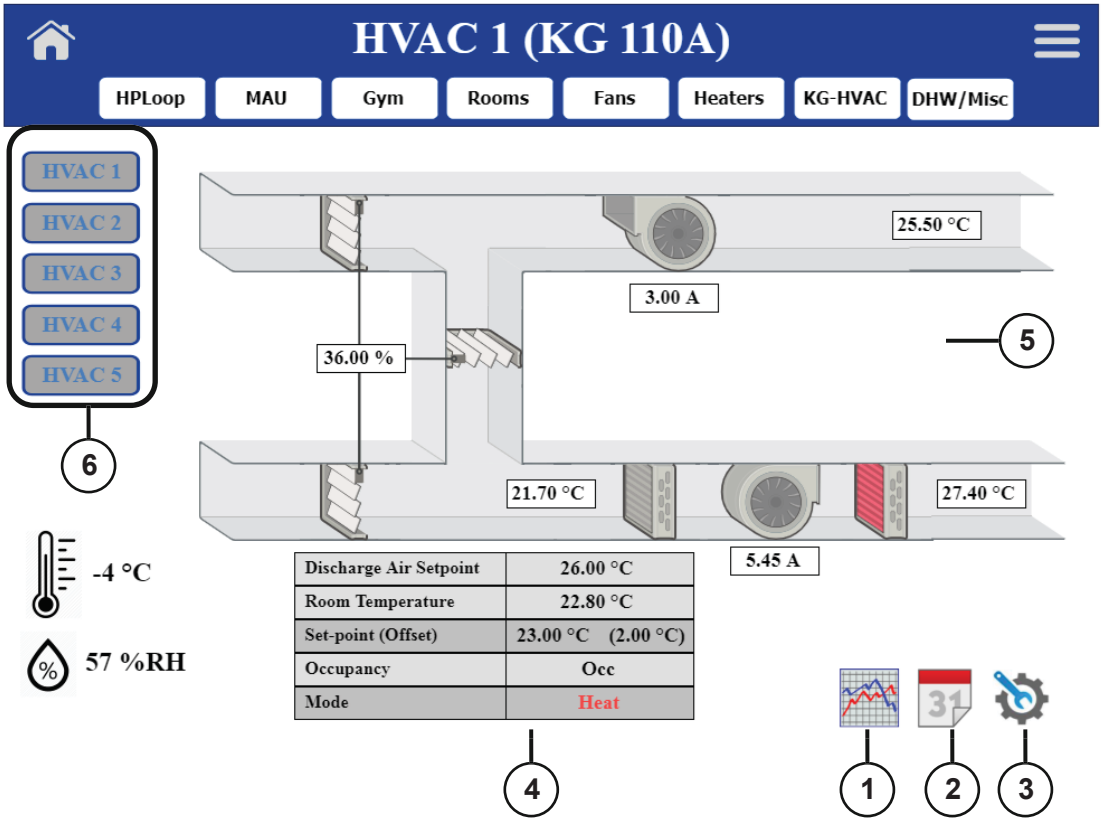


.13 HVAC Page

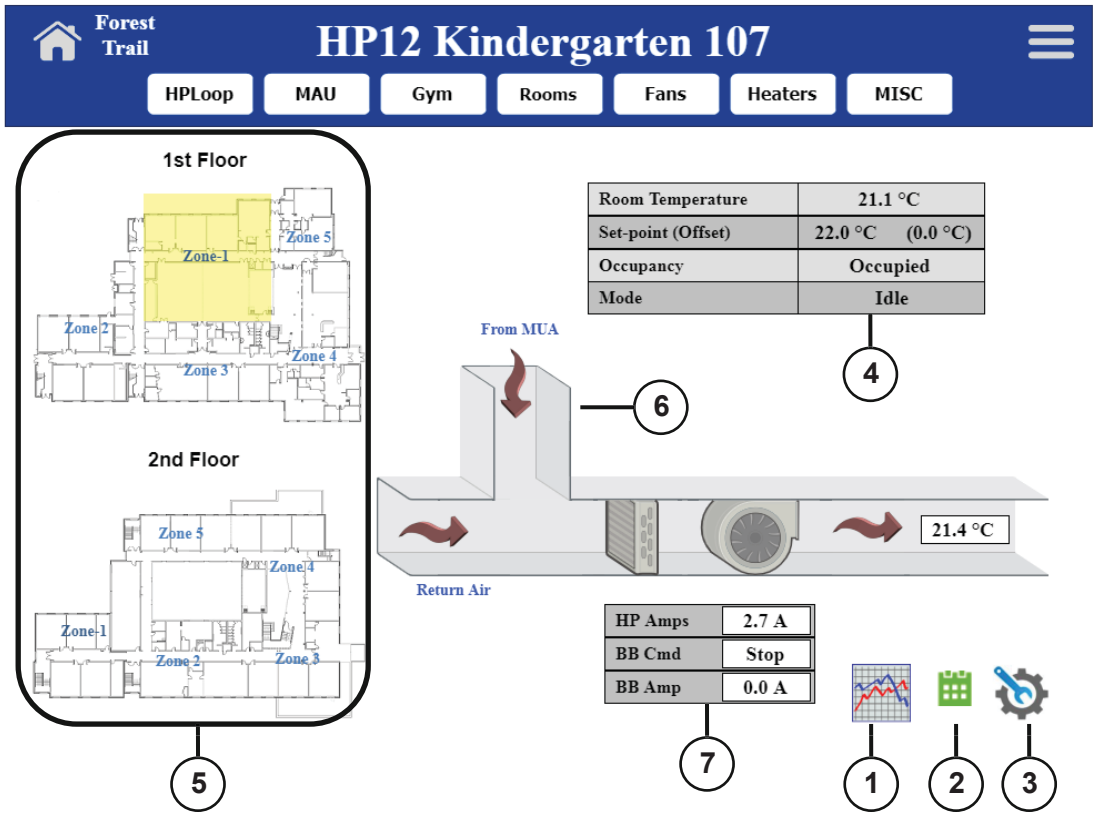
Where an HVAC Unit serves a classroom or office (which can include 1 by-pass box), an HVAC Header navigation button is not required and the unit operational information can be presented on the Rooms Page. The individual unit, navigation from chart, is to be configured per below.

Where is more than one HVAC Unit serving multiple common spaces, i.e., Library, Shop, etc., there is to be a HVAC Header navigation button used.

The HVAC page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status, Where more than one HVAC Unit exists in a facility, 6 - navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



.14 Heat-pump Page (individual equipment)
A Heat-pump page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, discharge air temperature (°C), and unit status (amperage), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, 5 – keyplan indicating zone the respective unit is located, and 6 - template Heat-pump graphic. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: 7 - unit status including auxiliary heat (amperage), return air temperature (°C), discharge air temperature (°C), auxiliary heat status (amperage).



.15 Fans and Heaters Page
The Fans and Heaters page(s) shall be comprised of a Chart with live data under the following headers: Unit Number, Area Served, RmTemp, Set-point, Command, Status, and Occupancy.

.16 Misc Page
The Misc page shall comprise operational information for: exterior lighting, domestic hot water status, trap flushing urinal flushing, grouped schedules, network comfort set-point.

3.15 LOW-VOLTAGE ELECTRICAL AND CONTROL WIRING

.1 It shall be the System Contractor's responsibility to complete and/or coordinate all wiring, less than 600 V, in accordance with 1.15, required for a complete Control System, including but not limited to:
- .1 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.
- .2 Power to all actuators and sensors.
- .3 Provide all wiring and cabling for network communications except for owner provided LAN(s)/WAN(s).
- .4 All sensor and control device input and output wiring.
- .5 All interconnecting cabling between and amongst network devices
- .6 Interlock wiring between devices, and between motor starters.
- .7 All other necessary wiring for fully complete and functional system as specified.
- .8 Install piping, wiring/cabling routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.

.2 Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with National Electric Code (NFPA 70), CSA C22.2 and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

.3 All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.

.4 The following cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.
- .1 Network / Communication
- .2 Signal (input / output control wiring)

.5 Maximum allowable voltage for control wiring shall be 120-volts.

.6 The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site. This Section includes wiring, circuit breakers and accessories rated 600 V and less.

3.16 POWER WIRING AND CABLING

.1 Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications.

.2 The B-BC panel shall be served from isolated ground receptacle via UPS by dedicated branch circuits.

.3 Power shall NOT be obtained by tapping into miscellaneous circuit that could inadvertently be switched off.

.4 Transformers and power supplies for controllers and field devices shall be supplied in accordance with manufacturers recommendations and shall be located within the designated control enclosure.

.5 Power for controls equipment shall be from a dedicated circuit. Where a controller is dedicated to controlling a single piece of equipment, power may be obtained directly from that equipment.

.6 All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.

3.17 NETWORK AND COMMUNICATION CABLING

.1 Network installation shall strictly adhere to the manufacturer's network installation instructions and procedures.

.2 All data cabling shall use stranded conductors. Solid core conductors shall not be accepted.

.3 Data cabling shall be run separately from power and signal wiring

.4 All communications wire shall be externally identified as "Building Automation System Network" in accordance with the HDSB's Building Automation Systems Standards and Design, latest revision.

.5 Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135, latest will be followed. Those include but are not limited to:

.1 Only one path can exist from any BACnet device to another

.2 The maximum length and cabling type of an MS/TP segment shall be in accordance with manufacturers specifications and shall comply with EIA-485.

.3 Each internetwork LAN must have a unique Network Number (1 - 65,545).

.4 The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.

.5 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.

.6 Primary LAN Network wire and cable shall be run separately from all other wiring.

.7 Other LAN Network wire and cabling shall be installed separate from any wiring over thirty (30) volts.

.8 All communications shielding shall be grounded as per Networked System manufacturer's recommendations.

3.18 BACNET ETHERNET COMMUNICATION CABLING

.1 Data cable shall Category 5 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.

3.19 SIGNAL (INPUT/OUTPUT 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 All BMS input/output point wire/cable and communication cable shall be shielded.
- .1 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.
- .2 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.

.3 All cabling shall be installed in a neat and workman like manner. Follow manufacturer's installation recommendations for all communication cabling.

.4 Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.

.5 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.

.6 Note: all free air cabling used in combustible rated buildings to interface to security or fire alarm systems shall be FT-6 rated.

.7 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

.8 Cables shall follow building lines and be installed in bundles resting in a cabling support system (J-hooks).

.9 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 terminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.

.10 All BAS equipment and components shall be grounded to building ground facilities.

.11 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.

.12 Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.

.13 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.

3.20 UTILITY MONITORING

.1 The metered systems include the electrical power, natural gas distribution, and water systems. The Controls Contractor is responsible for the integration and/or supply of metering equipment necessary to provide the following:
Electricity – real time and historical kWh and KW
Gas – real time and historical m3
Water – real time and historical L

.2 The Controls Contractor is responsible for coordination with the respective Electricity Provider for integration and/or installation.

.3 The Board will coordinate with Union Gas the installation of the Utility provided signal output. The Controls Contractor is responsible for connection, integration and programming.

.4 The Controls Contractor is responsible to integrate the water the existing Utility Provider's (Region of Halton) meter.

3.21 COMMISSIONING, TESTING, DEMONSTRATION, AND ACCEPTANCE

.1 The system shall be commissioned in its entirety. All commissioning and tested shall be documented and submitted prior to Demonstration and Acceptance testing. Commissioning and Testing shall include, but not limited to the following:
  .1 Verify all programming, naming, identification, and….conforms to the HDSB's Building Automation Systems Standards and Design, latest revision.
  .2 A point-to-point check of the location, installation, and labeling
  .3 Calibrate all analogue inputs and devices using actual versus the embedded UI
  .4 Control loops are to be fully set-up and tuned
  .5 Each control program and sequence shall be fully commissioned and confirmed by an end-to-end test, for the complete design intent compliance and functionality.
  .6 Verify failsafe conditions.

.2 The naming and identification of all points, networking instances, objects, meta tags, etc. is to be extracted from the site controls electronically and sent to the Owner or its Authorized representative in one of the following formats .csv, .xls or xlsx, for review and acceptance. The values are not to be edited or formatted prior to sending.

.3 Pursuant to 3.8.1, assist and cooperate with the Owner approved third party commissioning provider in the following manner: using a skilled technician who is familiar with the building, assist in the functional performance testing of the control system as per test requirements developed in the commissioning check sheets (prepared by the commissioning provider).

.4 When Commissioning, Testing, Demonstration and Acceptance process has been completed and approved and/or verified by the Owner, and within ten (10) days, the contractor will be provided with a signed letter from the owner indicating acceptance.

3.22 TRAINING

.1 Subsequent to the acceptance, per 3.9., and part of this contract, 1 day of training is to be provided to a maximum 6 individuals responsible for the operation of the site at the sole discretion of the Owner. The training shall provide instruction and demonstration on the operation, adjustment and maintenance of the BAS inclusive of all hardware and software supplied under this and other related specifications necessary to meet the functional intent.

.2 The training is to include, but not limited to, the following:
- .1 Location of all controllers, devices, sensors, peripherals, etc.
- .2 Equipment layout and dependencies
- .3 Sequence of operation
- .4 Preventative maintenance

3.23 WARRANTY, MAINTENANCE, AND SERVICE

.1 Provide warranty under provisions of these specifications.

.2 At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:

.1 Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within eight (8) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected through telephone support to the Owner, or its representatives, the next step is to attempt to correct the issue through remote site access. In the event the problem persists, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within forty-eight (48) hours of the Owner's initial request for service, as specified.

.2 Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within two (2) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected immediately through telephone support or remote site access, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight (8) hours of the Owner's initial telephone request for service, as specified.

.3 Owners Request for Service: Contractor shall specify three telephone numbers and email addresses, including order of contact and procedure in the event a contact fails to respond, for the Owner to use in the event of a need for service.

.3 Provide all labour, associated travel and expenses, materials and equipment necessary for the successful operation of this system for a period of 12 months from the date of final acceptance, per 3.9. In addition, provide three (3) visits for testing and evaluating the performance of the hardware and software installed per this specification, to be coordinated with the HDSB’s Building Automation Manager. One visit shall be during the cooling season, one visit shall be during the heating season, and one visit shall be during a shoulder season, either spring or fall. Provide a written report after each visit is complete. This service visit shall include, but not be limited to, the following:

.1 Check calibration and re-calibrate if needed instrumentation sensors for air flow, liquid flow, pressure, humidity, temperature, and transducers. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.2 Check the operation of dampers and damper actuators to assure no lock up has occurred and stroke is proper. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.3 Check the overall system field operations by performing a review of all points. Verify that all monitoring and command points are valid and active. Written records shall be kept indicating the performance of such exercises.

.4 If a problem develops at any time during the warranty/service period, the affected BAS point/object shall be monitored and logged for the remainder of the warranty/service period. “A problem” in the above statement will refer to an incident in which any of the following occur:

.1 An alarm occurs due to a defective control system component(s), improper installation or programming.

.2 Overall performance of the system is compromised due to a defective control component(s), improper installation or programming.

.3 Major recalibration (by greater than 5 times the catalogued accuracy) is required for a sensor during one of the service visits.

.5 Pursuant to 3.3, changes required to meet design, compliance, and functionality, that were not part of the Demonstration and Acceptance process, will be made at no cost to the Owner.

.6 Any changes to programming, inclusive of but not limited to set-points, schedules, sequences, alarms, history, network addressing, object naming, etc. are to be performed in accordance with the Change Management Procedures outlined in the HDSB’s Building Automation Systems Standards and Design, latest revision.

3.24 SCHEDULE A

.1 Objects / Points identified in Schedule A as Mandatory (‘Y’ in Mandatory column) must be included in program of the respective system or equipment. Where an Object or Point is not listed as Mandatory, inclusion within Schedule A does not dictate the requirement for use within a program, and are listed for information purposes only where equipment differs from standard and program variations must be made to meet the sequences per 23 09 93.

.2 Objects / Points identified as Mandatory must be adjustable, in accordance with 3.12 of this Section

.3 Where a ‘G’ and/or ‘V’ is indicated in the User Interface column, the Object or Point shall be represented on the respective graphic page, in accordance with 3.9 of this Section. Mandatory points without a ‘G’ and/or ‘V’ indicated in the User Interface column shall be presented in the settings page.

.4 Where an Object or Point is identified as a software point with a ‘B’ in the Software Point column of the table, BACnet value will be an accepted means of data source provided change of value requirements are met. BACnet shall not be used as a writeable point or as a data source for Alarms classified as Emergency.

3.25 SUPPLY OF CONTROL AIR DAMPERS AND OPERATORS

.1 Unless otherwise specified, supply required control dampers. Hand dampers to sheet metal trade at site in location where they are required for installation as part of sheet metal work. Ensure each damper is correctly located and mounted.

.2 Provide linkage and operators for dampers. Wherever possible locate damper operators so they are accessible from outside duct, plenum, and equipment casings. Bracket mount operators on ducts or plenums clear of insulation where applicable.

.3 Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide pilot positioners to couple their action.

.4 Ensure dampers located in ductwork other than galvanized steel are constructed of type 316 stainless steel.

3.26 SUPPLY OF AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Unless otherwise specified, supply required automatic control valves. Hand valves to appropriate piping trades at site in locations they are required for installation as part of piping work. Ensure each valve is properly located and installed.

.2 Provide an operator for each valve.

3.27 INSTALLATION OF THERMOSTATS

.1 Unless otherwise noted, provide required thermostats.

.2 Provide a ventilated clear polycarbonate cover for each thermostat located in finished areas, and a wire type guard for each thermostat located in unfinished areas and in areas such as mechanical rooms where thermostat is subject to damage.

.3 Unless otherwise indicated, mount room thermostats in accordance with requirements of local governing authority and, where applicable, barrier-free requirements. Review exact location of thermostats with Consultant prior to roughing-in.

.4 Provide stand-off mounting and an insulated sub-base for thermostats on outside walls.

.5 Perform control wiring associated with installation of electric or electric-electronic thermostats.

3.28 INSTALLATION OF CONTROL SYSTEM COMPONENTS

.1 Provide required control system components and related hardware. Refer to drawing control diagrams and sequences.

.2 Where components are pipe, duct, or equipment mounted supply components at proper time, coordinate installation with appropriate trade, and ensure components are properly located and mounted.

3.29 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS

.1 Refer to identification requirements specified in Section entitled Basic Mechanical Materials and Methods.

.2 Identify equipment as follows:
- .1 enclosures and components: engraved laminated nameplates with wording listed and approved prior to manufacture of nameplates;
- .2 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.

END OF SECTION

PROJECT NAME: Nelson High School - Renovations
4181 New Street, Burlington, ON

RDZ PROJECT NUMBER: 23178

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: Tanweer Mozaffar
E-mail : tanweer@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 12 17	Dry Type Transformer	
26 24 16	Panel Boards	
26 24 17	Power Panels	
26 27 26	Wiring Devices	
26 28 23	Disconnect Switches-Fused and Non-Fused	
26 50 00	Lighting	
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
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" $_____

.2 Supply and installation of one type “AA” $_____

.3 Supply and installation of one type “B” $_____

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 in order 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 $3,500. 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	5 YEARS

EQUIPMENT	ITEMS	WARRANTY
	wiring and other associated components	
DISTRIBUTION	Electrical distribution including switchboard, power panels, panel boards, contactors, transformers, relays, cables, wiring etc.	1 YEAR
FIRE ALARM SYSTEM	Fire alarm system complete with all components, devices etc.	1 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 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.

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 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CAN/CSA C22.2 No. 47, Air Cooled Transformer (Dry Type).
  .2 CSA C9, Dry Type Transformers.
  .3 National Electrical Manufactures Association (NEMA).

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 Dry type transformers shall, unless otherwise noted, be of the indoor air-cooled dry type of the size, rating and capacities as shown on the drawings and shall be sprinkler-proof.

.3 Transformers shall be of the 1.2 KV Class 10 KV B.I.L. 220°C insulation, copper wire, temperature rise above a maximum ambient temperature of 150 degrees C.

.4 Transformers shall have 4 - 2½% full capacity taps, 2 above and 2 below normal.

.5 Ample ventilation openings at top, bottom, front, and sides shall be provided but these shall be shielded to prevent access to the live parts.

.6 Transformers shall be equipped as required with eye bolts, braces, etc. to enable them to be wall mounted, floor mounted or suspended. Units shall be braced to block walls to suit seismic requirements.

.7 External anti-vibration isolation mountings shall be supplied and installed for all transformers.

.8 Transformers shall have two coats of primer and two finish coats of ASA 61 grey paint.

.9 Transformer nominal efficiency of different KVA ratings must follow ASHRAE Standard 90.1-2010. Transformers shall be Harmonic Mitigator and similar to Powersmiths Model T1000-C3, Delta Mitigator e-silver, Marcus Supreme, or approved equal by the Consultant.

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 the dry type transformers where shown on the drawings and ensure that there is adequate ventilation so that they operate as specified and that there is no transfer of heat to adjacent surfaces or equipment.

.3 Prior to energizing or commissioning any transformer it shall be fully inspected, tested, checked, and adjusted to include, but not limited to the following:
- .1 Grounding.
- .2 Ratio.
- .3 Polarity.
- .4 Insulation resistance.
- .5 Taps adjusted to give rated voltage specified at rated capacity.

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 particular 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 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 particular 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. Breaker(s) shall be with electronic trip(s) (LSI). The panels shall be as specified on the drawings.

.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 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.

.3 Refer to section 26 50 10, Lighting Fixtures Schedule

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 or Orcons 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 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 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 Manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
.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 The lighting fixtures with the letter shown, shall be of the types as described below:

Type ‘A’ Shall be Lithonia Lighting Cat. #BLWP4-40L-ADP-ADPT-120-EZ1-LP840-BLWPQMB, 4’-0” low profile LED Wraparound light fixture complete with high performance extruded acrylic diffuser, quick mount bracket, 120-volt integral driver and other mounting accessories as required to suit fixture installation as shown on drawings.

Type ‘AA’ Shall be same as Type ‘A’ except with continuous row mounting bracket, stem suspension kit and other mounting accessories as required to suit fixture installation as shown on drawings. Cat. #BLWP4-40L-ADP-ADPT-120-EZ1-LP840-BLWPCR-SQXX. Exact stem length will be confirmed by architect at later date.

Type ‘B’ Shall be ILP Volumetric Troffer Cat. #VST14-4L-U-40-DIM1, 1’-0” x 4’-0” recessed LED light fixture for T-bar ceiling mounting, complete with high reflective matte white post paint finish, high transmission frosted polycarbonate lens, and 120-volt integral dimming driver.

.3 LED light fixtures, unless otherwise noted, Influx Lighting, Salex, Signify, Cooper, Acuity and Hubbell Lighting shall be considered equal provided they meet the specifications, designed lighting calculations based on absolute IES files of the respective light fixtures.

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.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 TIA/EIA-606-A (latest edition), Administration Standard for the Commercial Telecommunications Infrastructure.

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.

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 Computer/data cabling installation scope shall be as follows:
- .1 Disconnect, relocate/ remove, and reinstall existing data cables and outlets complete with computer/ data jack and cover plates for data outlets and wireless network access points (WAP) at locations as shown on drawings.
- .2 Coordinate exact requirement, quantities, and all associated work on site.
- .3 Coordinate with school board IT department and disconnect, remove, and reinstall existing wireless access point (WAP) devices at locations as shown on drawings as required. Coordinate all work with school board IT department requirements and on site.
- .4 No tie wraps shall be used anywhere. Only Velcro shall be used.
- .5 All work performed must confirm to the latest version of the applicable codes, standards and regulations of authorities having jurisdiction.

.3 Hubbell products shall be used for the structured cabling system.

.4 Connectors – Category 6 Modular Jacks
- .1 Jacks shall be standard 8-position, Keystone, RJ-45 style.
- .2 Jacks shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
- .3 Each jack shall be single unit construction, with snap – fit to industry standard keystone opening (.760" x .580").
- .4 Jack termination method shall follow the industry standard 110 IDC punch-down.
- .5 Jacks shall have the Category 6 designation, visible from the front when installed.
- .6 Jacks shall not require special cords, specialty tools or special installation requirements.
- .7 Category 6 jacks shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
- .8 Approved Manufacturers:
  - .1 Hubbell Premise Wiring NEXTSPEED Ascent **HJS6x** (x=colour code) with "COBRA-LOCK" termination is the specified Category 6 jack.
  - .2 Hubbell Premise Wiring Xcelerator Category 6 Jack **HXJ6x** (x=colour code)

.5 Category 6 100 OHM Balanced UTP Cable – Plenum FT6
- .1 Category 6 UTP cable construction shall be four twisted pairs of 23 AWG insulated solid copper conductors, with a ripcord, surrounded by a tight outer jacket. Cable construction also includes a pair divider along the cable centre to maintain separation of individual pairs.
- .2 Plenum FT6 cable shall be premium grade, tested out to 550 MHz.
- .3 Plenum FT6 cable conductor insulation diameter shall be 0.039" ± .0005" high performance fluoro-copolymer.
- .4 Plenum FT6 cable conductor outer jacket diameter shall be 0.220" ± .008" with a nominal wall thickness of 0.015".
- .5 Plenum FT6 cable jacket material shall be low smoke PVC.
- .6 Cable shall be marked: "HUBBELL PREMISE WIRING ((LINK6)) CATEGORY 6 – [PLENUM] -- 4 PR 23 AWG c(UL)US <CMP> – (UL) VERIFIED TO TIA/EIA-568-C.2 -- Z/YY (XXXX) – NNNN".
  - .1 Frequency of marking shall be every 2.0 ft.
  - .2 (()) denotes Next-Speed Link6 series.
  - .3 [ ] denotes PLENUM or RISER.
  - .4 < > denotes CMP or CMR.
  - .5 'Z' represents the month of manufacture.
  - .6 'YY' indicates the year of manufacture.
  - .7 'NNNN' indicates the sequential footage markers.
  - .8 'XXXX' indicates the job number.
  - .9 'NNNN' indicates the sequential footage markers.
- .7 UL, ETL, or CSA agency certification or verification markings shall be marked on the cable jacket according to the certifying agency's requirements.
- .8 Colour coding of the pairs shall be as follows:
  - .1 Pair 1: White/Blue; Blue
  - .2 Pair 2: White/Orange; Orange
  - .3 Pair 3: White/Green; Green
  - .4 Pair 4: White/Brown; Brown
  - .5 Cable shall be supplied in 1000 ft Reelex boxes.

.6 Wall Mounted Outlets
- .1 Use 2-port flush mount faceplates. Faceplates shall be constructed of ABS moulding compound.
- .2 Each outlet shall be served by Category 6 jack.

.3 Faceplates shall be White in colour and shall be mounted at locations as shown on drawings.
.4 Each faceplate shall be mounted to an in-wall single gang box by Division 26.

.7 Surface Mounted Box
.1 Use a 4-port surface mount box. Surface mount shall be constructed of ABS moulding compound.
.2 Each outlet shall be served by Category 6 jack.
.3 Surface boxes shall be White in colour and shall be mounted at locations as shown on drawings.
.4 Provide surface mount boxes for all surface mount application.

.8 Labels
.1 Labels shall be mechanically printed. Handwritten labels are not acceptable.
.2 Supply and install self-laminated labels at both end of each cable.
.3 Supply and install labels at each outlet location. Labels shall be affixed to the faceplate on the space provided by the Manufacturer.
.4 Label all ports at the patch panel and voice field (BIX).
.5 All data and voice outlets shall be labelled as follows:

.1 V-001 shall indicate voice outlet #1.
.2 DA-001 shall indicate data outlet in Hub “A”, port #1.
.3 DB-001 shall indicate data outlet in Hub “B”, port #1.

.9 The successful bidder will be responsible for complete storage, handling, delivery, and installation of all materials.

.10 Communication contractor will be responsible for clean-up related to his/her scope of work. The contractor will be expected to remove all debris related to his work daily. Failure to comply will expose the contractor to back-charges from the general contractor or the school board for clean-up on the contractor’s behalf.

.11 The contractor shall have tradesmen who are fully qualified and experienced in the installation of a certified communications cabling system and wireless network systems.

.12 The successful contractor will be required to submit the following documents, prior to being awarded the contract:
.1 Current training and certification status by the specified manufacturer (Hubbell).
.2 Proof of RCDD on staff.
.3 Experience in construction projects for school boards.
.4 Experience in construction projects working for General Contractors.
.5 Experience in troubleshooting and problem solving in data communication networks.

.13 At least one member of the contractor’s project team must hold a current RCDD accreditation. The RCDD will be responsible for quality control and certification of the project.

.14 A Project Manager and Foreman shall be assigned to the project within 3 working days of contract award. These personnel will not be removed from the project without the prior consent of the Owner’s representative.

.15 The contractor will not subcontract any portion of the work, unless authorized in writing by the Board’s representative.

.16 The contractor must comply with all job-site requirements for the duration of the project.

.17 The contractor must comply with all requirements of the Occupational Health and Safety Act, without exception.

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 Computer/Data Network Cabling Installations
- .1 All cables must be properly handled and installed in accordance with the manufacturer's specifications. Undue pulling tension, abrasion or rough handling must be avoided to ensure that the cables will permit transmission up to the design speed of 1Gb/s. All cables must be installed without splices or cuts to ensure the elimination of reflections, discontinuities, impedance mismatches, etc. The maximum horizontal length from the workstation to the LAN/ Telecom room shall not exceed 300' (90m).
- .2 Wiring shall be mechanically protected by runs in cable tray or down drops in conduits.
- .3 Provide associated "J-hooks" as required for proper support.
- .4 Cabling Contractor is to adhere to all Standards, regulations, and documents for data cabling installation.
- .5 All products installed must meet or exceed all local, provincial, and federal building, fire, health, safety, and electrical codes.
- .6 The responsibility of the structure cabling contractor is to include but not to be limited to:
  - .1 Complete scope of work for structure cabling and devices as shown on drawings and indicated in specification.
  - .2 Supply and installation of device faceplates in surface and/or flush data outlet boxes and surface mounted raceways at locations as noted on drawings.
  - .3 Testing in conformance with noted procedures.
  - .4 Labelling of outlet faceplates and associated port on distribution panel. An “As-Built” floor plan of “outlet addresses” must be provided at the completion of the project.

.3 Category 6 Cable
- .1 All horizontal, UTP cables shall be continuous from end to end with no splices.
- .2 The maximum length for horizontal cables shall not exceed 300' (90m). Tak-Tape wrap shall be used on wiring bundles. Nylon cable ties are not acceptable.
- .3 Cables shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair because of termination shall be no greater than 0.5 inches (13mm).
- .4 Cables shall be installed such that cables can maintain minimum bend radius of at least 4 times the cable diameter. Cables shall be terminated in such a way that there is no tension on the conductors in the termination contacts.
- .5 Cables shall be properly labelled on front and back with the cable number and port connections for each port.
- .6 Contractor shall adhere to TIA standard requirements regarding pulling tension and allowable lubricants.
- .7 Contractor shall assume the responsibility for any difficulties or damage to the cable during placement.
- .8 Contractor shall provide school board with all installed cable measurements.
- .9 Cables shall be installed according to manufacturer’s instructions.
- .10 Firestop all openings where cable is installed through a fire barrier.
- .11 Unless otherwise noted, all horizontal cabling shall be installed in conduit, or run in cable tray/ J-hooks. Cables shall not be left on T-bar ceiling.
- .12 The following criteria must be met for conduit installation.
  - .1 For straight runs up to 50' (17m) the cables may occupy up to 40% of the conduit area.
  - .2 For conduit runs between 50' (17m) and 100' (30m) the cables may occupy up to 33% of the conduit area.
  - .3 For runs over 100' (30m) the cables shall not exceed 25% of the conduit area.

.4 Each 90-degree conduit bend shall be considered as the equivalent to 30' (9m) of conduit length.
.5 A pull box must be installed when more than the equivalent of two (2) 90-degree bends exist in the conduit run or if the run exceeds 200' (60m).
.6 Strain relief will be used on large wiring bundles where they drop down to wire racks.

.13 Conduits shall be installed following building lines. Under no circumstances shall cables or conduits be fastened to suspended ceiling support systems. Conduits shall be supported to building structure independent of other support systems.
.14 All conduit systems shall be left with a nylon fish string to allow for future additional cables.
.15 Terminations shall involve as little outer jacket removal as possible and cable pairs "untwisting" shall not exceed 1/2" (13mm). No conductors shall be visible at the rear of the TX connector.
.16 Slack cable must be provided to allow for minor workstation relocations. A coil of slack cable of an approximate 6' (2m) length shall be provided at workstation locations.

.4 Penetration Through Firewalls
.1 A conduit sleeve shall be provided where horizontal cables penetrate firewalls. The conduit sleeve shall be sized at 40% fill ratio with a plastic bushing at both ends.
.2 After the conduit sleeve is installed, the opening around the conduit shall be filled with ULC listed firestop and smoke seal materials.

.5 Outlets
.1 Single data outlet shall receive one (1) 4-pair of Category 6, FT-6 rated cables. Each dual data outlet shall receive two (2) 4-pair cables. Outlets with 4 jacks shall receive four (4) 4-pair cables.
.2 Each cable shall be tested and identified with the faceplate also identified.
.3 All outlets shall be mounted 12" (300mm) above finished floor unless mounted above a counter or other work area.
.4 All jacks shall be wired and connected back to respective racks in LAN rooms/ closets.

.6 Category 6 Jacks
.1 Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair because of termination to the jack IDC shall be no greater than 0.5 inches (13mm).
.2 Jacks shall be installed according to manufacturer’s instructions and properly mounted in plates, frames, housings, or other appropriate mounting device.
.3 Jacks shall be installed such that cables terminated to the jacks maintain a minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.

.7 Faceplates
.1 Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the faceplate prior to the mounting of the faceplate.
.2 Cable slack shall be stored behind the faceplate in such a way that allows the minimum bend radius of the cables to be maintained as per the following:

.1 UTP cable, a minimum of 1 foot of slack with a minimum bend radius of 4 times the cable diameter. Care shall be taken when mounting the faceplate to avoid crimping or kinking the cables.

.3 Faceplates shall be securely mounted to a surface mounted housing, a recessed box, or box eliminator bracket.

.4 Faceplates shall be labelled with the appropriate port designations as per the EIA/TIA 606 standard.

.8 Cable Testing and System Certification

.1 The structure cabling system certification shall include 100% cable testing and verification for a 1 Gb/S solution and shall be tested to level 2 link test standards with a Fluke 4000 or Omni scanner type devices.

.2 The verification of each cable shall be performed by the Contractor and shall be documented in original tester format and on a cable testing sheet which shall form part of the disk and hard copy documentation supplied at the end of the installation.

.3 Upon completion of the testing, the Consultant may ask the contractor to perform random tests of up to 30% of the cables. Cables that fail the test shall be replaced and/or corrected within three (3) days.

.4 All tests shall be in accordance with ANSI/EIA/TIA-568B.1, section 11, Cabling Transmission Performance and Test Requirements.

.5 Testing Procedures

.1 Testing shall include, but not be limited to the following:

.1 Cable length.
.2 Attenuation.
.3 Return Loss
.4 Insertion Loss
.5 Wire Map
.6 Near end cross talk (NEXT)
.7 Power sum near end cross talk (PSNEXT)
.8 Power sum attenuation to cross talk (PSACR)
.9 Power sum Equal level far end cross talk (PSELFEXT)
.10 Propagation Delay & Delay Skew

.2 Any cable not passing the testing procedure shall be replaced in its entirety. No splicing is permitted in the repair of any defective cable. Include in tender price for retesting any device/cable repaired/replaced until passing.

.6 Jacks shall be tested as part of the installed horizontal cabling system.

.7 Category 6 jacks shall be tested as part of the channel for Length, DC continuity, NEXT, PSNEXT, Attenuation, Return Loss, ELFEXT, and PSELFEXT using a level II tester for category 6 channel compliance.

.8 A “PASS” indication shall be obtained for all link or channel tests when tested using the appropriate level tester for the appropriate category.

.9 Testers shall be correctly set to test the type and manufacturer of the horizontal cable used in the link or channel being tested, including the correct NVP.

.10 Splicing of any cables will not be permitted for any reason.

.11 Test results shall be submitted in electronic format. Electronic reports shall be submitted on CD format in a Windows based database (Microsoft Excel is acceptable). All electronic reports must be accompanied by a certificate signed by an authorized representative of the company warranting the truth and accuracy of the electronic report.

.12 The test result documentation shall be submitted to the Consultant no later than 10 working days following the completion of the installation.

.9 As-Built Drawings

.1 Contractor shall always maintain an updated copy of as-built drawings on site.

.2 At the end of the project, contractor shall obtain Auto Cad files from the Consultant and update them with the work performed by the contractor. Contractor shall provide one (1) soft copy of updated as-built drawings and 3 sets of prints.

.3 As-built drawings shall be submitted to the Consultant no later than 10 working days following the completion of the installation.

.10 Warranty
.1 Communications cabling contractor will be required to provide a 25-year manufacturer's Extended Component Warranty and an Application Assurance Warranty for the entire communications cabling system. Warranty shall be in effect from the date of substantial completion as certified by the Architect.
.2 Communications cabling contractor shall provide certification number within two weeks of award of the project.
.3 Communications cabling contractor shall provide a letter of Certification within two weeks of substantial completion. This document will include the following:

.1 Verification of the performance of the installed system.
.2 Manufacturer's certification number.
.3 Identification of the installation by location and project number.

.4 The system manufacturer shall provide to the Owner that in 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.
.5 The Contractor shall provide a guaranteed twenty-four (24) hour response time to any warranty claims.
.6 Contractors must ensure that the selected network cabling component manufacturer and the wiring manufacturer must have contractual relationships to ensure that the system warranty is a one point of contact, true "end-to-end" structured cabling system warranty.

.11 Pre-qualified computer network sub-contractor for structure cabling:
.1 Millside Total Communications Inc.

Contact: Jamie Rose
Tel: 905-876-1110 Ext-204
Cell: 416-726-7823
Email: jamie@millsidetc.com
Unit #1-975 Fraser Drive, Burlington, ON L7L 4X8

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 P.A. system 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/horn shall match existing unit.

.5 All new P.A. system devices i.e., P.A. system speaker(s), horn(s) etc. shall match existing and shall be compatible with existing P.A. system panel.

.6 Relocate existing P.A. system devices as shown on drawings. Extend associated conduit, wiring, provide new back boxes as required and adjust all components to suit. Coordinate all work on site.

.7 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.

.8 Install wiring in new conduits/outlet boxes.

.9 Terminate new wiring in existing P.A. system panel.

.10 Terminate all conduits in corridor ceiling.

.11 The fish wire shall be installed in each conduit.

.12 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.13 Installations of equipment and wiring shall be done in accordance with manufacturer’s recommendations and school board requirements.

.14 After completion of the system provides verification report by system manufacturer/installer.

.15 Pre-qualified public address system sub-contractor:
.1 Hamilton Video & Sound Limited
Contact: Gord Faulkner
Tel: 905-522-1200 Ext-109
Cell: 905-746-4999
Email: gord@hvs.ca
1350 Osprey Drive Ancaster, ON L9G 4V5

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.

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 The fire alarm system is existing of Mircom manufacture and must be operational at all times. <u>All new devices must match existing</u>.

.2 <u>Provide extension to the existing system Mircom FX-2000 as shown complete with F.A. devices and all necessary alarm, supervisory, and shut-down, modules as required for proper installation and operation. F.A. panel shall support existing and new zones. Adjust all components to suit.</u>

.3 <u>All new devices shall match existing F.A. manufacturer (F.A. pull stations, smoke and heat detectors, F.A. speakers, duct detectors, etc.).</u>

.4 Where indicated on the drawings; remove or relocate existing fire alarm speaker/strobe, F.A. pull stations, F.A. detectors, F.A. duct detectors etc. as shown.

.5 Before re-installation, the F.A. speakers, F.A. pull stations or F.A. detectors shall be cleaned, tested, and restored to a sound and operating condition. Coordinate with drawings.

.6 Provide new F.A. devices i.e.: F.A. speakers, pull stations, heat and smoke detectors, duct detectors, etc. as shown on the drawings.

.7 The existing fire alarm control panel shall be modified/expanded to suit F.A. zones as shown on the drawings. Adjust and add all components to suit.

.8 The existing F.A. graphic shall be replaced with new multi-colour passive graphic to suit existing and new F.A. zones.

.9 Existing F.A. annunciator(s) shall be modified to suit existing and new F.A. zones.

.10 Combustion detectors shall operate on the ionization principle and shall be activated by the presence of combustion products. The detector shall be listed by Underwriters' Laboratories of Canada. The detector shall be a plug-in unit containing two ionization chambers, an amplifier-switching circuit and indicator lamp. The unit shall contain no moving parts. One chamber shall be for detection and the second chamber shall function as a reference, to stabilize the detector for changes in temperature, humidity, and pressure. It shall be possible to electrically check the detector's sensitivity and re-adjust the detector's sensitivity as required. The detector shall have incorporated a pilot light.

.11 The duct detectors shall be the same as the area detectors but shall include a duct mounting assembly, sampling tubes and remote indicating unit.

.12 End-of-line resistors shall be provided by this Division for the complete 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 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 Those 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 changes shall be verified by the manufacturer's representative, and a verification certificate presented upon completion in accordance with CAN/ULC-S537 (Latest Edition) - Standard for Verification of Fire Alarm Systems.

.15 Warranties all materials, installation, and workmanship for one (1) year from date of acceptance, unless otherwise specified.

.16 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.

.17 When the fire alarm system has been commissioned and verified it shall be fully demonstrated by this Division to the authorities having jurisdiction.

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-S1001-11 – Integrated Systems Testing of Fire Protection and Life 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 Integrated systems testing of fire protection and life systems report and certificate in accordance with CAN/ULC-S1001-11 – Standard for Integrated Systems Testing of Fire Protection and Life 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 Employ and pay for the services of an independent company, (i.e.: CFMS-West, Contact: Joseph Tanel; Ph: 647-400-9872; email: josephtanel@cfmswest.ca, Lonergan Engineering Inc., Contact: Michael Lonergan; Ph: 416-684-2305; email: m.lonergan@lonerganeng.com, Vintage Fire and Life Safety Ltd.; Steve Salese; Ph: 519-998-8944; steve@vintagefireandlifesafety.com or Approved Equal) to inspect, test and verify the operation of the fire alarm system in accordance with CAN/ULC-S1001-11 for Integrated Systems Testing of Fire Protection and Life Systems.

.4 Complete the installation, inspection, testing and verification of the fire alarm system as specified in Section 28 46 00, and perform "Integrated systems testing of fire protection and life systems" in accordance with CAN/ULC-S1001-11 with independent company and advise the Consultant and authority having jurisdiction in writing accordingly by providing all supporting documentation as required for CAN/ULC-S1001-11 inspection, testing and verification process three weeks prior to substantial completion of the contract.

.5 Provide all information, drawings, documents, shop drawings, and assistance to the independent company who will be performing inspection, testing and verification of integrated system testing of fire protection and life system in accordance with CAN/ULC-S1001-11.

.6 Coordinate with fire alarm system manufacturer, fire alarm system verification contractor and other trades and contractors for door hardware system, access control system, elevator system, mechanical systems, sprinkler and standpipe systems, building controls system, lighting control systems, security system etc. and facilitate to provide all required assistance necessary in order that the inspection, testing and verification in accordance with CAN/ULC-S1001-11 for Integrated systems testing of fire protection and life systems as specified herein can be successfully completed.

.7 Integrated Systems Testing of Fire Protection and Life Systems shall verify that the systems, their components including but not limited to Fire alarm systems, Sprinkler systems, Standpipe systems, Elevators, Hold-open devices, Cooking suppression system, Emergency generators, Fire pumps, Emergency Lighting systems, Electromagnetic locks, Smoke control systems, Ventilation (Pressurization) systems, Audio/Visual and/or Lighting controls, Notification systems, Water supplies, Water control valves, Freeze protection systems, Fixed fire suppression systems etc. and their interconnections with other building systems are functioning in accordance with the intent of their design.

.8 The independent company who will be performing inspection, testing and verification of integrated system testing of fire protection and life system in accordance with CAN/ULC-S1001-11 and acting as Integrated Testing Coordinator (ITC) shall include and perform all procedures as required by CAN/ULC-S1001-11 but not limited to:

.1 ITC shall develop and prepare an Integrated Testing Plan specific to the project, outlining the required tests and necessary functional results to conduct integrated fire protection and life systems testing.

.2 ITC shall attend construction meetings prior of integrated testing procedure; to review the integrated testing process with the architect, consultant, electrical contractor, mechanical contractor, general contractor, and owner’s representative.

.3 ITC shall review all relevant shop drawings during construction.

.4 ITC shall attend site prior to day of testing to review testing process with project team/ electrical contractor and confirm all systems are ready for testing.

.5 ITC shall discuss with the project team/ electrical contractor, the testing process to ensure all trades are aware of their expectations on day of testing.

.6 ITC shall ensure that integrated testing (IT) Plan is reviewed by consultant team prior to testing.

.7 ITC shall ensure that all applicable system start-up reports are received prior to testing.

.8 ITC shall perform testing of integrated fire protection and life safety systems in accordance with CAN/ULC-S1001-11 and integrated testing plan.

.9 ITC shall submit an integrated testing report, specific to the project and documenting the implementation of the integrated testing plan. The report shall confirm and acceptable to the requirements of the authorities having jurisdiction.

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 Inspect and test the fire alarm system and auxiliary equipment in accordance with CAN/ULC-S537 and integrated testing in accordance with CAN/ULC-S1001-11 as specified in Section 28 46 00 and as described above and complete and sign all necessary forms.

.3 Provide a letter addressed to the Consultant confirming that the fire alarm system verification and integrated testing have been satisfactorily completed.

END OF SECTION