Project Manual for the

Construction of the

HOLY FAMILY C.E.S. RENOVATIONS

at

1420 Grosvenor Street
Oakville, Ontario

for

HALTON CATHOLIC DISTRICT SCHOOL BOARD

802 Drury Lane
Burlington, Ontario

Project No.: 2325

2024 03 01

Snyder

1 General

1.1 OWNER

.1 Owner for the Project is:

The Halton Catholic District School Board
802 Drury Lane
Burlington, Ontario
L7R 2Y2

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 Hardware Consultant (H)

ABDP Consulting Ltd.
1910 Port Davidson Road
Smithville, Ontario
L0R 2A0
Telephone: 905.327.1374

.3 Structural Engineer (S)

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

.4 Mechanical Engineer (M)

DEI & Associates Inc.
55 Northland Road,
Waterloo, Ontario
N2V 1Y8
Telephone: 519.725.3555

.5 Electrical Engineer (E)

DEI & Associates Inc.
55 Northland Road,
Waterloo, Ontario
N2V 1Y8
Telephone: 519.725.3555

.6 Designated Substance Abatement (DS)

Maple Environmental, Inc.
482 South Service Road East, Suite 116
Oakville, Ontario
L6J 2X6
Telephone: 905.257.4408

END OF DOCUMENT

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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 2:00:00 pm local time on the 9th day of April, 2024 (hereinafter referred to as 'bid closing time').

.3 Offers to perform Subcontract SC01 - General will be received by Owner before 2:00:00 pm local time on the 9th day of April, 2024 (hereinafter referred to as 'bid closing time').

.4 Offers to perform the following trade Subcontracts will be received by Owner before 2:00:00 pm local time on the 9th day of April, 2024, (hereinafter referred to as 'bid closing time'):
.1 SC02 - Mechanical.
.2 SC03 - Electrical.
.3 SC05 - Structural Steel.
.4 SC06 - Aluminum Windows.
.5 SC07 - Controls.
.6 SC08 - Painting and Finishing.
.7 SC09 - Drywall and Acoustics.
.8 SC10 - Flooring.
.9 SC11 - Metal Lockers.
.10 SC12 - Door Hardware Supply.

.5 Subcontract SC04 - Designated Substance Abatement has already been issued for bidding by Owner. The identity of the successful SC04 Subcontractor, and the value of the SC04 Subcontract Price will be made available to C00 bidders after award of Subcontract SC04.

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

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

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

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

.10 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.

.11 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.

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

.13 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 HOLY FAMILY C.E.S. RENOVATIONS located at 1420 Grosvenor Street, Oakville, 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.: 2325 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 3:30 pm local time on March 21, 2024.

.2 Attendance by Bidders is mandatory. 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.

.3 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 C00 Bidders: Consent of Surety Form.
.3 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 CONTRACT SECURITY

.1 C00 - Contractor must submit with the bid a Consent of Surety, stating a reputable surety company is willing to issue contract security in accordance with the Contract Documents.

.2 Include cost of Consent of Surety in bid price.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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 or text message 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.

1.17 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.

1.18 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.

1.19 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.

1.20 BID ACCEPTANCE

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

.2 Owner may award Contract C00 - Contractor and Subcontract SC01 - General to the same Bidder. In this instance, lowest bidder will be determined by the aggregate sum of Contractor's Fee identified for Contract C00 and Subcontract Price for Subcontract SC01.

.3 The Contract 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 Contract will be established if and when the Bidder accepts all such conditions in writing or when the parties execute the agreement.

.4 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.

1.21 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.

1.22 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.

1.23 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: Limited Designated Substance Survey Report RV.1, (Flooring, Windows, & Interior Door Replacement, Holy Family Catholic Elementary School, 1420 Grosvenor Street, Oakville, Ontario;
Project No.: 21384;
Dated: January 29, 2024;
Prepared by: Maple Environmental, 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 are the General Conditions between Owner and Contractor.

1.2 SUPPLEMENTARY CONDITIONS

.1 Refer to 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 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 two hard-copy sets and one digital copy set of the Contract Documents without charge. The Contractor may produce as many additional hard-copy sets of the Contract Documents from the digital 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

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 11.2 - CONTRACT SECURITY

.1 Delete Paragraph 11.2.2 in its entirety.

1.22 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".*

1.23 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
HOLY FAMILY C.E.S. RENOVATIONS

located at:
1420 Grosvenor Street,
Oakville, Ontario;

and is further identified as:
Project No.: 2325.

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 TEMPORARY UTILITIES, FACILITIES AND SERVICES

.1 Subcontract SC01: Refer to Section 01 50 00 - Temporary Facilities and Controls.

.2 Each Subcontractor shall 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.

1.6 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 the 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.

1.7 COMMON REQUIREMENTS APPLICABLE TO SUBCONTRACTORS

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

.2 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.

.3 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.

.4 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.
  - .2 Provide and pay for those items listed above in temporary utilities, facilities and services as required for Subcontract Work.

1.8 SUBCONTRACT SC01 - GENERAL

.1 Perform final cleaning of the Project as specified in Section 01 74 00.

.2 Include the following:
- .1 Division 01 - General Requirements
  - .1 01 50 00 - Temporary Facilities and Controls (excluding temporary heat for masonry).
- .2 Division 02 - Existing Conditions
  - .1 02 41 19 - Selective Demolition
- .3 Division 03 - Concrete
  - .1 Cast-in-place concrete as noted on Drawings.
  - .2 03 35 46 - Concrete Topical Treatments
- .4 Division 04 - Masonry
  - .1 04 00 00 - Masonry
- .5 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
- .6 Division 07 - Thermal and Moisture Protection
  - .1 07 21 00 - Thermal Insulation
  - .2 07 26 00 - Vapour Retarders

.3 07 27 00 - Air Barriers
.4 07 27 36 - Sprayed Foam Air Barriers
.5 07 52 00 - Modified Bituminous Membrane Roofing
.6 07 62 00 - Sheet Metal Flashing and Trim
.7 07 84 00 - Firestopping
.8 07 92 00 - Joint Sealants

.7 Division 08 - Openings
.1 08 14 00 - Wood Doors
.2 08 71 00 - Door Hardware (Install hardware only)

.8 Division 10 - Specialties
.1 10 11 00 - Visual Display Surfaces
.2 10 14 00 - Signage
.3 10 21 13.21 - Solid Plastic Toilet Compartments
.4 10 28 13 - Toilet Accessories.

1.9 SUBCONTRACT SC02 - MECHANICAL

.1 Include the following:

.1 Division 20
.1 20 02 21 - Mechanical Supplemental Tender Form
.2 20 02 51 - Mechanical Contract General Requirements
.3 20 05 11 - Mechanical Work Requirements
.4 20 05 21 - Demolition and Renovation
.5 20 05 31 - Expansion Fittings and Loops
.6 20 05 32 - Thermometers and Pressure Gauges
.7 20 05 34 - Bases, Hangers and Supports (Indoor)
.8 20 05 35 - Bases, Hangers and Supports (Outdoor)
.9 20 05 49 - Vibration Control Measures
.10 20 05 53 - Identification of Mechanical Services
.11 20 06 11 - Testing, Adjusting and Balancing (TAB) of Mechanical Systems
.12 20 08 11 - Mechanical Contractor Commissioning Requirements

.2 Division 22 - Plumbing
.1 22 07 19 - Plumbing Piping Insulation
.2 22 11 16 - Domestic Water Piping
.3 22 11 20 - Backflow and Cross Connection Measures
.4 22 11 22 - Domestic Water Circulation Pump
.5 22 11 31 - Potable Water Auxiliary Equipment
.6 22 13 13 - Sanitary Drains
.7 22 13 16 - Sanitary Waste and Vent Piping - Cast Iron and Copper
.8 22 13 17 - Sanitary Waste and Vent Piping - Plastic
.9 22 14 15 - Storm Drainage Piping - Cast Iron and Copper
.10 22 14 16 - Storm Drainage Piping - Plastic
.11 22 14 26 - Storm Drains
.12 22 34 36 - Fuel-Fired Domestic Water Heaters
.13 22 36 13 - Plumbing Auxiliary Equipment
.14 22 37 13 - Portable Fire Extinguishers
.15 22 44 13 - Plumbing Fixture Combined with Drawing Schedule

.3 Division 23 - Heating, Ventilating and Air Conditioning
.1 23 01 31 - HVAC System Cleaning
.2 23 05 11 - Variable Frequency Drives
.3 23 05 81 - Pipe Welding
.4 23 07 13 - Duct Insulation
.5 23 07 19 - HVAC Piping Insulation
.6 23 11 23 - Facility Natural-Gas & Propane Piping
.7 23 21 11 - Hydronic Accessories
.8 23 21 13 - Hydronic Piping - Screwed/Welded
.9 23 21 23 - Pumps Hydronic
.10 23 25 13 - Water Treatment for Closed-Loop Hydronic Systems

.11 23 31 13 - Metal Ducts
.12 23 32 13 - Fabricated, Metal Air Plenums
.13 23 33 13 - Duct Accessories
.14 23 33 14 - Volume-Control Dampers
.15 23 33 16 - Fire Dampers
.16 23 33 17 - Smoke Control Dampers
.17 23 33 18 - Operating Dampers
.18 23 33 46 - Flexible Ducts
.19 23 33 53 - Duct Liners
.20 23 34 23 - Packaged Exhausters
.21 23 37 13 - Diffusers, Registers, and Grilles
.22 23 37 23 - Louvres and Vents for Intake and Exhaust
.23 23 51 33 - Insulated Sectional Chimneys
.24 23 52 13 - Stainless Steel Fire Tube Condensing Boilers
.25 23 65 13 - Open-Circuit, Forced-Draft Cooling Towers
.26 23 75 12 - Semi-Custom Outdoor Heating and Cooling Air Handling Units
.27 23 81 46 - Water-Source Unitary Heat Pumps
.28 23 82 29 - Radiators, Convectors, and Cabinet Heaters.

1.10 SUBCONTRACT SC03 - ELECTRICAL

.1 Include the following:
.1 Division 26 - Electrical
.1 26 01 13 - Electrical Supplemental Tender Form
.2 26 01 15 - Electrical Allowances and Fees
.3 26 01 16 - Electrical Contract General Requirements
.4 26 01 17 - Demolition and Renovation
.5 26 01 20 - Commissioning and Integrated Testing of Life Safety and Fire Protection System
.6 26 05 19 - Wires and Cables
.7 26 05 20 - Splitters, Junction and Pull Boxes
.8 26 05 21 - Outlet Boxes, Conduit Boxes and Fittings
.9 26 05 22 - Wire and Box Connectors - 0-1000V
.10 26 05 26 - Grounding Secondary
.11 26 05 33 - Conduits, Conduit Fastenings and Conduit Fittings
.12 26 05 75 - Auxiliary Systems
.13 26 24 16 - Panelboards
.14 26 24 17 - Moulded Case Circuit Breakers
.15 26 27 26 - Wiring Devices
.16 26 28 16 - Disconnect Switches
.17 26 29 13 - Starters and Contactors
.18 26 51 13 - Lighting Equipment
.2 Division 28 - Electronic Safety and Security
.1 28 31 25 - Fire Alarm System (Addressable).

1.11 SUBCONTRACT SC04 - DESIGNATED SUBSTANCE ABATEMENT

.1 Include the following:
.1 Division 02 - Existing Conditions
.1 02 82 10 - Type 1 Asbestos Abatement
.2 02 82 12 - Type 3 Asbestos Abatement.

1.12 SUBCONTRACT SC05 - STRUCTURAL STEEL

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

1.13 SUBCONTRACT SC06 - ALUMINUM WINDOWS

.1 Include the following:
.1 Division 08 - Openings
.1 08 51 13 - Aluminum Windows
.2 08 80 00 - Glazing.

1.14 SUBCONTRACT SC07 - CONTROLS

.1 Include the following:
.1 Division 25 - Integrated Automation
.1 25 20 11 - Building Automation System
.2 Points List.

1.15 SUBCONTRACT SC08 - PAINTING AND FINISHING

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

1.16 SUBCONTRACT SC09 - DRYWALL AND ACOUSTICS

.1 Include the following:
.1 Division 06 - Wood, Plastics and Composites
.1 06 16 43 - Gypsum Sheathing
.2 Division 07 - Thermal and Moisture Protection
.1 07 21 00 - Thermal Insulation (friction-fit thermal batt insulation only).
.3 Division 09 - Finishes
.1 09 21 16 - Gypsum Board Assemblies
.2 09 51 23 - Acoustical Tile Ceilings
.3 09 81 00 - Acoustic Insulation.

1.17 SUBCONTRACT SC10 - FLOORING

.1 Include the following:
.1 Division 09 - Finishes
.1 09 30 00 - Tiling
.2 09 65 13 - Resilient Base and Accessories
.3 09 65 16 - Resilient Sheet Flooring
.4 09 65 19 - Resilient Tile Flooring.

1.18 SUBCONTRACT SC11 - METAL LOCKERS

.1 Include the following:
.1 Division 10 - Specialties
.1 10 51 13 - Metal Lockers.

1.19 SUBCONTRACT SC12 - DOOR HARDWARE SUPPLY

.1 Include the following:
.1 Division 08 - Openings
.1 08 71 00 - Door Hardware (supply of door hardware, plus supply and install of pneumatic door operators and related equipment).

1.20 WORK SEQUENCE

.1 Construct Work in phases to accommodate Owner's continued use of existing facility during construction.

.2 Coordinate Progress Schedule and coordinate with Owner occupancy during construction.

.3 Required Phases: Refer to Drawings for a summary of Project phases and required completion dates for each.

1.21 CONTRACTOR ACCESS TO AND USE OF PLACE OF THE WORK

.1 Upon written request to Owner, and prior to commencing the Work at Place of the Work, Contractor may visit existing facility for purpose of observing existing conditions and taking field measurements. Such visits may only occur on weekdays after 3:30 pm.

.2 Contractor will be granted access to Place of the Work for purpose of commencing operations at Place of the Work on or after July 2, 2024.

.3 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.

1.22 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.

1.23 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.

1.24 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 August 18, 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 the supply only of a Product, the 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 SC-01: Include the stipulated sum of $300,000 for the following parts of the Work:
.1 Inspection and testing services as described in Section 01 40 00.
.2 Completion of architectural CAD as-built drawings as described in Section 01 78 00.
.3 Supply and inastallation of signage, as specified in Section 10 14 00.
.4 Additional work not indicated in Contract Documents.

END OF SECTION

1 General

1.1 INSTRUCTIONS

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

.2 Coordinate affected related Work and modify surrounding work to integrate the Work under 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 of base 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 base 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 base 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 that proposed substitute will perform equally as well or better as specified Product.

.3 Accompany each request for substitution with a list of properties for both specified Product and proposed substitute, including:
- .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, as long as they meet specified criteria.

.6 Failure to order specified Products in adequate time to meet the construction progress 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 an RFI in sufficient time will not be reimbursed by Owner.

.5 Submit one RFI per RFI form, numbered consecutively in a single sequence, in the 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 the 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, it shall be the responsibility of Contractor to ensure that no work is carried out that may increase the cost of the variation contemplated.

.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 the 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, traffic, and 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 THE 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 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 As-built documents as specified 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, coordinate with their work.

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

1.4 CONTINUANCE OF OWNER OPERATIONS

.1 Coordinate and schedule the Work to minimize any disruption to normal functions of 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 their best interests regarding the 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 the minutes. Include significant proceedings and decisions. Identify action by the 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, Subcontractor, 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 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, major 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-furnished Products;
.9 As-built drawings;
.10 Operation and maintenance manuals;
.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 requirements and procedures necessary for compliance with regulatory requirements and the authorities having jurisdiction.

1.8 PROGRESS AND PROGRESS DRAW MEETINGS

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

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

.3 Submit to Consultant a copy of application for payment not less than two Working Days before scheduled progress draw meeting. Consultant may require changes to 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 progress of the Work 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, as-built drawings: expedite as required;
.10 Maintenance of quality standards;
.11 Review of proposed changes for affect on construction progress 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 Resubmit 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 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 progress 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 performance of tests and inspections, and for 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 a 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 review of the Submittal until submission is complete.

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

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

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 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 a 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 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 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 progress of the parts of the Work relevant to engineered Submittal. Report on progress and quality of 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 an 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 operating 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 as 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 CWB or 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 individual specification Sections for Product-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 operating 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 and colours.

1.10 INTERFERENCE DRAWINGS

.1 Prepare one 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 in the form of portable document format (.pdf) files to Consultant prior to start 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 regulatory requirements and authorities having jurisdiction.

1.5 EMERGENCY CONTACT INFORMATION

.1 Submit to authority having jurisdiction emergency contact information for site superintendent, 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 building 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 beyond defined areas of construction, coordinate with Owner's representative at Place of the Work to ensure the 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 beyond defined areas of construction is restricted to the following times:
.1 July 1 to August 31: Mondays to Fridays, between 7:30 am and 4:00 pm.
.2 September 1 to June 30: Mondays to Fridays, between 4:00 pm and 10:30 pm.

.3 Make special arrangements with Owner to perform portions of the Work in existing facility beyond defined areas of construction 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 at Place of the Work 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 at Place of the Work. Cooperate with Owner when scheduling such portions of the Work.

1.9 FOOD AND BEVERAGE RESTRICTIONS IN EXISTING FACILITY

.1 Limit the consumption of food and beverages in existing facilities to only those areas designated by Owner.

.2 There shall be no food or beverages allowed within existing facility beyond defined areas of construction.

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

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

.5 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 by false activation of fire alarms as a result of execution of the Work.

1.11 SPILL RESPONSE

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

.2 Supply and maintain a 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 regulatory requirements.

.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 health and safety plan in accordance with applicable regulatory requirements prior to commencing Work involving excavating, transporting or handling potentially contaminated materials.

.2 Keep 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 materials from Place of the Work.

.4 Provide and maintain safe working environment for on-site personnel and minimize impact of construction activities on 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, 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 a 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 Subcontract, responsible Subcontractor shall reimburse Owner the deposit amount. 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, including public utilities.

.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.

.4 Perform the Work in conformance with regulatory requirements.

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 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 specified minimum will be considered to conform.

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

.4 Standards, specifications, associations and regulatory agencies are referred to throughout Contract Documents by abbreviated designations, as listed below:

.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 IGMA Insulating Glass Manufacturers Association;
.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 TSSA Technical Standards and Safety Authority;
.77 TTMAC Terrazzo, Tile and Marble Association of Canada;
.78 ULC Underwriters' Laboratories of Canada;
.79 ULI Underwriters' Laboratories Incorporated;
.80 WDMA Window and Door Manufacturers' Association; and
.81 WHI Warnock-Hersey International.

1.4 QUALITY ASSURANCE

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

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

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

.4 Decisions as to 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 INDEPENDENT INSPECTION AND TESTING AGENCIES

.1 Except as otherwise specified, Owner will appoint independent inspection and testing agencies to be retained and paid by Contractor to inspect, test or perform other quality control reviews of parts of the Work.

.2 Retain and pay for inspection and testing that is for Contractor's own quality control, or is required by regulatory requirements (including integrated systems testing of fire protection and life safety systems, to CAN/ULC-S1001).

.3 Contract Price includes a stipulated price cash allowance for payment of independent inspection and testing services to be retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor's own quality control or is required by regulatory requirements. Refer to Section 01 21 00.

.4 Employment of inspection and testing agencies by Contractor or Owner does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.

.5 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off-site manufacturing and fabrication plants.

.6 For inspection and testing required by Contract Documents or by authorities having jurisdiction, notify Consultant and inspection and testing agencies in a timely manner in advance of required inspection and testing.

.7 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00.

.8 Supply labour, Construction Equipment and temporary facilities needed to obtain and handle test samples at Place of the Work.

.9 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.

1.7 DEFECTIVE WORK

.1 Refer to GC 2.4 - Defective Work.

1.8 QUALITY CONTROL REPORTS

.1 Submit the 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 Promptly forward quality control reports 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 that 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 a minimum of 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 work of all Sections required to construct 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 dates for preparation.

.6 Specifications identify whether a 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 provide adequate temporary lighting; operation of power tools; temporary heating and ventilation; and to ensure the 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 Owner's approval, permanent heating system, or portions thereof, may be used when available. Be responsible for damage thereto.
- .6 On completion of 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 Consultant.

.5 Temporary Water:
- .1 Owner will designate an existing source and pay 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 USE OF NEW PERMANENT UTILITIES

.1 When new permanent utilities are used during execution of the Work, pay for usage costs at prevailing rates.

.2 Maintain new permanent utilities used for construction purposes. Make Good damage prior to Owner occupancy.

1.5 CONSTRUCTION FACILITIES

.1 Field Offices and Sheds
- .1 Provide and maintain in clean condition during progress of the Work, an adequately lighted, heated and ventilated construction field office with sufficient space and furnishings to accommodate holding meetings, filing documents, and laying out Contract Documents.
- .2 Subcontractors may provide their own offices as necessary. Direct location of these offices.
- .3 Do not store Products or Construction Equipment in construction field office.
- .4 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of Products and Construction Equipment.

.2 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.

.3 Sanitary Facilities
- .1 Provide a sufficient quantity of separate 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 during construction period.
- .4 Except where connected to municipal sewer system, periodically remove wastes from Place of the Work.

1.6 HOISTS AND CRANES

.1 Provide, operate and maintain hoists and cranes required for moving of workers, Products and equipment.

.2 Make financial arrangements with Subcontractors for use thereof.

.3 Hoists and cranes shall be operated by qualified operator.

1.7 VEHICULAR ACCESS AND PARKING

.1 Construct and maintain temporary roads and accesses to Place of the Work.

.2 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.

.3 Clean private roadways as necessary, and as directed by Consultant.

.4 Coordinate access restrictions with Subcontractors and Suppliers.

.5 Remove snow from temporary roads and accesses to allow complete access to Place of the Work.

.6 Maintain access of emergency vehicles to Place of the Work at all times.

.7 Parking will be permitted at Place of the Work as long as it does not disrupt performance of the Work and continuance of Owner operations.

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, workers, and public and private property from injury and damage.
- .3 Provide locking gates to restrict access to only authorized personnel and vehicles.
- .4 Provide and maintain full safety protection at open shafts in floors, roof decks and other working surfaces.
- .5 Provide and maintain suitable warning signs as required by all applicable regulations and by-laws.

.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 protection of workers, finished areas of Work and the public.
- .2 Maintain and relocate protection until such Work is complete.

.4 Security Measures:
- .1 Become familiar with Place of the Work and surrounding neighbourhood.
- .2 Implement adequate security measures to prevent vandalism, theft, arson, and trespassing by unauthorized persons at Place of the Work.
- .3 Maintain security measures 24 hours a day, 7 days a week, 52 weeks of year, including times when construction may be shut down due to strikes or lockouts.
- .4 Remove security measures after Owner occupancy of the Project.

.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 applicable 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 drainage of water from existing facility or Place of the Work, Provide 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 to ensure their continuous operation during execution of the Work, and upon completion of Contract.

1.10 PROJECT IDENTIFICATION

.1 Within 3 weeks of Contract award, Provide a Project identification sign in a location designated by Consultant.

.2 Construct Project identification sign 2 440 x 2 440 mm in size; using wood framing and plywood, graphic to be full colour laminated print mounted on 13 mm thick Crezon.

.3 Install Project identification sign plumb and level, with bottom of sign set 1 220 mm above finished grade.

.4 Maintain Project identification sign in clean condition.

.5 Remove and dispose of Project identification sign when directed by Consultant.

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 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.

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 of failure to notify Consultant of foreseeable supply delays at commencement of the Work, Consultant may 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.

.2 Provide necessary protection for Products where required.

.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 Products from packaging or bundling until required in the Work.

.5 Do not allow Products to be placed in contact with ground or in contact with other Products that could stain them. Store Products 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, equipped with a suitable size and type of fire extinguisher.

.7 Store Products within existing facility only as approved by Owner. Move such Products should they become a hindrance to continuing operations of existing facility or to delivery of other Products.

.8 Receive, handle, protect and store items purchased by Owner for the Project as they are delivered to Place of the Work.

.9 Remove flammable waste 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 a manufacturer's installation instructions and the 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 pipes, ducts, and wiring in floors, walls and ceilings, 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, firestops and smoke seals, and insulation.

.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 loadbearing structural member without 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 services' utilities, execute Work at times directed by authorities having jurisdiction, with a minimum of disturbance to pedestrian and vehicular traffic, and to the Work.

.3 Protect, relocate or maintain existing active services.

.4 When existing services are encountered, cap off in accordance with 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, such as access panels, outlets, and facility service items, indicated on Drawings are approximate only.

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

1.7 INSERTS, ANCHORS AND FASTENERS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent Products, 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 the 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 Products 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 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 separate 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 separate contractor.
- .7 Written permission of affected separate 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 Work for penetrations of mechanical and electrical work.

.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.

.10 Do not use pneumatic or impact tools with masonry without prior written approval of Consultant.

.11 Restore work with new Products in accordance with Contract Documents.

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

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

.14 Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, 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 acceptable standard of cleaning. 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 rubbish and waste at Place of the Work is not permitted.

.3 Burying of rubbish and waste 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 materials in appropriate containers and dispose of in accordance with authorities having jurisdiction.

.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 authorities having jurisdiction.

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

.3 Submit a copy of hauling company's Certificate of Approval to authority having jurisdiction prior to transport of any contaminated material.

.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 Arrange for affected Subcontractors to 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 for building equipment and systems.

.2 Cooperate with testing organization. Ensure 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 the appearance of original surfaces, 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 requirements regarding protection of installed Products.

.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 to the Work, enclose Project with tarpaulins, plastic sheeting or glazing, and temporary locking doors.

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

.11 Protect prefinished Products from damage resulting from subsequent construction operations.

.12 Protect existing trees and vegetation designated to remain from construction damage, to OPSS.MUNI 801. Provide snow fencing or other protection where directed by Consultant.

1.3 UNDERGROUND AND CONCEALED SERVICES

.1 Protect pipes, ducts, cables, conduits, wires and other utility and facility services against damage arising from performance of the Work.

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

1.4 WATERPROOFING AND ROOFING

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

.2 When traffic or material storage is unavoidable, follow recommendations for protection of surfaces from manufacturer of roofing or waterproofing material.

.3 Keep waterproofed and roofed surfaces free of debris.

.4 Following completion of roof system, adequately ventilate entire Project to prevent moisture build up under new roof membrane. Coordinate ventilation requirements with roof installer's recommendations.

1.5 MAKING GOOD

.1 Notify Consultant of, and perform remedial work required to Make Good defective or unacceptable work.

.2 Ensure properly qualified workers perform remedial work.

.3 Coordinate adjacent affected work as required.

.4 Make Good defective and damaged parts of the Work.

.5 Make Good damage to property located adjacent to Place of the Work.

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

.7 Make Good existing conditions as noted on Drawings.

.8 Prioritize the correction of defective work which, in the sole discretion of Owner, adversely affects Owner's day to day operations.

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

.10 Make Good damage to utility services in accordance with authority 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 Video Inspections of Underground Site Services
- .1 Prior to applying for Substantial Performance of the Work, conduct a video inspection of interior condition of underground utility services, including water mains, storm sewers and sanitary sewers.
- .2 Pay cost of video inspection as Cost of the Work.
- .3 Submit video record to Consultant.

.3 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 above-ceiling deficiencies have been corrected.
- .5 Substantial performance inspection may not proceed until above-ceiling deficiencies have been corrected.

.4 Substantial Performance of the Work
- .1 Refer to GC 5.5 - Substantial Performance of the Work.
- .2 Prior to applying for 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 to be added to deficiency list.
- .4 Prior to applying for 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 Complete and reviewed operations and maintenance manuals, as specified in Section 01 78 00.
  - .4 Inspection and acceptance certificates required from regulatory agencies.
  - .5 Life safety systems verification.

.5 Final Payment
- .1 When deficiencies have been corrected, and not later than 60 days after 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 Upon applying for Substantial Performance of the Work, submit [][3] hard copies and one digital copy of final operation and maintenance manual to Consultant.

.2 Bind hard copies in commercial-quality 3-ring binders, 8-1/2" x 11" size, with maximum ring size.

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

.4 Organize data in the form of an instructional manual, with contents arranged by systems, using specification Section numbers and sequence as listed in the Table of Contents.

.5 Identify hard copy binders with a typed or neatly printed title, "Operation and Maintenance Manual"; listing the volume number, Project name and address, and identifying the subject matter of each volume's contents.

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

.7 Organize 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 the name and address of the Project, the name of the Owner and the corresponding Section number and title, and the issuer's name, address, telephone and fax number, contact person information, seal and signature.

.9 Drawings: Provide 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 material 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 Finish 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 all finished surfaces.
- .7 Brochures, cuts of equipment and fixtures.
- .8 Operating 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 a 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 in Specifications to record actual construction, including manufacturers, trade name, and catalog number of each project actually installed, particularly optional items and substitute items.

.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 Substantial Performance of the Work, submit to Consultant special tools or equipment required for maintenance purposes.

.2 Spare parts and extra stock 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 extra stock 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 stock materials in specified quantities.

.6 Supply Products of same manufacture and quality as Products incorporated in the Work.

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 for instruction.

.5 Review contents of operation and maintenance manual in detail. Explain all 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 demonstration and training.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 02 82 00 - Asbestos Abatement.

1.2 REFERENCES

.1 CSA S350-M1980 (R2003): Code of Practice for Safety in Demolition of Structures.

.2 CSA Z783-12: Deconstruction of Buildings and Their Related Parts.

1.3 SEQUENCING

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

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

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

1.4 SPECIAL PROCEDURE SUBMITTALS

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

1.5 QUALIFICATIONS

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

1.6 FIELD CONDITIONS

.1 Inspect and photograph existing adjacent surfaces and assemblies.

.2 Record conditions and stability in a manner suitable for evaluation of possible damage caused by deconstruction operations.

.3 Approximate locations of existing facility services may be indicated on Drawings. Owner and Consultant assume no responsibility for accuracy of such information.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Permits and Fees: Include tipping charges and other related fees necessary for completion of deconstruction operations.

.2 Utilities: Obtain approval from authorities having jurisdiction prior to commencing deconstruction operations.

.3 Hazardous Waste: Conform to authorities having jurisdiction.

2.2 EQUIPMENT

.1 Deconstruction: Appropriate equipment for type of deconstruction being contemplated.

.2 Do not use heavy equipment for making openings in existing walls or in confined spaces where damage to other parts of the Work or adjacent property may result.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify locations and construction of structures to be demolished.

.3 Verify construction and details of other existing and adjacent property.

.4 Verify location of utility and facility services.

.5 Undertake x-ray investigations of existing building elements designated for selective demolition to determine locations of concealed components, utility services and facility services.

3.2 PREPARATION

.1 Erect shoring, bracing and other temporary structures to prevent collapse, settlement and movement of property. Refer to Section 01 50 00.

.2 Provide and maintain dust protection screen as specified in Section 01 50 00.

.3 Provide and maintain weather enclosures as specified in Section 01 50 00.

.4 Barricade access by unauthorized persons to areas in which deconstruction is in-progress.

.5 Post danger signs in conspicuous locations to warn persons that deconstruction is in-progress.

.6 Erect protection to ensure safe access that must be maintained to existing areas still occupied by the public.

.7 Protect adjacent property from damage caused by deconstruction operations.

.8 Remove flammable and contaminated materials, and refuse from area before deconstruction operations commence.

.9 Arrange for disconnection, capping and plugging of facility services that may be affected by deconstruction operations.

3.3 DECONSTRUCTION

.1 Perform deconstruction work in an expeditious and safe manner.

.2 Conform to CSA S350-M and CSA Z783.

.3 Confine deconstruction operations to only those areas required.

.4 Prevent and contain spread of dust.

.5 Do not drop debris more than one storey unless in an enclosed chute. Lower large components carefully, under control and fully supported at all times.

.6 Withdraw or flatten protruding nails as deconstruction operations proceed.

3.4 SALVAGE

.1 Carefully remove materials scheduled for salvage to CSA Z783.

.2 Clean and prepare salvaged items for use by others.

.3 Store salvaged materials in secure locations, protected from damage.

.4 Items not scheduled for salvage become property of Contractor.

3.5 CLEANING

.1 Leave Place of the Work in a clean and orderly condition, ready for use by others.

.2 Remove debris as specified in Section 01 74 00 and in accordance with authorities having jurisdiction.

.3 Remove protections, barricades and other temporary constructions on completion of deconstruction operations.

.4 Make Good property and materials damaged during deconstruction operations.

END OF SECTION

1. GENERAL

1.1 General And Related Work

1.1.1 All sections of the specifications form a part of the Contract Documents and shall be read to determine their effect upon the work of this section.

1.1.2 This specification fulfils the requirements of the report required by R.R.O. 2005, Reg. 278 as amended by O. Reg. 510/92, Section 10.

1.1.3 Related work specified elsewhere:

Division 2, General Conditions:
Section 028212- Type 3 Asbestos Removal

1.1.4 It is the intent that work performed as per this section will result in the removal and disposal of all ACM specified for removal and the decontamination of all materials that have been contaminated by ACM during work of this section.

1.1.5 This specification document should be read in conjunction with the "Limited Designated Substance Survey Report Rv.1" prepared by Maple Environmental (dated January 29, 2024).

1.2 Project Summary

In general terms, the scope of the project involves a flooring, window, and interior door replacement project based on architectural drawings prepared by Synder Architects on behalf of the Halton Catholic District School Board.

1.3 Site Conditions

1.3.1 12"x12" vinyl floor tiles contain Chrysotile asbestos.

1.3.2 Ceramic floor tile mortar base contains Chrysotile asbestos.

1.3.3 Interior and exterior window putty associated with internal components of window frames contain Chrysotile asbestos.

1.3.4 Mastic associated with asbestos-containing vinyl floor tiles does not contain asbestos.

1.3.5 Ceramic floor tile grout does not contain asbestos.

1.3.6 Interior door frame caulking does not contain asbestos.

1.3.7 Asbestos-containing vinyl floor tiles scheduled to be removed as part of this project are present in the majority of Classrooms, storage Rooms, Stage, and the Boy's and Girl's Change Rooms as indicated on Drawing AR-01.

1.3.8 Asbestos-containing ceramic floor tile mortar base scheduled to be removed as part of this project are present in the Main Corridors and select Washrooms as indicated on Drawing AR-01.

1.3.9 Vinyl floor tiles and ceramic floor tiles are applied to a concrete substrate.

1.3.10 Asbestos-containing vinyl floor tiles are present below fixed millwork where present in the Work Area. Vinyl floor tiles are not scheduled to be removed below fixed items.

1.3.11 Ceramic floor tiles are applied to an asbestos-containing mortar base over a concrete substrate. Wire lath is not known to be present.

1.3.12 Acoustic ceiling tiles are present throughout the building. All acoustic ceiling tiles in the building do not contain asbestos.

1.3.13 The majority of walls in Work Area consist of a masonry block.

1.3.14 Vinyl base boards are present throughout the Work Area.

1.3.15 Ceramic tile grout and mortar base do not contain lead.

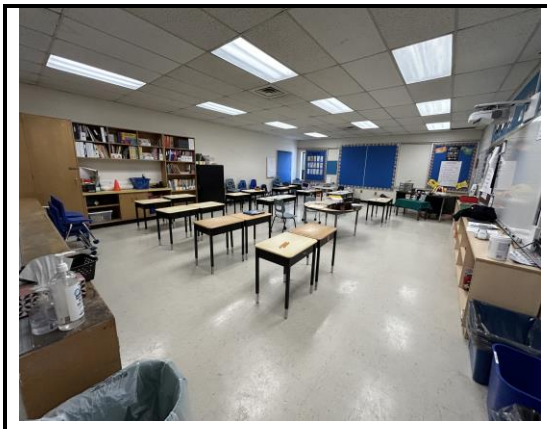
1.4 Outline of Work

1.4.1 Using Type 1 asbestos procedures remove and dispose of as asbestos waste, asbestos-containing vinyl floor tiles in the Work Areas depicted on Drawing AR-01.

1.4.2 There is approximately 11,500 square feet of asbestos-containing vinyl floor tiles to be removed using Type 1 Asbestos Abatement Procedures.

1.4.3 Abatement Contractor is responsible for all take-offs.

1.4.4 Refer to Figure 1 below for examples of different ACM vinyl floor tile systems to be removed.



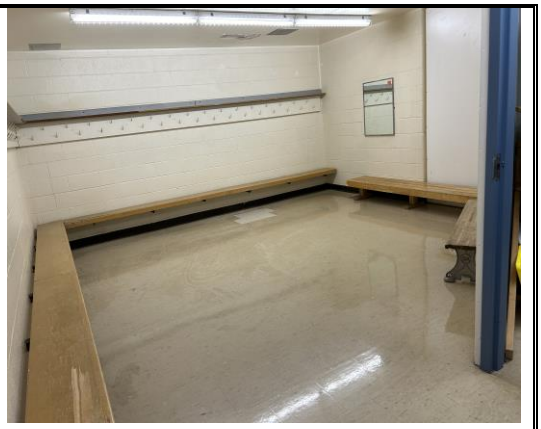


Figure 1: Examples of different ACM vinyl floor tile systems to be removed.

1.4.5 There are 32 windows with asbestos-containing putty (interior and exterior to be removed using Type 1 Asbestos Abatement Procedures.

1.4.6 Refer to Figure 2 below to view a typical window to be removed in the project area.

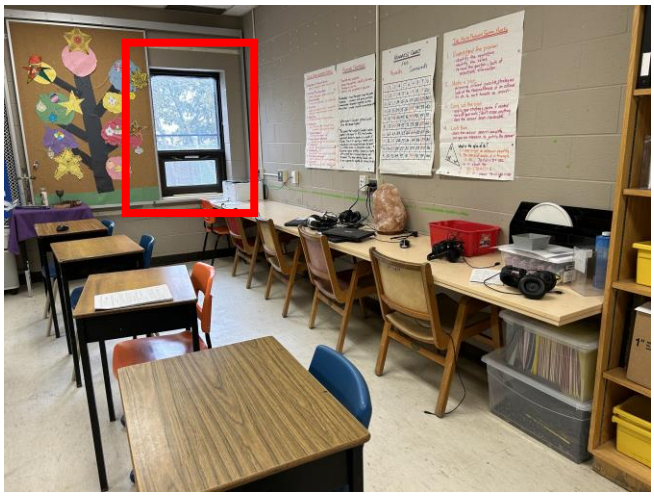


Figure 2: Example of typical window to be removed from project area.

1.4.7 Abatement contractor is responsible to remove the window in its entirety including sills, frame, glass, non-ACM frame caulking, etc.

1.4.8 Abatement contractor is responsible to provide labour for the installation of rigid hoarding to be installed over the window openings once the windows are removed.

1.4.9 Abatement contractor to demolish windows with caution and in a neat systematic manner to avoid damaging adjacent building materials present.

1.4.10 Abatement contractor to make every effort to minimize/avoid damages to surrounding wall/ceiling finishes during work.

1.4.11 Removal of vinyl floor tiles and windows is to be performed without the use of power tools. Should power tools be required, work must be completed using Type 3 Asbestos procedures. Obtain approval from Asbestos Abatement Consultant prior to proceeding with Type 3 procedures (not anticipated for this project).

1.4.12 Abatement contractor is NOT responsible for removing non-asbestos black mastic in the Type 1 Work Areas.

1.4.13 Millwork, shelving, cabinets, and other items fastened to the floor are to remain in Work Areas and are to be protected with a single layer of rip proof polyethylene and tape. Remove vinyl floor tiles neatly up to the face of fixed items to remain in the Work Areas.

1.4.13.1 Abatement Contractor is responsible to remove and dispose of vinyl baseboards. Vinyl baseboards may be disposed of as clean waste.

1.4.14 Install a single layer of rip-proof polyethylene drop sheet below window removal Work Areas.

1.4.15 Disable air handling system supplying or exhausting air into the Work Areas.

1.4.16 Seal wall vents, diffusers, etc. in Work Area with rip proof polyethylene and tape.

1.4.17 Smart screens and any other sensitive electronic equipment should be protected with rip proof polyethylene and tape as required to avoid physical damage.

1.4.18 Install rip proof polyethylene zipper flap and post asbestos warning signage at each entrance to Type 1 Work Areas.

1.4.19 Dispose of as asbestos waste, all materials removed by work of this project, unless specified otherwise.

1.4.20 Large sections of waste must be wrapped with polyethylene, sealed, and labelled as asbestos waste.

1.4.21 Make good, all damage to concrete floors created by work of this project that would affect the installation of new flooring materials. The abatement contractor is not responsible to prepare the concrete substrate to accept new flooring, rather they are only required to repair any damages (if any) caused during the abatement process.

1.4.22 The location of the waste disposal bin to be coordinated at a later date in coordination with the General Contractor and the Owner.

1.4.23 General Contractor to complete the following in the Work Area to facilitate removal of asbestos-containing vinyl floor tiles:

1.4.23.1 Remove and dispose of partition stall walls in Washrooms.

1.4.23.2 Disconnect toilets and sinks as required.

1.4.23.3 Supply, cut, and measure material for rigid hoarding to be installed over window openings by the abatement contractor.

1.4.24 The Owner is responsible to complete the following items in order to facilitate the removal of asbestos-containing vinyl floor tiles:

1.4.24.1 Re-locate all contents, furniture, and miscellaneous items where present within the Work Areas.

1.5 Schedule

1.5.1 Ensure work proceeds to schedule, meeting all requirements of this specification.

1.5.2 Asbestos abatement is anticipated to occur over two phases of work as depicted on Drawing AR-01.

1.5.3 The first phase of abatement will encompass the Work Areas on the north portion of the building between July 8, 2024 to July 21, 2024.

1.5.4 The second phase of abatement will encompass the Work Areas on the south portion of the building between July 22, 2024 to August 4, 2024.

1.5.5 Hours of abatement work are not restricted. Abatement is permitted to occur during regular hours, after hours, and on weekends at the contractor's discretion.

1.5.6 Project schedule to be coordinated in conjunction with the Owner and the General Contractor.

1.6 Quality Assurance

1.6.1 Ensure the removal and handling of ACM or asbestos contaminated materials is performed by trained and competent personnel. The Asbestos Abatement Consultant reserves the right to remove any personnel that, in their opinion, does not meet these qualifications.

1.6.2 All related work of this section shall be performed by licensed persons, experienced and qualified for the work required.

1.6.3 The Asbestos Abatement Contractor is solely responsible for the control of the project, construction practices, his Subcontractors or their agents, employees or other persons performing any of the Work.

1.7 Definitions

1.7.1 Air Monitoring: The process of measuring the fibre content of a specific volume of air.

1.7.2 Amended water: water with a non-ionic surfactant wetting agent added to reduce water surface tension to 35 or less dynes, to allow thorough wetting of asbestos fibres.

1.7.3 Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

1.7.4 Asbestos Abatement Consultant: The Owner or person designated by the owner to provide inspection and air monitoring of the Contractor's work.

1.7.5 Asbestos-Containing Material (ACM): Any material containing asbestos of any type or mixture of types.

1.7.6 Asbestos-Containing Waste Material: Any material which is or is suspected of being or any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.

1.7.7 Asbestos debris: Pieces of ACM that can be identified by colour, texture, or composition, or means dust, if the dust is determined by an accredited Asbestos Abatement Consultant to be ACM.

1.7.8 Asbestos Work Area: where the actual removal, sealing and enclosure of asbestos-containing materials takes place.

1.7.9 Authorized visitor: the Owner or his approved representative and/or persons representing regulatory agencies.

1.7.10 Barrier: Any surface that seals off the work area to inhibit the movement of fibres.

1.7.11 Clean Area: Either an operating area or an area in which removal work has already been completed.

1.7.12 Demolition: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

1.7.13 Disposal Bag: A properly labelled 6 mil thick leak-tight plastic bag used for transporting asbestos waste from the work area to the disposal site.

1.7.14 D.O.P. Test: Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out asbestos fibres.

1.7.15 Filter: A media component used in respirators, vacuum cleaners or negative pressure filter fan units to remove solid or liquid particles from the inspired air.

1.7.16 Friable Asbestos Material: Material that contains asbestos that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.7.17 HEPA Filter: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.

1.7.18 Occupied Area: Any area of the building outside the Asbestos Work Area.

1.7.19 Polyethylene: sheeting of type and thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealant, and to prevent escape of asbestos fibres through the sheeting into a clean area.

1.7.20 Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

1.7.21 Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal

encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.

1.7.22 Work: Includes all services, labour and material required to complete the work as specified in the contract.

1.8 Regulations

1.8.1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among those requirements or with these specifications the more stringent requirement shall apply. The regulations shall include but not be limited to the following:

1.8.1.1 Ontario Ministry of Labour, Occupational Health and Safety Division, Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations, O.Reg. 278/05.

1.8.1.2 Ontario Ministry of the Environment Regulation 347, under the Environmental Protection Act.

1.8.1.3 Government of Canada Regulations respecting the Handling, Offering for Transport and Transporting of Dangerous Goods. (Extract from the Canada Gazette Part II, dated February 6, 1985).

1.8.1.4 Regulations for Construction Projects O.Reg. 213/91.

1.8.1.5 Office of the Fire Commissioner of Canada.

1.8.1.6 Ontario Hydro Electrical Safety Code.

1.8.1.7 Ontario Occupational Health and Safety Act RSO 1990 c0.1 as amended.

1.8.1.8 WHMIS Regulations RRO 1990 Reg. 860.

1.9 Notification

1.9.1 Notify Sanitary Landfill site as per Ontario Regulation 347.

1.9.2 Inform all sub trades of the presence of friable ACM identified in the site conditions.

1.9.3 Notify immediately Ontario Ministry of Labour, as required by Regulation 278 as amended by O. Reg. 510/92, Section 7, if friable materials not identified in the site conditions are discovered during the project.

1.10 Submittals

1.10.1 Submit prior to starting work:

1.10.1.1 Permits for transportation of asbestos waste and location of landfill.

1.10.1.2 Proof that workers have received WHMIS training.

1.10.1.3 Work Place Safety and insurance Clearance Certificates.

1.10.1.4 Pre-removal survey of damage in all areas where asbestos abatement will take place or waste will be transported.

1.11 Worker Protection

1.11.1 Prior to commencing work instruct workers in all aspects of work procedures and protective measures.

1.11.2 Provide workers who request a respirator with personally issued marked respiratory equipment acceptable to the Occupational Health and Safety Division of the Ontario Ministry of Labour, suitable for the Asbestos exposure.

1.11.3 Ensure that suitable respiratory protective equipment is worn by every worker who enters the Asbestos Work Area. A respirator provided by an employer and used by a worker shall be:

1.11.3.1 a non-powered reusable air purifying dust respirator or better, equipped with High Efficiency Particulate Aerosol (HEPA) Filters suitable for asbestos-containing dust.

1.11.3.2 fitted so that there is an effective seal between the respirator and the worker's face;

1.11.3.3 assigned to a worker for the worker's exclusive use;

1.11.3.4 used and maintained in accordance with the procedures specified by the equipment manufacturer;

1.11.3.5 cleaned, disinfected and inspected after use on each shift, or more often if necessary;

1.11.3.6 free of damaged or deteriorated parts replaced prior to being used by a worker;

1.11.3.7 be stored in a convenient, clean and sanitary location; when not in use;

1.11.3.8 certified by the US National Institute for Occupational Safety and Health (NIOSH) or the British Standards Institution for exposure to airborne asbestos fibre.

1.11.3.9 Do not eat, drink, smoke or chew except in established locations outside the Asbestos Work Area.

1.12 Visitor Protection

1.12.1 Provide clean protective clothing and equipment and approved respirators to Authorized Visitors where requested.

1.12.2 Ensure Authorized Visitors have received required training for entry into Asbestos Work Area.

1.13 Air Monitoring

1.13.1 Air monitoring will be performed following the National Institute for Occupational Safety and Health method 7400.

1.13.2 The contractor shall cooperate fully with the asbestos abatement consultant in the collection of air monitoring samples, including the collection of personal worker samples.

1.13.3 Results of PCM samples of 0.05 fibres per millilitre of air (fibre/mL) or greater, outside of Asbestos Work Area, will indicate asbestos contamination of these areas. The contaminated areas shall be isolated and cleaned in the same manner applicable to the Asbestos Work Area, at no cost to the Owner.

2. PRODUCTS AND FACILITIES

2.1 Materials and Equipment

2.1.1 All materials and equipment brought to work site must be in good condition and free of asbestos, asbestos debris, and fibrous materials.

2.1.1.1 Disposable items must be of new materials only.

2.1.2 Asbestos Waste Container: An impermeable container acceptable to disposal site and Ministry of the Environment comprised of one of the following:

2.1.2.1 A 6 mil (0.15 mm) sealed polyethylene bag, inside a second 6 mil (0.15 mm) sealed polyethylene bag.

2.1.2.2 A 6 mil (0.15 mm) sealed polyethylene bag, positioned inside or outside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.

2.1.2.3 Label containers as required by the Ministry of the Environment and Regulation 838.

2.1.2.4 Container must be new materials only.

2.1.3 HEPA Vacuum: Vacuum with all necessary fittings, tools and attachments. All air must be filtered by HEPA filter before discharge.

2.1.4 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.

2.1.5 Rip-Proof Polyethylene Sheeting: 8 mil (0.20mm) fabric made up from 5 mil (0.13 mm) weave and 2 layers of 1.5 mil (0.05 mm) poly laminate or approved equal. In sheet size to minimize on-site seams and overlaps.

2.1.6 Sprayer: Garden-type portable manual sprayer or water hose with spray attachment if suitable.

3. EXECUTION

3.1 Site Preparation

3.1.1 Disable air handling system supplying or exhausting air into the Work Area.

3.1.2 Seal wall vents and ceiling diffusers in Work Area with polyethylene and tape.

3.1.3 Seal smart screens with polyethylene and tape.

3.1.4 HEPA vacuum or wet wipe dust from all surfaces within Asbestos Work Area.

3.1.5 Install polyethylene zipper flap and post asbestos warning signage at entrance to the Work Area.

3.2 Removal

3.2.1 Wet, where possible, all material to be disturbed.

3.2.2 Undo fasteners if necessary to remove material.

3.2.2.1 Break material only if unavoidable.

3.2.3 Wet freshly exposed edges of broken materials.

3.2.4 Wet material and use hand scraping to remove material adhered to substrate or supports. The use of power-tools is prohibited.

3.2.5 Place removed material into Asbestos Waste Containers.

3.2.6 Clean Asbestos Work Area frequently with HEPA vacuum or with wet cleaning methods.

3.3 Waste and Material Handling

3.3.1 Ensure asbestos-containing or asbestos-contaminated materials, removed during work are treated, packaged, transported and disposed of as asbestos waste.

3.3.2 Transport waste and materials through occupied areas of the building during quiet hours along predetermined routes.

3.3.3 Provide twenty-four (24) hour notice to the Owner's Representative prior to transportation through occupied areas.

3.3.4 Clean up waste routes and loading area after each load. Use asbestos abatement procedures if appropriate or requested by Owner's Representative.

3.3.5 Drop garbage bins at designated locations. Keep bins covered and enclosed while at the site. Bin loading area shall be kept clean at all times.

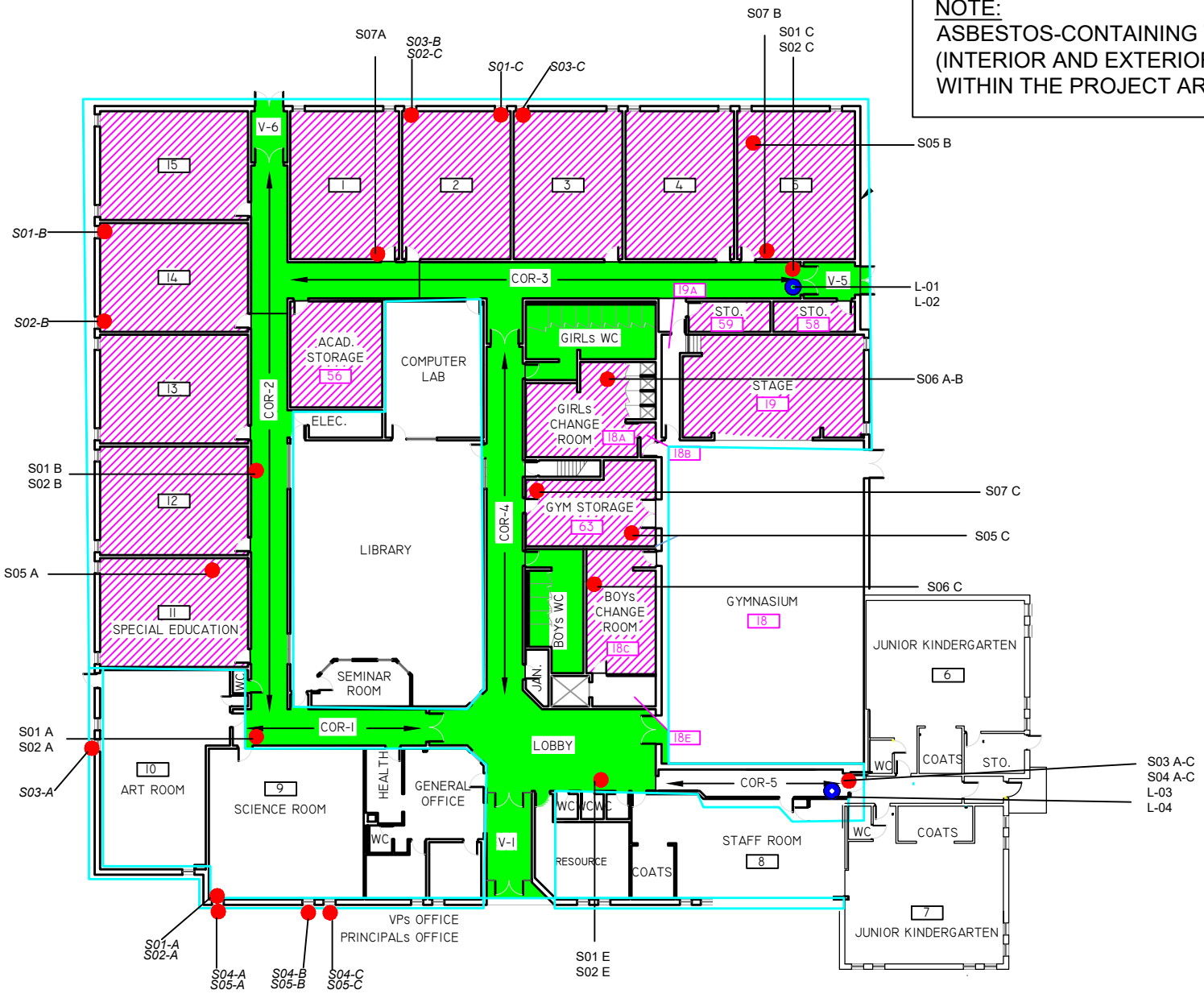
3.3.6 Pick-up and drop off of garbage bin shall be at pre-approved times, and must not interfere with the Owners operations.

3.3.7 Transport asbestos contaminated waste to landfill licensed by Ontario Ministry of Environment.

3.3.8 Co-operate with Ministry of the Environment inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

End of Section

NOTE:
ASBESTOS-CONTAINING WINDOW PUTTY (INTERIOR AND EXTERIOR) IS PRESENT WITHIN THE PROJECT AREA.



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PROJECT NO.: 21384

Drawn By: W.Davidson

Checked By: J. De Sousa

SAMPLE LOCATIONS	
SYMBOL	DESCRIPTION
	ASBESTOS BULK SAMPLE: S##
	LEAD BULK SAMPLE: L-##

CONFIRMED ACM	
SYMBOL	DESCRIPTION
	ACM CERAMIC TILE MORTAR BASE
	ACM VINYL FLOOR TILE
	OUTLINE OF SURVEYED AREA
NOTE	WINDOW PUTTY (INTERIOR AND EXTERIOR)

Designated Substance Survey

Halton Catholic District School Board

Holy Family Catholic School

1420 Grosvenor Street, Oakville

First Floor Plan

SCALE: NTS

SHEET: DS-01

DATE: January 2024

1. GENERAL

1.1 General And Related Work

1.1.1 All sections of the specifications form a part of the Contract Documents and shall be read to determine their effect upon the work of this section.

1.1.2 This specification fulfils the requirements of the report required by R.R.O. 2005, Reg. 278 as amended by O. Reg. 510/92, Section 10.

1.1.3 Related work specified elsewhere:

Division 2, General Conditions:
Section 028210- Type 1 Asbestos Removal

1.1.4 It is the intent that work performed as per this section will result in the removal and disposal of all ACM specified for removal and the decontamination of all materials that have been contaminated by ACM either during or prior to work of this section.

1.1.5 This specification document should be read in conjunction with the "Limited Designated Substance Survey Report Rv.1" prepared by Maple Environmental (dated January 29, 2024).

1.2 Project Summary

In general terms, the scope of the project involves a flooring, window, and interior door replacement project based on architectural drawings prepared by Synder Architects on behalf of the Halton Catholic District School Board.

1.3 Site Conditions

1.3.1 Refer to Section 028210 for details.

1.4 Outline of Work

1.4.1 Using Type 3 procedures as specified remove and dispose of all asbestos-containing ceramic floor tile mortar base in the Type 3 Work Area as indicated on Drawing AR-01.

1.4.2 There is approximately 5,500 square feet of asbestos-containing ceramic floor tile mortar base to be removed using Type 3 Asbestos Abatement Procedures.

1.4.3 Abatement Contractor is responsible for all take-offs.

1.4.4 Refer to Figure 1 below for examples of different views of ACM ceramic floor tile mortar base to be removed.

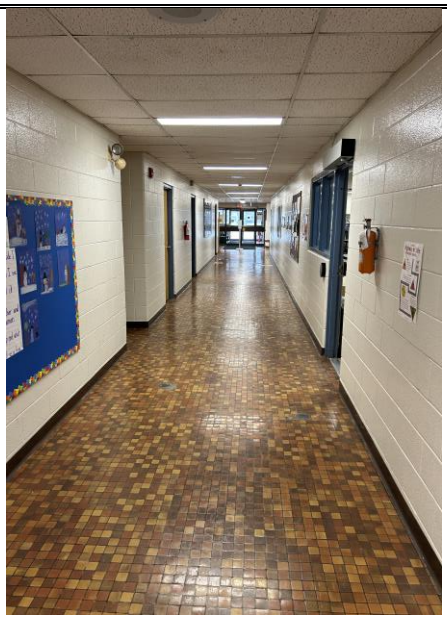


Figure 1: Examples of different ACM ceramic tile mortar base to be removed.

1.4.5 Abatement contractor to include the removal and disposal of associated ceramic floor tiles and grout. Ceramic floor tiles and grout are to be disposed of as asbestos waste.

1.4.6 Dispose of as asbestos waste, all materials removed by work of this Section, unless specified otherwise.

1.4.7 Abatement contractor is responsible to remove ceramic tile mortar base in the Boy's and Girl's Washrooms where the material is applied as a wall base.

1.4.8 Abatement Contractor is to remove and dispose of the vinyl baseboards in the Work Areas. Vinyl baseboards may be disposed of as clean waste.

1.4.9 Doors to classrooms, storage rooms, etc. (i.e. bordering the asbestos Work Areas) are to be removed or temporarily secured open in order to facilitate the removal of asbestos-containing ceramic floor tile mortar base from the Corridors.

1.4.10 Door openings to classrooms, storage rooms, etc. (bordering the asbestos Work Areas) to be sealed with a minimum of one layer of rip proof polyethylene sheeting and tape. Provide additional layers of polyethylene and/or wood or metal supports as required.

1.4.11 Seal all floor drains in Washrooms with tape.

1.4.12 Construct a three (3) chambered Worker Decontamination Unit (including a shower) at the entrance to the Work Areas with appropriate signage and Notice of Project (NOP).

1.4.13 Protect surfaces, building fabric and items not specified for removal remaining within Asbestos Work Area, including walls, ceilings, windows, door openings, etc. with a minimum of one layer of rip proof polyethylene sheeting and tape.

1.4.14 Locations of wall mounted fire pull stations and defibrillators are to be clearly identified/labelled on wall polyethylene. Secure an exacto knife to wall polyethylene in these locations in the event that the contractor requires access to these items during an emergency.

1.4.15 Existing lighting may be utilized in Work Area provided it is sealed with clear polyethylene and tape.

1.4.16 Provide additional temporary lighting in the Work Area as required.

1.4.17 Disable air handling system affecting asbestos Work Area. The air handling system shall not be enabled until completion of work.

1.4.18 Ensure there is an adequate number of negative air units within the Work Area to establish appropriate negative air pressure.

1.4.19 Ensure the exposed concrete floor is left clean, dry, and free of residual ceramic floor tile mortar base upon completion of the removal of the ceramic floor tiles and grout.

1.4.20 Make good, all damage to concrete substrate created by work of this project that would affect the installation of new flooring materials. The abatement contractor is not responsible to prepare the sub floor to accept new flooring, rather they are only required to repair any damages caused during the abatement process.

1.4.21 General Contractor to complete the following in the Work Area to facilitate removal of asbestos-containing ceramic tile mortar base:

1.4.21.1 Remove and dispose of partition stall walls in Washrooms.

1.4.21.2 Disconnect toilets and sinks as required.

1.4.21.3 Supply, cut, and measure material for rigid hoarding to be installed over window openings by the abatement contractor.

1.4.22 The Owner is responsible to complete the following items in order to facilitate the removal of asbestos-containing ceramic tile mortar base:

1.4.22.1 Re-locate all contents, furniture, and miscellaneous items where present within the Work Areas.

1.5 Schedule

1.5.1 Ensure work proceeds to schedule, meeting all requirements of this specification.

1.5.2 Asbestos abatement is anticipated to occur over two phases of work as depicted on Drawing AR-01.

1.5.3 The first phase of abatement will encompass the Work Areas on the north portion of the building between July 8, 2024 to July 21, 2024.

1.5.4 The second phase of abatement will encompass the Work Areas on the south portion of the building between July 22, 2024 to August 4, 2024.

1.5.5 Hours of abatement work are not restricted. Abatement is permitted to occur during regular hours, after hours, and on weekends at the contractor's discretion.

1.5.6 Project schedule to be coordinated in conjunction with the Owner and the General Contractor.

1.6 Supervision

1.6.1 Provide an on-site Superintendent that has the authority to oversee all aspects of the work, including but not limited to, negotiation of changes to the contract, scheduling, manpower, equipment, production, and communication and co-ordination with Asbestos Abatement Consultant.

1.6.2 The Asbestos Abatement Consultant reserves the right to reject or accept any Superintendent without explanation.

1.6.3 Supervisory personnel must hold a recognized certificate proving certification as an Asbestos Supervisor in the province of Ontario as required by Regulation 278/05 (253-S), and have supervised a minimum of five (5) other asbestos abatement projects.

1.6.4 Supervisory personnel must be on site at all times during work that may disturb ACM.

1.6.5 The Contractor cannot replace supervisory personnel without written approval from the Asbestos Abatement Consultant.

1.7 Quality Assurance

1.7.1 Ensure the removal and handling of ACM or asbestos contaminated materials is performed by trained and competent personnel having obtained certification to perform work in a Type 3 Operation in the Province of Ontario as required by Regulation 278/05. The Asbestos Abatement Consultant reserves the right to remove any personnel that, in their opinion, does not meet these qualifications.

1.7.2 All related work of this section shall be performed by licensed persons, experienced and qualified for the work required.

1.7.3 The Asbestos Abatement Consultant is empowered to order work to stop when a breach of the containment enclosure has, or is likely to occur. Cost of additional work by Contractor and/or Asbestos Abatement Consultant to remedy conditions shall be the burden of the Asbestos Abatement Contractor.

1.7.4 The Asbestos Abatement Contractor is solely responsible for the control of the project, construction practices, his Subcontractors or their agents, employees or other persons performing any of the Work.

1.8 Definitions

1.8.1 **Airlock:** a system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least 1.5 m apart.

1.8.2 **Air Monitoring**: The process of measuring the fibre content of a specific volume of air.

1.8.3 **Amended water**: water with a non-ionic surfactant wetting agent added to reduce water surface tension to 35 or less dynes, to allow thorough wetting of asbestos fibres.

1.8.4 **Asbestos**: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

1.8.5 **Asbestos Abatement Consultant**: The Owner or person designated by the owner to provide inspection and air monitoring of the Contractor's work.

1.8.6 **Asbestos-Containing Material (ACM)**: Any material containing asbestos of any type or mixture of types.

1.8.7 **Asbestos-Containing Waste Material**: Any material which is or is suspected of being or any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.

1.8.8 **Asbestos debris**: Pieces of ACM that can be identified by colour, texture, or composition, or means dust, if the dust is determined by an accredited Asbestos Abatement Consultant to be ACM.

1.8.9 **Asbestos Work Area**: where the actual removal, sealing and enclosure of asbestos-containing materials takes place.

1.8.10 **Authorized Visitor**: the Owner or his approved representative and/or persons representing regulatory agencies.

1.8.11 **Barrier**: Any surface that seals off the work area to inhibit the movement of fibres.

1.8.12 **Clean Area**: Either an operating area or an area in which removal work has already been completed.

1.8.13 **Curtained Doorway**: an arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two overlapping sheets of polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. All free edges of polyethylene shall be reinforced with duct tape and the bottom edge shall be weighted to ensure proper closing. Each polyethylene sheet shall overlap openings not less than 1.5 m on each side.

1.8.14 **Demolition**: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

1.8.15 **Disposal Bag**: A properly labelled 6 mil thick leak-tight plastic bag used for transporting asbestos waste from the work area to the disposal site.

1.8.16 **D.O.P. Test**: Dioctylphthalate aerosol challenge of a HEPA filter system and is used to establish the integrity and effectiveness of the system to filter out asbestos fibres.

1.8.17 **Encapsulant:** A material that surrounds or embeds asbestos fibres in an adhesive matrix, to prevent release of fibres.

1.8.17.1 **Bridging Encapsulant**: an encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.

1.8.17.2 **Penetrating Encapsulant**: an encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.

1.8.17.3 **Removal Encapsulant**: a penetrating encapsulant specifically designed to minimize fibre release during removal of asbestos-containing materials rather than for in situ encapsulation.

1.8.18 **Encapsulatio**n: Applying to asbestos-containing materials, with an encapsulant.

1.8.19 **Filter**: A media component used in respirators, vacuum cleaners or negative pressure filter fan units to remove solid or liquid particles from the inspired air.

1.8.20 **Fitting**: Unless otherwise described in Site Conditions, all connections of a pipe which include elbows, ends, caps, valves, hangers, tees and unions.

1.8.21 **Friable Asbestos Material**: Material that contains asbestos that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.8.22 **Glove Bag**: A sack with inward projecting long sleeve gloves, which are designed to enclose an object from which an asbestos-containing material is to be removed.

1.8.23 **HEPA Filter**: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.

1.8.24 **Negative Pressure**: a system which extracts air directly from work area, filters such extracted air through a High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building. This system shall maintain a minimum pressure differential of 0.03 inches Water Gauge relative to adjacent areas outside of work areas, be equipped with an alarm to warn of system breakdown, and be equipped with an instrument to continuously monitor and automatically record pressure differences.

1.8.25 **Negative Pressure Respirator**: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

1.8.26 **Occupied Area**: Any area of the building outside the Asbestos Work Area.

1.8.27 **Polyethylene**: sheeting of type and thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealant, and to prevent escape of asbestos fibres through the sheeting into a clean area.

1.8.28 **Positive Pressure Respirator**: A respirator in which the air pressure inside the respiratory inlet covering is positive during inhalation and exhalation in relation to the air pressure of the outside atmosphere.

1.8.29 **Respirator**: A device designed to protect the wearer from the inhalation of harmful atmospheres.

1.8.30 **Straight Run Pipes**: Part of the building system not included under the description of Fitting, including but not limited to straight, angled or curved sections of pipe, pumps, headers and reducers.

1.8.31 **Surfactant**: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

1.8.32 **Water Filtration Sy**stem: A multi-stage filtration system for filtering shower and wastewater. Typically constructed with at least two filters, the primary stage retains 20 microns or larger particles and the final stage removes 5 micron or larger particles.

1.8.33 **Wet Cleaning**: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.

1.8.34 **Work**: Includes all services, labour and material required to complete the work as specified in the contract.

1.9 Regulations

1.9.1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among those requirements or with these specifications the more stringent requirement shall apply. The regulations shall include but not be limited to the following:

1.9.1.1 Ontario Ministry of Labour, Occupational Health and Safety Division, Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations, O. Reg. 278/05.

1.9.1.2 Ontario Ministry of the Environment Regulation 347, under the Environmental Protection Act.

1.9.1.3 Government of Canada Regulations respecting the Handling, Offering for Transport and Transporting of Dangerous Goods. (Extract from the Canada Gazette Part II, dated February 6, 1985).

1.9.1.4 Regulations for Construction Projects O. Reg. 213/91.

1.9.1.5 Office of the Fire Commissioner of Canada.

1.9.1.6 Ontario Hydro Electrical Safety Code.

1.9.1.7 Ontario Occupational Health and Safety Act RSO 1990 c0.1 as amended.

1.9.1.8 WHMIS Regulations RRO 1990 Reg. 860.

1.10 Notification

1.10.1 Notify the Ministry of Labour, Construction Health and Safety Branch, as per R.R.O. 2005, Reg. 278 as amended by O. Reg. 510/92, for Type 3 removal work.

1.10.2 Notify Sanitary Landfill site as per Ontario Regulation 347.

1.10.3 Inform all sub trades of the presence of friable ACM identified in the site conditions.

1.10.4 Notify immediately Ontario Ministry of Labour, as required by Regulation 278 as amended by O. Reg. 510/92, Section 7, if friable materials not identified in the site conditions are discovered during the project.

1.11 Submittals

1.11.1 Submit prior to starting work:

1.11.1.1 Permits for transportation of asbestos waste and location of landfill.

1.11.1.2 Names and credentials of supervisory personnel.

1.11.1.3 Proof in the form of a certificate that supervisory personnel have attended a training course on asbestos removal.

1.11.1.4 Proof with references that supervisory personnel have supervised at least five other asbestos removal projects.

1.11.1.5 Proof that all workers performing Type 3 asbestos removal have 253-W certification cards as required by O. Reg. 278/05.

1.11.1.6 Proof that workers have received WHMIS training.

1.11.1.7 Work Place Safety and insurance Clearance Certificates.

1.11.1.8 Proposed schedule including all stages of work (if applicable).

1.11.1.9 Shop drawings for each Work Area detailing waste and worker decontamination facilities, platform and hoarding layouts, location of negative

air discharge panels, Material Safety Data Sheets for chemicals or materials used in the course of the project.

1.11.1.10 Negative air unit performance data and results of D.O.P. tests as required.

1.11.1.11 Certificate proving that each worker on site has been fit tested for the respirator appropriate for the work being performed.

1.11.1.12 Pre-removal survey of damage in all areas where asbestos abatement will take place or waste will be transported.

1.11.1.13 Ministry of Labour Notice of Project form.

1.12 Worker Protection

1.12.1 Prior to commencing work instruct workers in all aspects of work procedures and protective measures.

1.12.2 Provide workers with personally issued marked respiratory equipment acceptable to the Occupational Health and Safety Division of the Ontario Ministry of Labour, suitable for the Asbestos exposure.

1.12.3 Ensure that suitable respiratory protective equipment is worn by every worker who enters the Asbestos Work Area. A respirator provided by an employer and used by a worker shall be:

1.12.3.1 A full-face non-powered reusable air purifying dust respirator or better, equipped with High Efficiency Particulate Aerosol (HEPA) Filters suitable for asbestos-containing dust for Type 3 Operations where the asbestos-containing materials are wetted and where sprayed asbestos is present, the spray material only contains chrysotile asbestos.

1.12.3.2 Fitted so that there is an effective seal between the respirator and the worker's face;

1.12.3.3 Assigned to a worker for the worker's exclusive use;

1.12.3.4 Used and maintained in accordance with the procedures specified by the equipment manufacturer;

1.12.3.5 Cleaned, disinfected and inspected after use on each shift, or more often if necessary;

1.12.3.6 Free of damaged or deteriorated parts replaced prior to being used by a worker;

1.12.3.7 Be stored in a convenient, clean and sanitary location; when not in use;

1.12.3.8 Certified by the US National Institute for Occupational Safety and Health (NIOSH) or the British Standards Institution for exposure to airborne asbestos fibre.

1.12.4 Protective Clothing:

1.12.4.1 Provide workers with full body disposable coveralls. Full body disposable type coveralls shall be:

1.12.4.1.1 Worn by every worker who enters the work area,

1.12.4.1.2 Made of a material which does not readily retain nor permit penetration of asbestos fibres,

1.12.4.1.3 full body covering including head covering with snug fitting cuffs at the wrists, ankles and neck,

1.12.4.1.4 Include suitable footwear,

1.12.4.1.5 Repaired or replaced if torn.

1.12.4.2 Provide other body protection required under applicable safety regulations.

1.12.4.3 Do not eat, drink, smoke or chew except in established locations outside the Asbestos Work Area.

1.12.4.4 Personnel must be fully protected at all times when possibility of disturbance of asbestos exists.

1.12.4.5 Provide and post in Clean Change Room the procedures described under Worker Protection.

1.12.5 Work Area Entry Procedures

1.12.5.1 Personnel and Authorized Visitors are to use the following procedures to enter contaminated Asbestos Work Area:

1.12.5.1.1 Remove all clothing including undergarments and footwear in Clean Change Room.

1.12.5.1.2 Put on respirator with new or tested filters, and coveralls in Clean Change Room.

1.12.5.1.3 Store all street clothes, uncontaminated footwear, towels, etc. in the Clean Change Room.

1.12.6 Work Area Exit Procedures

1.12.6.1 Personnel and Authorized Visitors are to use the following procedures to exit contaminated Asbestos Work Area:

1.12.6.1.1 Remove visible contamination from protective clothing using HEPA vacuum or by wet wiping.

1.12.6.1.2 Proceed to Equipment and Access Room and remove all contaminated clothing and equipment except respirator.

1.12.6.1.3 Store contaminated footwear, hard hats, etc. in Equipment and Access Room.

1.12.6.1.4 Proceed naked to showers while still wearing respirator.

1.12.6.1.5 Shower, cleaning outside of respirator with soap and water. Thoroughly wet body, head and hair, remove respirator and wash body, head and hair. Wet clean inside and outside of respirator face piece.

1.12.6.1.6 Remove filters for testing or dispose as asbestos waste. Remove prior to entering the Clean Change Room.

1.12.6.1.7 Cover openings on filters to be re-used with duct tape prior to entering the clean area.

1.12.6.1.8 Proceed to the Clean Change Room, dry off and dress in street clothing.

1.13 Visitor Protection

1.13.1 Provide clean protective clothing and equipment and approved respirators to Authorized Visitors.

1.13.2 Ensure Authorized Visitors have received required training for entry into Asbestos Work Area.

1.14 Air Monitoring

1.14.1 Air monitoring will be performed following the National Institute for Occupational Safety and Health method 7400.

1.14.2 The contractor shall cooperate fully with the asbestos abatement consultant in the collection of air monitoring samples, including the collection of personal worker samples.

1.14.3 Results of PCM samples of 0.05 fibres per millilitre of air (fibre/mL) or greater, outside of Asbestos Work Area, will indicate asbestos contamination of these areas. The contaminated areas shall be isolated and cleaned in the same manner applicable to the Asbestos Work Area, at no cost to the Owner.

1.14.4 Clearance air monitoring samples will be collected after a suitable settling period following application of lock-down agent. Clearance levels must be less than 0.01 fibre/mL for the Work Area to be deemed clean. Contractor to provide aggressive air sampling equipment (leaf blower and fan) for consultant's use.

2. PRODUCTS

2.1 Materials and Equipment

2.1.1 Polyethylene Sheeting: A single polyethylene film, 0.15 mm (6 mil) minimum thickness unless otherwise specified.

2.1.2 Rip Proof Polyethylene Sheeting: Woven fibre reinforced fabric bonded both sides with polyethylene sheeting. 0.20 mm (8-mil) fabric made up from 0.13 mm (5-mil) weave and 2 layers 0.04 mm (1.5-mil) poly laminate.

2.1.3 Flame-Resistant Polyethylene Sheeting: A single polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films, 0.15 mm (6-mils) thickness.

2.1.4 Drop Sheets: In polyethylene type and size appropriate for the work being performed.

2.1.5 Tape: Reinforced cloth or fibreglass reinforced tape in 2" or 3" widths suitable for sealing polyethylene sheeting under both wet conditions using amended water, and dry conditions.

2.1.6 Spray Cement: Spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

2.1.7 Caulking: One component non-staining acrylic polymer sealant to conform to GSB Specification 19GP-5M.

2.1.8 Foam: Low density polyurethane expanding foam Froth-Pack or equivalent or better.

2.1.9 Wetting Agent: Non-sudsing surface active agent. Acceptable product Aqua-Gro or approved equal.

2.1.10 Sealer: Slow-drying sealer shall be a non-staining, clear, water dispersable type that remains tacky on the surface for a minimum of 8 hours for the purpose of trapping any residual airborne fibres during the settling period. The product must have flame spread and smoke development ratings both less than 50 and shall leave no stain when dry. Acceptable products: Borden Polyco 804, Double AD TC-55, equivalent or better. Also referred to as "Lockdown Agent".

2.1.11 Encapsulant: Type 1 penetrating Class A water based encapsulant conforming to CGSB 1-GP-205M and approved by the Fire Marshall having flame spread and smoke development ratings both less than fifty (50). Acceptable products: Ocean 666, Decadex Fire Check equivalent or better.

2.1.12 Asbestos Waste Containers: Waste shall be contained in two separate containers which shall be dust-tight and impervious to asbestos and any chemicals used during the removal process. The inner container shall be a sealable polyethylene bag (or where the glove bag method is used, the glove bag itself). Where there are sharp objects included in the waste material, the outer container shall be a sealable fibre type drum, otherwise the outer container may either be a sealable polyethylene bag. Containers shall be as follows:

2.1.12.1 Polyethylene Waste Bag: 0.15 mm (6 mil) thick leak-tight polyethylene bags labelled as required by sub-section 3.5 Waste Disposal.

2.1.12.2 Fibre Drums: 55 US gallon capacity heavy duty leak tight fibre drums with tight sealing locking metal top and metal bottom.

2.1.12.3 Labels: Waste containers shall have a pre-printed cautionary asbestos warning label, acceptable to local dump authorities, clearly visible when ready for removal to disposal site.

2.1.13 Fire Extinguishers: Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

2.1.14 First Aid Supplies: Comply with governing regulations and recognized recommendations within the construction industry.

2.1.15 Ground Fault Panel: Electrical panel, installed by licensed electrician and equipped as follows:

2.1.15.1 Ground fault circuit interrupters of sufficient capacity to power temporary electrical equipment and lights in Asbestos Work Area.

2.1.15.2 Interrupters to have a 5 mA ground fault protection.

2.1.15.3 Necessary accessories including main switch disconnect, ground fault interrupter lights, test switch to ensure unit is working, and reset switch.

2.1.15.4 Openings sealed to prevent moisture or dust penetration.

2.1.16 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.

2.1.17 Lock-down Agent: Sealant for purpose of trapping residual dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Lock-down agent shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate.

2.1.18 Negative Air Unit: Portable air handling system which extracts air directly from the Asbestos Work Area and discharges the air to the exterior of the Asbestos Work Area. Equipped as follows:

2.1.18.1 Prefilter and HEPA filter. Air must pass HEPA filter before discharge.

2.1.18.2 Pressure differential gauge to monitor filter loading.

2.1.18.3 Auto shut off and warning system for HEPA filter failure.

2.1.18.4 Separate hold down clamps to retain HEPA filter in place during change of prefilter.

2.1.19 Protective Coveralls: Disposable full body coveralls complete with hoods manufactured of a material which does not permit penetration of asbestos fibres.

2.1.20 Airless Sprayer: Spray equipment for amended water: for application to asbestos-containing materials for saturation prior to removal. Airless spray units are only acceptable, such as Grace Hydrospray or approved equal.

2.1.21 Power Washer: Spray equipment for saturation of asbestos-containing material with amended water for cleaning of surfaces in abatement work area after asbestos removal, capable of delivering an airless stream of water at a pressure of not less than 1200 psi or exceeding 2500 psi.

2.1.22 Fine Atomizing Spray Nozzle: Nozzle for airless sprayer capable of delivering not less than 1 gallon per minute of fine particle spray of amended water.

2.1.23 Garden Sprayer: A hand pump type pressure-can garden sprayer fabricated out of either metal or plastic, equipped with a metal wand at the end of a hose that can deliver a stream or fine spray of liquid of amended water under pressure.

2.1.24 Scaffolding: The type, erection and use of all scaffolding shall comply with all applicable OSHA provisions.

2.1.25 Temporary Lighting: Provide general service incandescent lamps or fluorescent lamps of wattage required for adequate illumination as required by the work. Protect lamps with guard cages grounded together to distribution panel or tempered glass enclosures.

2.1.26 Electrical Power Cords: Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas of work.

2.1.27 Water Heater: ULC rated electric water heater appropriately sized for project to supply hot water for the Decontamination Unit shower. Activate from ground fault panel. Provide with relief valve compatible with water heater operation; pipe relief valve down to drip pan on floor with rigid piping. Drip pans shall consist of a 12" x 12" x 6" deep pan, made of 19 gauge galvanized steel, with handles.

2.1.28 Sump Pump: Provide totally submersible waterproof sump pump with integral float switch and shall have a manual switch. Provide unit sized to pump 2 times the flow capacity of all showers or hoses supplying water to the sump, through the filters specified herein when they are loaded to the extent that replacement is required. Provide unit capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump.

2.1.29 Shower: General shower shall be of the walk through type to permit use by one person at a time.

2.1.29.1 Shower Enclosure: Shower enclosure shall be of a minimum 24 gauge steel walls with baked enamel, galvanized steel, aluminum or stainless steel finish, 16 gauge floor with porcelain enamel finish, brass drain and tapping for mixing valve. Shower installation shall be complete with globe valve for tempered water with a shower head complete with orifice to restrict the flow to 2.5 USGPM.

2.1.29.2 Shower Pan: Provide one piece waterproof shower pan of minimum size 4' x 8' by 6" deep. Fabricate from seamless fibreglass minimum 1/16" thick reinforced with wood, 18 ga. stainless or galvanized steel with welded seems or, copper or lead with soldered seams.

2.1.29.3 Shower Head and Controls: Provide a factory-made shower head producing a spray of water which can be adjusted for spray size and intensity. Feed shower separately with water from hot and cold supply lines. Arrange so that control of water temperature, flow rate, and shut off is from inside shower without outside aid.

2.1.29.4 Hose Bib: Provide heavy bronze angle type with wheel handle, vacuum breaker, and 3/4" National Standard male hose outlet.

2.1.29.5 Filters: Provide multi-stage cascaded filter units on drain lines from showers or any other water source carrying asbestos-contaminated water from the work area. Provide units with disposable filter elements where the primary filter passes particle 20 microns and smaller and the final filter passes particles 5 microns and smaller. Connect so that discharged water passes primary filter and output of primary filter passes through secondary filter.

2.1.30 Type A Hoarding Wall: wall separating Occupied Area from Work Area consisting of the following:

2.1.30.1 wood or metal studs at 24" on centre with top and bottom plate fitted snugly to underside of ceiling. Provide gasket between top plate and ceiling as required.

2.1.30.2 2 layers of independently sealed rip-proof polyethylene sheeting on Work Area side of wall.

3. EXECUTION

3.1 Preparation Prior to Contamination

3.1.1 Perform pre-removal damage survey and submit to Asbestos Abatement Consultant.

3.1.2 General Contractor to complete the following in the Work Area to facilitate removal of asbestos-containing ceramic floor tile mortar base:

3.1.2.1 Remove and dispose of partition stall walls in Washrooms.

3.1.2.2 Disconnect sinks and associated plumbing in Washrooms.

3.1.2.3 Disconnect toilets and associated plumbing in Washrooms.

3.1.3 Abatement Contractor is to remove and dispose of the vinyl baseboards in the Work Areas. Vinyl baseboards may be disposed of as clean waste.

3.1.4 The Owner will be responsible to re-locate all contents present within the Work Areas to a designated storage location in the building.

3.1.5 Disable air handling system affecting asbestos Work Area. The air handling system shall not be enabled until completion of work.

3.1.6 Protect surfaces, building fabric and items not specified for removal remaining within Asbestos Work Area, including walls, ceilings, windows, door openings, etc. with a minimum of one layer of rip proof polyethylene sheeting.

3.1.7 Doors to classrooms, offices, etc. (bordering the asbestos Work Areas) are to be removed or temporarily secured open in order to facilitate the removal of asbestos-containing ceramic floor tile mortar base from the corridors.

3.1.8 Door openings to classrooms, offices, etc. (bordering the asbestos Work Areas) to be sealed with a minimum of one (1) layer of rip proof polyethylene sheeting. Provide additional layers of polyethylene and/or wood or metal supports as required.

3.1.9 Seal floor drains in Washrooms with tape.

3.1.10 Existing lighting may be utilized in Work Area provided it is sealed with clear polyethylene and tape.

3.1.11 Provide additional temporary lighting in the Work Area as required.

3.1.12 Install Waste and Worker Decontamination Facility for each of the Work Areas. Worker Decontamination Enclosure System shall comprise of an Equipment and Access Room, a Shower Room, and a Clean Room, as follows:

3.1.12.1 **Equipment and Access Room**: build an Equipment and Access Room between Shower Room and work areas, with two air locks, one to the Shower Room and one to work areas. The Equipment and Access Room shall be large enough to accommodate the storage of work boots, or any other protective clothing that might be used again, and at least three workers allowing them sufficient space to undress comfortably.

3.1.12.2 **Shower Room**: build a Shower Room between the Clean Room and Equipment and Access Room, with two air locks, one to the Clean Room and one to Equipment and Access Room. Provide a constant supply of hot and cold water. The Shower Room shall have individual controls inside the room to regulate water temperature and flow. Provide piping and connect to water sources and drains. Pump waste water through a 5 micrometre filter system acceptable to Consultant before directing into drains. Provide soap, clean towels and appropriate containers for disposal of used respirator filters.

3.1.12.3 **Clean Room**: build a Clean Room between the Shower Room and clean areas outside of enclosures, with two air locks, one to outside of enclosures and one

to Shower Room. Provide lockers or hangers for workers street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install a mirror to permit workers to fit respiratory equipment properly, and sufficient hangers and hooks.

3.1.12.4 Construct Worker Decontamination Enclosures as follows:

3.1.12.4.1 Build suitable framing for enclosures, and line with polyethylene sheeting sealed with tape. Framing shall be constructed of 2" x 4" wood or metal studs at 24" 0.C (max.) with 2" x 4" sill and top plates fastened with metal fasteners. Use 2 layers of rip-proof polyethylene on floors. Use 2 layers of polyethylene sheeting on walls and ceiling. Exterior to be covered with rigid sheathing (drywall) taped at seams and joints (not mudded). Provide solid door entry to decontamination facility complete with lock-set. Provide duplicate keys to project consultant.

3.1.12.4.2 Build curtained doorways between enclosures.

3.1.12.4.3 Provide viewing port into Work Area.

3.1.13 Erect Type A walls separating Asbestos Work Area from Occupied Areas.

3.1.14 Supply water as required for Asbestos Work Area and Decontamination Facilities. Water will be supplied by the Owner from existing potable water system. Contractor is responsible for all fittings. Contractor shall install using vacuum breakers or other backflow preventer as required by local authority.

3.1.14.1 Water supply shall be by means of high-pressure hose and fittings. A master shut-off valve shall be installed adjacent to, and on the clean side, of the decontamination facility. Any hose and hose connections must be for high pressure only and downstream of the master shut-off valve and is not to be left under pressure unattended. Maintain hose connections and outlet valves in leak-proof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from pans as it accumulates.

3.1.15 Provide and install drainage facilities from temporary shower.

3.1.16 Provide and install drainage in removal work areas as required.

3.1.17 Provide and install a filtration system to filter all water to be disposed of from the removal and decontamination area.

3.1.18 Pre-clean all surfaces in the Asbestos Work Area, using a HEPA vacuum or damp cloth prior to installing protection.

3.1.19 Fire alarms, heat detectors, and smoke detectors will remain active. Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Fire Commissioner of Canada and Provincial Fire Marshall.

3.1.20 Provide a fire extinguisher at each emergency exit and in both sides of the decontamination facilities.

3.1.21 Install temporary lighting in all work areas at levels that will provide for a safe and efficient use of the work area. Install battery powered emergency lights so as to Light exit routes through Asbestos Work Area.

3.1.22 Establish negative pressure in Asbestos Work Areas as follows:

3.1.22.1 Distribute negative air filter/fan units evenly around the Asbestos Work Area. Remove windows and replace with 1/2" plywood with appropriately sized openings for exhaust. Switch the negative air pressure system to the "ON" mode and operate continuously until final completion of the work, including final cleanup. Exhaust air to the outside of the building using sealed ducting. A spare negative air unit will be fully installed and ready to operate as a backup unit. The negative air pressure system must have the capacity to exchange air volume of the work area three times per hour and maintain a minimum of 0.03 inches of water gauge differential. Operate negative pressure system continuously from the time the first polyethylene is installed to seal openings until final completion of the work including final cleanup and air testing. Replace pre-filters and HEPA filters as required and on a regular basis to maintain even and constant draw across negative air unit. Do not discharge negative air ducting with-in 25 feet of building access points. Replace windows removed for discharge panels upon completion of project.

3.1.22.2 Leak test negative air units in place using DOP method.

3.1.22.3 Do not discharge negative air units into Occupied Areas unless specified or with written approval from Asbestos Abatement Consultant.

3.1.22.4 Provide continuous reading pressure differential monitor to monitor site pressure for duration of project.

3.1.23 Isolate at panel and disconnect or ground existing power supply to Asbestos Work Area where necessary. Power supply to remaining areas of building must not be disrupted during work of this section.

3.1.24 Post signs at locations where access to a sealed Asbestos Work Area is possible. Signs shall be installed at Curtained Doorways leading directly into a contaminated area.

3.1.25 Such signs shall read:

CAUTION

Asbestos Hazard Area
No Unauthorized Entry
Wear assigned protective equipment
Breathing asbestos dust may cause serious bodily harm

3.1.26 Do not proceed to Asbestos Removal without written notification from Consultant. Provide Consultant with 24 hours notification of request for review of site preparations.

3.2 Asbestos Removal

3.2.1 Apply the specified wetting agent to the asbestos-containing ceramic floor tile mortar base using an airless spray equipment capable of providing a "mist" application to prevent release of fibres. Saturate the asbestos material sufficiently to wet it to the substrate without causing excess dripping.

3.2.1.1 Spray the asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion. Score the outer surface where water does not penetrate the outer layers.

3.2.2 Remove the saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed, pack the material in

sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

3.2.2.1 Place enough material into bags that makes the bags easy to handle and do not over fill. Seal all filled waste containers with a layer of tape.

3.2.3 Collect waste water from the floor, do not allow it to pool.

3.2.3.1 Mist the air continuously where asbestos is being disturbed with amended water using one dedicated airless sprayer equipped with a fine atomizing nozzle.

3.2.3.2 If fibre levels exceed 2.0 f/cc, then additional dedicated sprayer(s) will be required as directed by the Asbestos Abatement Consultant.

3.2.3.3 Contain waste water in sealable plastic containers, suitable for transport and disposal without leaking or dispose of by pumping into a settling tank, filtering the water using specified filters, and then pumping into a sanitary sewer.

3.2.4 Clean external surfaces of the waste bags thoroughly by wet sponging. Remove from immediate working area to Equipment and Access Chamber of the Decontamination Unit.

3.2.4.1 Clean external surfaces of the waste bags thoroughly again by wet sponging before moving containers to Decontamination Shower chamber.

3.2.4.2 Once in the Shower Chamber, place waste bag into a second poly waste bag and seal the bag with tape. Ensure that containers are removed from the Decontamination Unit by workers who have entered from uncontaminated areas dressed in clean coveralls.

3.2.5 Use power tools, grinders, scrapers or any other mechanical equipment as required to remove the asbestos-containing fibrous backing material debris remaining adhered to the adhesive.

3.2.6 After completion of scraping removal work, all surfaces from which asbestos has been removed shall be wire brushed and wet-sponged to remove all visible material. During this work the surfaces shall be kept wet.

3.2.7 After wire brushing and wet sponging to remove visible asbestos, wet clean the entire work area including the Equipment and Access Room, and equipment used in the process.

3.2.7.1 Pre-filters on negative air units shall be treated as asbestos waste and disposed of accordingly. Place new filter and pre-filters on Negative Air Units.

3.2.8 Do not proceed with work of applying Lock-down Agent without obtaining written permission from the Asbestos Abatement Consultant indicating a Visual Clearance Inspection has been performed and the site is satisfactory to the Consultant. Provide a minimum of 24 hours notice to consultant for the need of a visual clearance inspection.

3.3 Application of Lock-down Agent

3.3.1 After completion of the final cleaning and after the Asbestos Abatement Consultant has passed a Visual Clearance Inspection, spray sealant (approved by the Asbestos Abatement Consultant) on all surfaces in the Asbestos Work Area.

3.3.2 Allow a 24 hour settling period, and for the sealer to dry. During this settling period, no entry or activity will be permitted in the work area.

3.3.3 Obtain written permission from Asbestos Abatement Consultant to proceed with Asbestos Work Area Dismantling following acceptable clearance air monitoring results of 0.01 f/mL. Should clearance air monitoring results exceed 0.01 f/mL, the contractor will, at no cost to the owner, re-clean the entire Asbestos Work Area and apply another coat of Lock Down Agent.

3.4 Asbestos Work Area Dismantling

3.4.1 Maintain the perimeter seal and use Worker Decontamination Facility.

3.4.2 Operate negative air units during teardown is completed.

3.4.3 Remove all polyethylene, tape, and enclosures from Asbestos Work Area.

3.4.4 Remove visible fibres or residue found during removal of polyethylene using a HEPA vacuum.

3.4.5 Place Polyethylene, tape, cleaning material, clothing and other contaminated waste in asbestos waste containers and dispose of as asbestos waste.

3.4.6 Seal vacuum hoses and fittings, flexible ductwork and all tools used in contaminated work site in 6-mil polyethylene bags prior to removal from Work Area.

3.4.7 Wash equipment used in contaminated Asbestos Work Area to remove all asbestos contamination, or double bag for transportation prior to being removed from Asbestos Work Area, via waste and equipment decontamination facility.

3.4.8 Clean up Asbestos Work Area, Equipment and Access area, washing/Showering Room, and other enclosures that may be contaminated.

3.4.9 Remove polyethylene protection and hoarding walls where hoarding walls separate occupied areas from Work Area.

3.4.10 Remove polyethylene sheeting from contaminated side of decontamination facilities.

3.4.11 Wash and mop with clean water all surfaces in the Asbestos Work Area.

3.4.12 Remove all temporary lights, ground fault panels and Negative Pressure Units.

3.4.13 Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape.

3.4.14 Remove decontamination facilities, platforms and platform scaffolding, tunnels, etc.

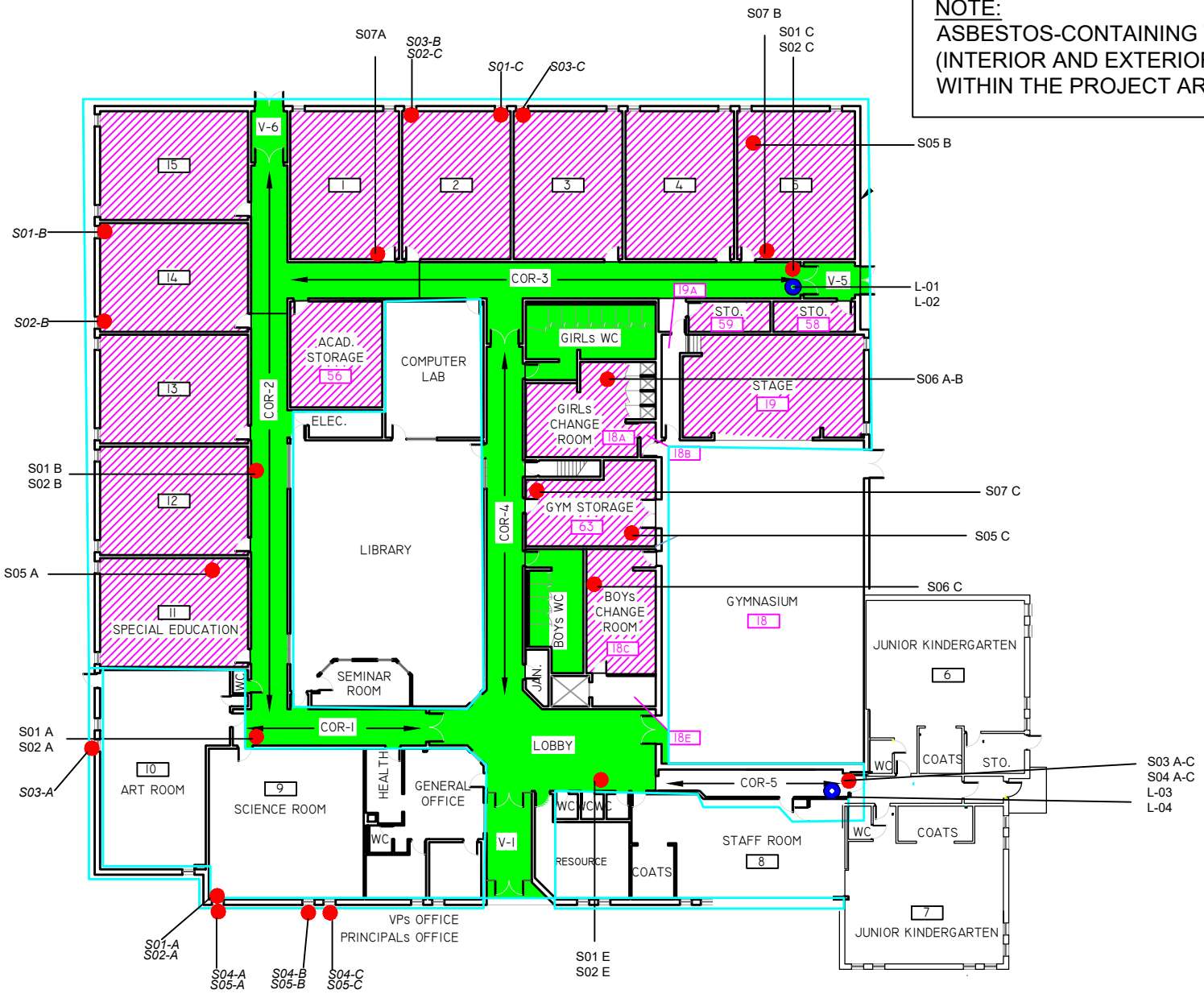
3.4.15 Damp mop and clean with HEPA vacuum Occupied Areas previously below platforms, tunnels and decontamination facilities with HEPA vacuum.

3.5 Re-establishment of Objects and Systems

3.5.1 Make good at completion of work, all damage not identified in pre-removal survey.

End of Section

NOTE:
ASBESTOS-CONTAINING WINDOW PUTTY (INTERIOR AND EXTERIOR) IS PRESENT WITHIN THE PROJECT AREA.



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PROJECT NO.: 21384

Drawn By: W.Davidson

Checked By: J. De Sousa

SAMPLE LOCATIONS	
SYMBOL	DESCRIPTION
	ASBESTOS BULK SAMPLE: S##
	LEAD BULK SAMPLE: L-##

CONFIRMED ACM	
SYMBOL	DESCRIPTION
	ACM CERAMIC TILE MORTAR BASE
	ACM VINYL FLOOR TILE
	OUTLINE OF SURVEYED AREA
NOTE	WINDOW PUTTY (INTERIOR AND EXTERIOR)

Designated Substance Survey

Halton Catholic District School Board

Holy Family Catholic School

1420 Grosvenor Street, Oakville

First Floor Plan

SCALE: NTS

SHEET: DS-01

DATE: January 2024

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, 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: One-component; urethane / acrylic polymer based, high solids, liquid sealer; clear and transparent, non-yellowing formulation; chemical-resistant; maximum 200 g/L VOC content; eg. Decra-Seal W/B by W. R. Meadows of Canada Limited.

.2 Slip-Resistant Additive: Finely ground polymer, silica-free aggregate; eg. Sure-Step by W. R. Meadows of Canada Limited.

2.3 MIXING

.1 Mix slip-resistant additive into sealer at manufacturer's recommended rate.

.2 Occasionally stir mixture to keep particles well suspended within coating.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 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.

3.3 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 06 20 00 - Finish Carpentry.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 07 26 00 - Vapour Retarders.

.5 Section 07 27 00 - Air Barriers.

.6 Section 07 62 00 - Sheet Metal Flashing and Trim.

.7 Section 07 92 00 - Joint Sealants.

.8 Section 08 51 13 - Aluminum Windows.

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

.5 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.

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

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

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

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

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

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

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

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

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

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

.16 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 a manner 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.

1.6 EXISTING CONDITIONS

.1 Existing conditions at Place of the Work may require adjustment to counteract variations resulting from inaccuracies in previous construction.

.2 Restricted availability of imperial-sized Products may also require adjustments be made.

.3 Make necessary adjustments to ensure proper fit and coursing of masonry.

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 OD; 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.

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 REINFORCEMENT AND ANCHORAGES

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

.2 Multiple Wythe Joint Reinforcement: To CSA A370; Ladder-type, Extra Heavy Duty, fabricated from steel wire to ASTM A951/A951M; mill galvanized; eg. BL-12 by Blok-Lok.

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

.4 Strap Anchors: 6.0 mm thick, 38 mm wide steel plate with 50 mm long Z-shaped bends; hot dipped galvanized; lengths to suit application; eg. BLT-11Z by Blok-Lok.

.5 Anchors: To CSA A370; purpose made for substrate; stainless steel for exterior walls, mill galvanized for interior walls.

2.4 MASONRY ACCESSORIES

.1 Flexible Membrane Flashing: 0.5 mm thick flexible polyvinyl chloride (PVC) sheet.

.2 Flashing Tape: 75 mm wide, self-adhesive sealing tape; eg. X-Seal Tape by Blok-Lok.

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

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

2.5 MORTAR MIXES

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

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

2.6 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.

2.7 GROUT MIXES

.1 Grout for Use in Spaces 50 mm or Wider: To CAN/CSA-A179, Coarse Grout using Property Specification method; Portland cement-sand-coarse aggregate mix.

.2 Grout for Use in Spaces Narrower than 50 mm: To CAN/CSA-A179, Fine Grout using Property Specification method; Portland cement-sand mix.

.3 Match grout's 28 day compressive strength to compressive strength of concrete masonry unit being filled.

2.8 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.

2.9 FINISHES

.1 Hot Dipped Galvanized Coating on Strap Anchors: To ASTM A123/A123M, Coating Grade 75; minimum 503 g/m^2 zinc coating on all surfaces.

.2 Mill Galvanized Coating: To ASTM A641/A641M, Regular; minimum 30 g/m^2 zinc coating on all surfaces.

3 Execution

3.1 PREPARATION

.1 Supply metal anchors to 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 into masonry assemblies.

.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 services Subcontractors. Locating openings is the responsibility of the component installer.

.4 Accurately locate chases and openings and neatly finish to the required sizes.

.5 No pipe, conduit chases or enclosures shall be covered until advised that the work has been inspected and tested.

.6 Coordinate placement of steel and concrete anchors with appropriate Subcontractor.

3.3 COURSING

.1 Place masonry to lines and levels indicated.

.2 Maintain masonry courses to uniform width.

.3 Lay 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 air/vapour barrier and moisture protection type membranes are scheduled, or 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 MASONRY FLASHING

.1 Extend flashing through veneer, turn up and bed into mortar joint of masonry, seal to concrete, or seal into sheathing over framed back up; as appropriate.

.2 Lap end joints and seal watertight.

3.7 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.

3.8 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.

3.9 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.

3.10 TOLERANCES

.1 Variation from Unit to Adjacent Unit: $\leq$ 1.5 mm.

.2 Variation of Joint Thickness: $\leq$ 3 mm in 1 000 mm.

3.11 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.

3.12 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 compressive strength and water content of mortar and grout mixes.

.4 Submit product data on design mix, indicating Property specification method used, required environmental conditions and admixture limitations.

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; veneer core, butt edge, unsanded faces; preservative treated, thicknesses as indicated on Drawings.

.3 Plywood - Interior Applications: To CSA O151, CSP species, SHG Grade; 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 $\underline{<}$ 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 Hardware: To ASTM A153/A153M, Classes C or D; hot dipped zinc alloy coating.

3 Execution

3.1 SITE APPLIED WOOD TREATMENT

.1 Apply touch-up coatings to CAN/CSA O80.

.2 When wood in contact with exterior cementitious materials, roofing and related metal flashings has not been previously preservative treated, brush apply two coats of touch-up wood preservative.

.3 Apply two coats of touch-up wood preservative to sawn ends of preservative treated material.

.4 Apply two coats of touch-up flame retardant coating to sawn ends of flame retardant treated material.

3.2 INSTALLATION

.1 Erect 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 flame retardant treated wood blocking for mounting electrical equipment where indicated on Drawings.

.7 Construct curb and cant members of single pieces per location.

.8 Curb roof openings except where prefabricated curbs are provided.

.9 Form corners by lapping side members alternately.

.10 Coordinate work with installation of decking and support of decking at openings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 07 21 00 - Thermal Insulation.

.2 Section 07 27 00 - Air Barriers.

.3 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 ASTM C475/C475M-17: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 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.

.3 ASTM C1002-20: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.4 ASTM C1177/C1177M-17: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.5 ASTM C1264-19: Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.

.6 ASTM C1280-18: Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

.7 CGC Gypsum Construction Handbook.

.8 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.9 GA-214-2021: Levels of Finish for Gypsum Panel Products.

.10 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.11 ULC List of Equipment and Materials.

1.3 QUALIFICATIONS

.1 Applicators: A firm specializing in applying gypsum sheathing, having minimum 5 years documented experience.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Conform to ASTM C1264.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
- .1 CertainTeed Canada, Inc.
- .2 CGC Inc.
- .3 G-P Gypsum Corporation.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Gypsum Sheathing Board (GSB-1): To ASTM C1177/C1177M; as follows:
- .1 Thickness 12.7 mm.
- .2 Edges: Square.
- .3 Core: Silicone-treated gypsum.
- .4 Facers: Glass fiber mesh, both sides.
- .5 Manufacturer and Product Name: eg. DensGlass Exterior Sheathing by G-P Gypsum Corporation.

.2 Gypsum Sheathing Board (GSB-2): To ASTM C1177/C1177M, Type X; as follows:
- .1 Thickness: 15.9 mm.
- .2 Edges: Square.
- .3 Core: Silicone-treated gypsum.
- .4 Facers: Glass fiber mesh facers, both sides.
- .5 Flame Spread Index (CAN/ULC-S102): $\leq$ 10.
- .6 Manufacturer and Product Name: eg. DensGlass Fireguard Sheathing by G-P Gypsum Corporation.

.3 Steel Drill Screws: To ASTM C954; galvanized steel, sheet metal type.

.4 Self-Tapping Screws: To ASTM C1002, Type S, Fine Thread; galvanized steel.

.5 Adhesive: To CAN/CGSB-71.25-M.

.6 Joint Materials: To ASTM C475/C475M; reinforcing tape, joint compound, adhesive, water, fasteners.

.7 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

3 Execution

3.1 INSTALLATION

.1 Install Products to ASTM C1280.

.2 Install boards perpendicular to supports with ends staggered.

.3 Secure board edges over firm bearing.

.4 Screw fasten boards to furring or framing.

.5 Finish boards to GA-214, Level 1.

.6 Finished work shall be plane and free from depressions.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 06 24 00 - High Pressure Decorative Laminate.

.3 Section 06 41 00 - Architectural Wood Casework.

.4 Section 07 92 00 - Joint Sealants.

.5 Section 08 14 00 - Wood Doors.

.6 Section 08 71 00 - Door Hardware.

.7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ANSI A135.4-2004: Basic Hardboard.

.2 ANSI A208.1-2009: Particleboard.

.3 ANSI A208.2-2009: Medium Density Fiberboard (MDF) for Interior Applications.

.4 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.5 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.6 AWMAC NAAWS 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 MDF Trim: 300 mm long, illustrating size and shape of profiles.
- .4 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 MATERIALS

.1 Dressed Lumber - Softwood (DL-SWD): To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content, with mixed grain capable of receiving a high quality opaque finish; sizes as indicated on Drawings.

.2 Dressed Lumber - Hardwood (DL-HWD): White Birch species, to NHLA Select and Better Grade; kiln dried to maximum 7 percent moisture content, with vertical grain capable of receiving a high quality transparent finish; sizes as indicated on Drawings.

.3 Plywood - Softwood (PLY-SWD): CSP to CSA O151; SEL TF Grade; SPF veneer core of minimum 9 plies; thicknesses as indicated on Drawings; capable of receiving a high quality opaque finish.

.4 Plywood - Softwood, 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 a high quality opaque finish.

.5 Plywood - Hardwood (PLY-HWD): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Hardwood veneer core, minimum 9 plies.
.2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Pleasing match grain capable of receiving a high quality transparent finish.

.6 Plywood - Hardwood, Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
.1 Core: Composite core, moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue.
.2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Pleasing match grain capable of receiving a high quality transparent finish.

.7 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.

.8 Melamine Composite Panel (MCP): Particleboard core with factory-applied low pressure laminate (LPL) thermo-fused to both faces; Premium quality; thicknesses as indicated on Drawings; colours, textures and patterns as selected by Consultant.

.9 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; having minimum 740 kg/m^3 density and maximum moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.

.10 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.

2.2 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.

2.3 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 Dimension Lumber: As specified in Section 06 10 00.

.9 Primer: Alkyd primer sealer type.

.10 Wood Filler: Solvent base, tinted to match surface finish colour.

.11 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

2.4 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 Install wood doors as specified in Section 08 14 00.

.10 Install door hardware as specified in Section 08 71 00.

.11 Seal gaps and joints as specified in Section 07 92 00.

3.2 ADJUSTING AND CLEANING

.1 Set exposed fasteners.

.2 Apply wood filler 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.

.3 Section 08 14 00 - Wood Doors.

1.2 REFERENCES

.1 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.

.2 ASTM E84-23c: Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.

.4 CAN/CGSB-71.20-M88: Adhesive, Contact, Brushable.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 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 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 High Pressure Decorative Laminate - Flame-Retardant (HPDL-FR): To ANSI/NEMA LD 3; decorative surface papers impregnated with melamine resins, bonded under heat and pressure to fire-retardant kraft papers impregnated with phenolic resins; colours, textures, and patterns as selected by Consultant; NEMA Types, Grades, thicknesses, and surface burning characteristics as listed below:
- .1 Vertical Surface Type: Grade VGF; 0.8 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
  - .1 Flame Spread Index = 15.
  - .2 Smoke Developed Index = 15.
- .2 Backer Type: Grade BKV; 0.7 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
  - .1 Flame Spread Index = 15.
  - .2 Smoke Developed Index = 0.

.3 Core Materials: As indicated on Drawings.

.4 Sealer: Water-resistant type.

.5 Draw Bolts and Splines: Suitable for new core bases, and acceptable to fabricator.

.6 Contact Adhesive: To CAN/CGSB-71.20-M.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify cutouts in core materials are prepared for faucets, sinks, and other penetrating components.

3.2 PREPARATION

.1 Make joints in core materials tight, flush, and hairline; using draw bolts and splines.

.2 Round internal corners, chamfer edges and seal exposed edges in core materials.

3.3 INSTALLATION

.1 Comply with ANSI/NEMA LD 3, Annex A and AWMAC NAAWS 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 sink 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 protective coverings 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.

.4 Section 08 14 00 - Wood Doors.

.5 Section 08 71 00 - Door Hardware.

.6 Section 08 80 00 - Glazing.

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 A156.1-2016: Butts and Hinges.

.10 ANSI/BHMA A156.9-2015: Cabinet Hardware.

.11 ANSI/BHMA A156.11-2014: Cabinet Locks.

.12 ANSI/BHMA A156.26-2017: Continuous Hinges.

.13 CSA O112.9-10: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.14 CSA O112.10-08 (R2013): Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.15 CSA O121-08 (R2013): Douglas Fir Plywood.

.16 CSA O141-05 (R2009): Softwood Lumber.

.17 CSA O151-09: Canadian Softwood Plywood.

.18 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.

.19 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.

.20 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 custom 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.

2 Products

2.1 MATERIALS

.1 Dressed Lumber - Softwood (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.

.2 Dressed Lumber - Hardwood (DL-HWD): White Birch 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.

.3 Plywood - Hardwood (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: White Birch species; Face Grade A; Plain-Sliced; of clear Book match grain capable of receiving high quality transparent finish.

.4 Plywood - Hardwood, 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: White Birch species; Face Grade A; Plain-Sliced; of clear Book match grain capable of receiving high quality transparent finish.

.5 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.

.6 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; minimum 740 kg/m^3 density and maximum moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.

.7 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.

.8 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.

.9 Dimension Lumber: As specified in Section 06 10 00; sizes as indicated on Drawings.

2.2 MANUFACTURED UNITS

.1 Teacher Closet Doors: Solid core flush wood doors, non-rated type; as specified in Section 08 14 00; with decorative laminate faces to match architectural wood casework.

2.3 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 Glass: 6 mm thick tempered safety glass, Type GL-3 as specified in Section 08 80 00.

.14 Glazing Materials: As specified in Section 08 80 00.

.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, Type SEAL-INT-GP.
.2 Other Wet Areas: Interior mildew-resistant sealant, Type SEAL-INT-MR.

2.4 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; eg. National disc tumbler cylinder cam lock C8080 Series, Chrome finish, keyed to Owner's master keying system.

.7 Padlock Hasp: Stainless steel, Type 304; with countersunk screw holes.

.8 Slide Bolt For Inactive Leaf: 60 mm long barrel bolt, nickel plated.

.9 Elbow Catch: Heavy duty type, nickel finish; eg. Model 5540180 by Richelieu.

.10 Door Bumper: Nylon bumper; eg. Model MP303-11 by Richelieu.

.11 Pilaster Strip: 16 mm wide, 4 mm deep perforated metal strip, zinc plated; length as required; Model 2332GXX by Richelieu.

.12 Pilaster Clip: Heavy duty bent metal clips, zinc plated; Model CP2562G by Richelieu.

.13 Shelf Support for Drilled Gable: 5 mm OD metal pin, plastic-clad; eg. Model 34004011 by Richelieu.

.14 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.

.15 Cable Grommet: Plastic counter top fitting for computer / telephone / power cables; two-part cable set with spring closure top, 50 mm OD; Black colour; Model 60.2700.90 by Richelieu, or Type SG by Doug Mockett.

.16 Wire Management Moulding: 50 x 38 mm size, lengths as indicated; complete with mounting screws; Black colour; eg. Model 512490 by Richelieu.

.17 Magnetic Catch: Magnetic catch, automatic opening.

.18 Automatic Door Bolt: Model 245.58.754 by Hafele.

.19 Display Case Hardware:
- .1 Track Set for Display Glass Sliding Doors: Anodized aluminum upper track, bottom track and glass H-rail; Model 1551210 by Richelieu.
- .2 Hardware Set for Two Glass Doors: One glass door lock with two identical keys, upper track silencer, u-spline plastic gaskets, 4 casters and 4 end caps; capable of supporting up to 14.6 kg per door; Model BP15510 by Richelieu.
- .3 Glass Shelf Bracket: Adjustable bracket, White colour; Model 4180 by Richelieu; sizes as noted on Drawings.
- .4 Glass Shelf Pilaster Strip: White colour; Model 4080 by Richelieu; sizes as noted on Drawings.
- .5 Glass Shelf Cushion: Rubber cushion; Model 109100 by Richelieu.

.20 Base Cabinet Leveller: 100 mm size, adjustable to minus 5 mm and plus 10 mm; Model 637.45.326 by Hafele.

.21 Safety Coat Hook: Magnetic safety release type, fabricated from high strength polycarbonate; release weight of 11.8 kg; Safety Release Coat Hook by HenkelHook, colours as selected by Consultant.

.22 Fixed Coat Hook: As specified in Section 06 20 00.

.23 Closet Rod and Flanges: As specified in Section 06 20 00.

2.5 TEACHER CLOSET DOOR HARDWARE

.1 Butt Hinges: To ANSI/BHMA A156.1, Grade 1; 1-1/2 pair per leaf; 75 x 75 mm size, 5-knuckle ball bearing standard weight full mortise butt hinges, with brushed chrome finish; eg. Model FBB179 by Stanley.

.2 Slide Bolt For Inactive Leaf: Type as specified above, two required for top and bottom attachment to inactive door leaf.

.3 Lockable Handset: As specified in Section 08 71 00.

2.6 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 - Casework Doors: Factory install cabinet hinges, runners and hardware, anchoring components firmly into position for long life under hard use. Provide quantity of hinges 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 Hardware Preparation - Teacher Closet Doors: Machine cut relief for hinges, and core doors for handsets and cylinders.

.15 Equally space banks of drawers, with minimum height of 120 mm.

.16 Apply decorative laminate to core materials as specified in Section 06 24 00.

.17 Factory seal cutouts and service fitting openings in countertops with moisture-resistant epoxy.

.18 Drill holes in gables to receive adjustable shelving pins. Provide ferow sleeves in drilled holes.

.19 Install neoprene or rubber bumpers at top and bottom of doors and drawers.

.20 Adjust doors and drawers to proper operation prior to installation.

2.7 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.

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 suitably removable wood access panels, each secured with minimum 4 brass screws.

.12 Install laminate-clad countertops, as specified in Section 06 24 00.

.13 Install glazing as specified in Section 08 80 00.

.14 Provide closers and filler strips in matching finish as required to ensure a neat and complete finished assembly.

.15 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.

.16 Install teacher closet doors and related door hardware.

3.2 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.

3.3 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect completed installation from damage with protective coverings.

.3 Maintain protection until Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Concrete Unit Masonry.

.2 Section 06 16 43 - Gypsum Sheathing.

.3 Section 07 26 00 - Vapour Retarders.

.4 Section 07 27 00 - Air Barriers.

.5 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.6 Section 07 84 00 - Firestopping.

.7 Section 09 21 16 - Gypsum Board Assemblies.

.8 Section 09 81 00 - Acoustic Insulation.

1.2 REFERENCES

.1 ASTM C518-17: 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-22ae1: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate 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 of polystyrene insulations.

.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 Firestone Building Products.

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 Mechanical Fasteners: Stainless steel screw type fastener, complete with 75 mm OD moulded plastic disc washer.

.2 Adhesive for Use with Polystyrene: To CGSB 71-GP-24M, Type 1.

.3 Adhesive for Use with Other Materials: Mastic type, synthetic rubber base, fungi resistant, gun or trowel application.

.4 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 Unless specified otherwise, secure rigid board insulation with adhesive, applied in three continuous beads per board length.

.2 Install insulation boards on wall surface either horizontally or vertically as required. Place membrane surface of insulation solidly against substrate and securely fasten.

.3 Do not crush insulation face when fastening with mechanical fasteners.

.4 Stagger side and end joints.

.5 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 services 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 others.

.5 Protect insulation requiring a thermal barrier in accordance with applicable regulatory requirements.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 07 21 00 - Thermal Insulation.

.3 Section 07 27 00 - Air Barriers.

.4 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 ASTM E96/E96M-22ae1: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate 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 Firestone Building Products.
.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 SBS modified asphalt membrane laminated to a tri-laminate woven high density polyethylene top surface; and as follows:
.1 Thickness: 0.76 mm.
.2 Moisture Vapour Permeance (ASTM E96/E96M): $\leq$ 1.5 Ng/Pa•s•m^2.
.3 Manufacturer and Product Name: eg. V-Force Vapour Barrier Membrane by Firestone Building Products.

.3 Primer for Bituminous Membrane Vapour Retarder: Single-component, water-based primer; eg. V-Force WB Primer by Firestone Building Products.

.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 surfaces to receive vapour retarder 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 with approved primer prior to application of self-adhered bituminous membranes.

3.2 INSTALLATION

.1 Install Products to SWI Sealant and Caulking Guide Specification.

.2 Plastic Sheet Vapour Retarders
.1 Position joints or laps of sheets over firm bearing to achieve an effective and permanent seal.
.2 Seal laps, joints, and terminations with an approved sealant to ensure complete, continuous seal of building envelope.

.3 Bituminous Membrane Vapour Retarders
.1 Apply self-adhered 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 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 00 00 - Masonry.

.3 Section 06 16 43 - Gypsum Sheathing.

.4 Section 07 21 00 - Thermal Insulation.

.5 Section 07 26 00 - Vapour Retarders.

.6 Section 07 27 36 - Sprayed Foam Air Barrier.

.7 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.8 Section 07 92 00 - Joint Sealants.

.9 Section 08 12 13 - Hollow Metal Frames.

.10 Section 08 51 13 - Aluminum Windows.

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-22ae1: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate 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 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): ≥ 1 655 ng/Pa•s•m^2.
.4 Tensile Strength (ASTM D882): 182 N.
.5 Product and Manufacturer Name: eg. Blueskin VP 160 by Henry (a Carlisle Company).

.2 Air/Vapour Barrier Sheet Membrane: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; SBS rubberized asphalt sheet membrane, self-adhering grade; and as follows:
.1 Thickness: ≥ 1.0 mm.
.2 Air Leakage (ASTM E2178): ≤ 0.02 L/s•m^2 @ 75 Pa.
.3 Water Vapour Permeance (ASTM E96/E96M, Method A): ≤ 1.71 ng/Pa•s•m^2.
.4 Elongation (ASTM D412 - Modified): 200 percent.
.5 Tensile Strength (ASTM D412 - Modified): 3.45 MPa.
.6 Puncture Resistance (ASTM E154/E154M): 178 N.
.7 Product and Manufacturer Name: eg. Blueskin SA by Henry (a Carlisle Company).

.3 Air/Vapour Barrier 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): ≤ 0.02 L/s•m^2 @ 75 Pa.
.2 Water Vapour Permeance (ASTM E96/E96M, Method A): ≤ 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).

2.4 ACCESSORIES

.1 Attachments: Galvanized steel bars and anchors.

.2 Adhesive: Compatible with sheet barrier and substrate, permanently non-curing.

.3 Tape: 66 mm wide, self-adhesive polypropylene tape; eg. Contractor Tape by Dupont.

.4 Primer: As recommended by self-adhering membrane manufacturer.

.5 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

3 Execution

3.1 PREPARATION

.1 Ensure surfaces to receive air barrier 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 porous surfaces designated to receive self-adhered sheet membranes.

.5 Tape unfinished joints in sheathing boards.

3.2 INSTALLATION

.1 Install Products to SWI Sealant and Caulking Guide Specification.

.2 Provide air tight joints.

.3 Seal Products completely around projections and penetrations.

.4 Fully adhere sheet membranes to primed substrate, using consecutive weatherboard method.

.5 Eliminate wrinkles, gaps, bubbles, air pockets and fishmouths.

.6 Apply transition sheet membranes at openings and transitional connections.

.7 Leave a 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 air barriers prior to concealment and identify gaps, holes and punctures.

.2 Seal gaps, holes and punctures with air/vapour barrier sealant.

.3 Request Consultant inspection of air barriers prior to concealment. Work that has been concealed prior to Consultant inspection will be exposed while Consultant remains at Place of the Work, inspected, and 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 suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 00 00 - Masonry.

.3 Section 07 21 00 - Thermal Insulation.

.4 Section 07 26 00 - Vapour Retarders.

.5 Section 07 27 00 - Air Barriers.

.6 Section 07 92 00 - Joint Sealants.

.7 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

.1 SWI Sealant and Caulking Guide Specification.

.2 CAN/ULC-S710.1-2019: Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.3 CAN/ULC S710.2-11: Standard for Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Application.

.4 CAN/ULC-S711.1-2019: Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.5 CAN/ULC S711.2-11: Standard for Thermal Insulation - Bead Applied Two-Component Polyurethane Air Sealant Foam, Part 2: Application.

1.3 SEQUENCING

.1 Sequence installation of Products in conjunction with air barriers and vapour retarders.

1.4 PRODUCT DATA

.1 Submit Product data as specified in Section 01 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 materials 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 designated to receive air sealant foam 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 06 10 00 - Rough Carpentry.

.2 Section 07 21 00 - Thermal Insulation.

.3 Section 07 26 00 - Vapour Retarders.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

.5 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 CSA A231.1:19: Precast Concrete Paving Slabs.

.9 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.10 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.

.11 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.12 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.

.13 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 Board: To ASTM C1278/C1278M; 6.4 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
.1 Combustibility (CAN/ULC-S114): Noncombustible.
.2 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index $\leq$ 5.
.2 Smoke Developed Index = 0.
.3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.

.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 tapered insulation Shop Drawings.

.5 Cover Board: To ASTM C1278/C1278M; 12.7 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
.1 Combustibility (CAN/ULC-S114): Noncombustible.
.2 Surface Burning Characteristics (CAN/ULC-S102):
.1 Flame Spread Index $\leq$ 5.
.2 Smoke Developed Index = 0.
.3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.

.6 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.

.7 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 Insulation Fasteners: Premium No. 12 hex head fasteners and 75 mm OD locking plates; corrosion-resistant, twin lead threads with sharp drill point and tapered wedge entry; sufficient length to penetrate structural deck a minimum of 19 mm; complete with galvanized steel disc washers.

.4 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.

.5 Base and Cap Flashing Membranes: Similar to base and cap sheet roofing membranes.

.6 Insulation Adhesive: One-component elastomeric foamable adhesive; eg. Millennium Adhesive by IKO Industries, Ltd.

.7 Miscellaneous Adhesives: As recommended by roofing manufacturer.

.8 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.

.9 Rooftop Walkway Pavers: To CSA A231.1; 610 x 610 mm size, 45 mm thick precast concrete paver units, Diamond pattern, Standard texture; Natural colour; eg. Concrete Roof Ballast Slabs by Brooklin Concrete Products.

.10 Walkway Paver Pedestals: Prefabricated, high density polyethylene adjustable paver pedestals and levelling plates, complete with integral spacer ribs on upper surface; eg. Model 7X Pave-El Pedestals by Envirospec, Inc.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 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 beads of insulation adhesive, applied at manufacturer's recommended rate of application.

.3 Secure insulation boards along building perimeter with mechanical fasteners, quantity and spacing as recommended by manufacturer to achieve required wind uplift resistance.

.4 Lay subsequent layers of insulation with joints staggered 150 mm.

.5 Lay insulation boards with edges in moderate contact without forcing.

.6 Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

.7 Install tapered insulation boards where indicated and in accordance with accepted Shop Drawings.

.8 When recommended by insulation manufacturer, tape joints of insulation boards.

.9 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 ROOFTOP WALKWAY PAVERS

.1 Conform to layout indicated on Drawings.

.2 Install paver pedestals along perimeter and at corners of pavers, spaced in a grid pattern at regular intervals to support pavers at their corners.

.3 Install paver pedestals on levelling pads.

.4 Install pavers on pedestals level, flat and without movement.

.5 Adjust pedestal heights to achieve a perfectly flat transition between adjacent pavers.

.6 Avoid lippage.

3.12 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.

3.13 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.

3.14 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 04 00 00 - Masonry.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 52 00 - Modified Bituminous Membrane Roofing.

.4 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/A653M, 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 a minimum of 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 04 00 00 - Masonry.

.2 Section 07 92 00 - Joint Sealants.

.3 Section 09 21 16 - Gypsum Board Assemblies.

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 commencement of firestopping, arrange and conduct a preinstallation meeting as specified in Section 01 31 00.

.2 Preinstallation Meeting: Discuss proposed methods and materials to be used in instances.

.3 Representatives of Owner, Consultant, Contractor, 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 sealed, 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 manufacturer's field inspection reports as specified in Section 01 40 00.

.2 Manufacturer's Field Inspection Reports: Manufacturer's written acceptance of installation based on regular inspections.

1.9 QUALIFICATIONS

.1 Manufacturer's Design Engineer: A professional engineer having minimum 10 years documented experience designing firestop and smoke seals, licensed to practice at Place of the Work.

.2 Installer: A firm specializing in installing firestopping and smoke seals, 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 and penetration fire stop 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 firestopping and smoke sealing systems to CAN/ULC-S115 and as described below:
- .1 Asbestos free materials and systems fully capable of maintaining an effective barrier against gases, flame and smoke in compliance with CAN/ULC-S115, not exceeding opening sizes stated.
- .2 Service Penetration Assemblies: Certified by CAN/ULC-S115 and used by ULC Guide 40 U19. Service components listed as certified in this guide are noted under Label Service of ULC.

.6 Fire resistance rating of 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 affect bond of sealant.

.3 Remove incompatible materials which affect bond by scraping, brushing, water or solvent cleaning, or sandblasting.

3.3 APPLICATION

.1 Install firestop insulation in compacted thicknesses required by ULC design. Compress insulation approximately 33 percent.

.2 Apply sealant in strict accordance with ULC certification.

.3 Coordinate and cooperate with adjacent, contiguous and related 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 firestopping assemblies from damage.

.3 Make Good damaged firestopping assemblies.

.4 Maintain protection until Owner occupancy.

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 07 26 00 - Vapour Retarders.

.5 Section 07 27 00 - Air Barriers.

.6 Section 07 27 36 - Sprayed Foam Air Barrier.

.7 Section 07 62 00 - Sheet Metal Flashing and Trim.

.8 Section 07 84 00 - Firestopping.

.9 Section 08 51 13 - Aluminum Windows.

.10 Section 08 80 00 - Glazing.

.11 Section 09 21 16 - Gypsum Board Assemblies.

.12 Section 09 30 00 - Tiling.

.13 Section 09 51 23 - Acoustical Tile Ceilings.

.14 Section 22 44 13 - Plumbing Fixtures Combined with Drawing Schedules.

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, and 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 the 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 5 years, including coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of either adhesion or cohesion, or do not cure.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of exterior weatherseal sealants, exterior high-movement sealants, glazing sealants, interior general purpose sealants and interior mildew-resistant sealants having Product considered acceptable for use:
.1 Dow Chemical Company.
.2 General Electric.
.3 Master Builders Solutions Canada, Inc.
.4 Tremco.

.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 Manufacturers of interior tiling sealants having Product considered acceptable for use:
.1 Mapei.

.4 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 High-Movement Sealant - (SEAL-EXT-HM): To ASTM C920, Type S, Grade NS, Class 50, Use NT, T, M, A, O, and I; one-part medium modulus, low VOC, UV stable, non-sag polyurethane sealant; accommodating joint movement of plus 100 percent and minus 50 percent, with 120-minute skin time; eg. Dymonic 100 by Tremco, colours as selected by Consultant.

.3 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.

.4 Glazing Sealant (SEAL-GLZ): To CAN/CGSB-19.13-M, Type MG-2-25-A-L; one-part, moisture curing, acetoxy silicone sealant; eg. Proglaze by Tremco, Clear colour.

.5 Interior General Purpose Sealant (SEAL-INT-GP): To CAN/CGSB-19.17-M; one-part, siliconized acrylic latex, mildew-resistant, accommodating joint movement of plus or minus 12-1/2 percent; eg. Tremflex 834 by Tremco, colours as selected by Consultant.

.6 Interior Mildew-Resistant Sealant (SEAL-INT-MR): To ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; one-part, acetoxy silicone sealant, complete with integral fungicide; eg. Tremsil 200 by Tremco, colours as selected by Consultant.

.7 Interior Floor Tiling Sealant (SEAL-INT-FT): Premium grade, sanded siliconized acrylic; Keracaulk S by Mapei, colours to match adjacent tile grout colours.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: 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.

.9 Install exterior high-movement sealant (SEAL-EXT-HM) in areas where anticipated differential movement exceeds the movement capabilities of other specified exterior weatherseal sealants.

3.3 FIELD QUALITY CONTROL

.1 Inspect completed sealant joints for adhesion and cohesion to ASTM C1521.

.2 Inspect completed sealant joints for holes, gaps, and areas where leaks could become present.

.3 Reject failed joints, joints filled with only a skin bead, and joints having an 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 06 20 00 - Finish Carpentry.

.2 Section 06 24 00 - High Pressure Decorative Laminate.

.3 Section 08 71 00 - Door Hardware.

.4 Section 08 80 00 - Glazing.

.5 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

.1 ANSI A208.1-2009: Particleboard.

.2 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.

.3 CSA O141-05 (R2009): Softwood Lumber.

.4 ANSI/DHI A115.IG-1994: Installation Guide for Doors and Hardware.

.5 NFPA 80-2007: Fire Doors and Other Opening Protectives.

.6 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.7 CAN/ULC-S113:2016 (R2020): Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies.

.8 ULC List of Equipment and Materials.

.9 ANSI/WDMA I.S. 1A-13: Industry Standard for Interior Architectural Wood Flush Doors.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating door elevations, stile and rail reinforcement, cutouts, and internal blocking for hardware attachment.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Pile Products flat on level supports to prevent warping.

.3 Protect face of first unit by placing plywood or cardboard between supports and unit face. Cover top unit in a similar manner.

.4 Store Products in a dry, well-ventilated area.

.5 Seal top and bottom edges of Products stored for an extensive period of time.

1.5 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Extended Warranty: For a period of 3 years, covering against warping beyond installation tolerances, and delamination or degradation of door faces.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Door-Lam.
.2 Jeld-Wen, Inc.
.3 Lambton Door.
.4 Marshfield Door Systems.
.5 Masonite International Corporation.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Doors: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

2.3 MATERIALS

.1 Lumber: To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content.

.2 Particleboard: To ANSI A208.1; 448 kg/m^3 solid particleboard.

.3 Fire Rated Board: Solid non-combustible, inorganic composite board; ULC labelled.

.4 Agrifiber Board: To ANSI A208.1; core material fabricated from residual material from a grain crop, similar in composition to particleboard; ULC labelled.

.5 Honeycomb Filler: Structural small cell kraft paper honeycomb; 36.3 kg per ream; 16.5 kg/m^3 minimum density; sanded to required thickness.

.6 Decorative Laminate: To ANSI/NEMA LD3; colours, textures, and patterns as selected by Consultant; and as follows:
.1 Non-Rated Applications: High pressure decorative laminate Type HPDL, Vertical Surface type, as specified in Section 06 24 00.
.2 Rated Applications: Flame-retardant high pressure decorative laminate Type HPDL-FR, Vertical Surface type, as specified in Section 06 24 00.

2.4 MANUFACTURED UNITS

.1 Solid Core Flush Wood Doors - Fire Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 45-, 60- or 90-minute rating as scheduled; 3-ply construction, as follows:
.1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
.2 Core: Fire rated board.
.3 Face Assembly Adhesive: Type I - Waterproof.
.4 Core Assembly Adhesive: Type II - Water-resistant.
.5 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
.6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, decorative laminate face edge shows.
.7 Door Faces: Decorative laminate.

.2 Solid Core Flush Wood Doors - 20-Minute Rated: To CAN/ULC-S113 and ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 20-minute rating; 3-ply construction, as follows:
.1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
.2 Core: Agrifiber board.
.3 Face Assembly Adhesive: Type I - Waterproof.
.4 Core Assembly Adhesive: Type II - Water-resistant.

.5 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
.6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, decorative laminate face edge shows.
.7 Door Faces: Decorative laminate.

.3 Solid Core Flush Wood Doors - Non-Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 3-ply construction, as follows:
.1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
.2 Core: Particleboard.
.3 Face Assembly Adhesive: Type I - Waterproof.
.4 Core Assembly Adhesive: Type II - Water-resistant.
.5 Glass Stop: Matching wood, flat bead type.
.6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, decorative laminate face edge shows.
.7 Door Faces: Decorative laminate.

2.5 FABRICATION

.1 Fabricate Products to AWMAC NAAWS 4.0, Custom Grade.

.2 Provide and prepare sufficient amount of blocking in edges to accommodate installation of scheduled hardware.

.3 Fabricate fire-rated Products with sufficient wood blocking to fasten scheduled hardware.

.4 Fabricate paired doors with no bevel on meeting edges.

.5 Prepare doors to receive scheduled door hardware. Machine cut relief for hinges and closures, and core doors for handsets and cylinders. Coordinate with Section 08 71 00.

.6 Provide and prepare openings for glazing.

.7 Apply decorative laminate to AWMAC NAAWS 4.0 and as specified in Section 06 24 00.

2.6 FINISHES

.1 Apply one coat uncut shellac to door cutouts.

3 Execution

3.1 PREPARATION

.1 Arrange with Section 09 90 00 to finish glass stops, top rails, bottom rails and stile edges to match decorative laminate door faces prior to door, glazing, and hardware installation.

3.2 INSTALLATION

.1 Install Products to ANSI/DHI A115.IG.

.2 Existing Doors: Machine cut relief for hinges and closures and coring for handsets and cylinders.

.3 Do not trim rated wood doors.

.4 Trim non-rated wood doors only as necessary, and as follows:
.1 Door Width: $\leq$ 5 mm.
.2 Door Height: Trimmed equally on top and bottom edges, to a combined maximum of 10 mm.

.5 Prepare doors to receive door hardware to AWMAC NAAWS 4.0.

3.3 TOLERANCES

.1 Distortions measured with straight edge over not more than 1 066 x 2 134 mm surface area, as follows:
- .1 Diagonal Distortion: ≤ 6 mm measured from corner to corner.
- .2 Vertical Distortion: ≤ 6 mm measured from top to bottom.
- .3 Width Distortion: ≤ 6 mm measured from edge to edge.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 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-23: 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 fire rated class indicated in schedule.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled 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 grey primer applied over rust-inhibiting phosphate treatment; paintable.

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 locations of access panels with facility services Subcontractors.

3.2 INSTALLATION

.1 Install Products straight, plumb and level.

.2 Install Products flush with adjacent surfaces.

.3 Install Products for long life under hard use.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.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 92 00 - Joint Sealants.

.6 Section 08 80 00 - Glazing.

.7 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA CW-10-15: Care and Handling of Architectural Aluminum from Shop to Site.

.2 AAMA/WDMA/CSA 101/I.S. 2/A440-22: North American Fenestration Standard / Specification for Windows, Doors and Skylights.

.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 A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.7 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.8 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.9 CAN/CGSB-79.1-M91: Insect Screens.

.10 CSA A440S1:19: Canadian Supplement to AAMA/WDMA/CSA 101/I.S. 2/A440-17, North American Fenestration Standard / Specification for Windows, Doors and Skylights.

.11 CSA A440.2:22: Fenestration Energy Performance.

.12 CSA A440.4:19: Window, Door, and Skylight Installation.

.13 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.

.14 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating:
.1 Large scale details of members and materials, of brackets and anchorage devices and of connection and jointing details;
.2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
.3 Dimensions and thicknesses;
.4 Glazing details, description of materials including catalogue numbers, products and manufacturer's names;
.5 Aluminum alloy and temper designations;
.6 Finish specifications; and
.7 Other pertinent data.

.3 Submit documentation of:
.1 Compliance with AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1.
.2 Thicknesses, profiles and descriptions of components used in assembly.
.3 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project and meet specified performance criteria.
.4 Ensure calculations are stamped, signed and dated by fabricator's design engineer.

1.4 CERTIFICATES

.1 Submit certifications as specified in Section 01 40 00.

.2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

1.5 TEST AND EVALUATION REPORTS

.1 Submit test reports as specified in Section 01 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 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions; sufficient quantity for inclusion in operation and maintenance manual.

1.7 QUALIFICATIONS

.1 Fabricator's Design Engineer: A professional structural engineer experienced in designing aluminum windows, licensed to practice at Place of the Work.

.2 Fabricator and Installer: A firm specializing in fabricating and installing aluminum windows, having minimum 5 years documented experience.

1.8 MOCK-UPS

.1 Construct mock-ups as specified in Section 01 40 00.

.2 Mock-Up: One 1 220 x 1 220 mm size mock-up panel, including one corner cross section for each type of window assembly, demonstrating sill and jamb sections, and complete with thermal break, hardware, weatherstripping, glazing, screen, and shop-applied finishes.

.3 Accepted mock-ups will be used as the standard for acceptance of the Work.

.4 Remove and replace installed Product that does not conform to accepted mock-up.

.5 Remove mock-ups from Place of the Work upon Substantial Performance of the Work.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Conform to AAMA CW-10.

.3 Take precautionary measures and adequately protect frames and frame finishes to prevent damage during fabrication, storage, shipping, handling and installation.

.4 Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.

.5 Deliver and store units carefully to avoid damage to window frame.

1.10 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 10 years, covering the following:
.1 Finish: Replace any window unit whose finish shows defects, such as but not limited to delamination, blistering or excessive fading.
.2 Performance: Replace or repair any window unit with air leakage, water leakage, defects or malfunctions under normal usage.

.3 Installer's Extended Warranty: For a period of two years, protecting against leakage, operational defects and malfunction under normal usage.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 Aerloc Industries Ltd.
.2 Alumicor.
.3 Alwind Industries, Ltd.
.4 Commdoor Aluminum.
.5 CRL US Aluminum.
.6 Kawneer.
.7 Oldcastle BuildingEnvelope.
.8 Windspec Inc.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

.1 Aluminum Windows: Extruded aluminum frame and operable vent sash sections, shop fabricated, anodized finish; site-glazed with sealed insulating glass units; complete with insect screens, metal sills, metal flashings, anchorages and attachment devices.

.2 Configuration: As indicated on Window Schedule.

2.3 PERFORMANCE CRITERIA

.1 Aluminum Windows: To AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1, and meeting the following performance criteria:
.1 Air Tightness:
.1 Fixed Units: Class Fixed.
.2 Operable Vents: Class A3.
.2 Water Tightness: Class B3.
.3 Wind Load Resistance: Class C5.
.4 Screen Strength: Class S1.
.5 Forced Entry: Class F2.

.6 Temperature Index (CSA A440.2): I $\geq$ 58.
.7 Assembly Thermal Transmittance (ANSI/NFRC 100):
.1 Fixed Units: U $\leq$ 2.15 W/m^2 degrees C.
.2 Operable Vents: U $\leq$ 2.56 W/m^2 degrees C.
.8 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC $\leq$ 0.40.

2.4 DESIGN CRITERIA

.1 Design assembly to drain water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system to the exterior.

.2 Design intermediate members within units to be either solid or tubular design to suit wind loading, weight carrying requirements and wind deflection limitations.

.3 Design coupling mullions to permit unit module construction and provide for thermal expansion. When required, reinforce wind load carrying members with steel reinforcement suitably treated to prevent electrolytic action.

.4 Design operable vents to have a restricted opening not exceeding 100 mm.

2.5 MATERIALS

.1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy.

.2 Sheet Aluminum: To ASTM B209/B209M, 3003-H14 alloy.

.3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.

.4 Steel Sections: Shaped to suit mullion sections.

.5 Fastener: Stainless steel.

.6 Screen Mesh: 18/16 aluminum mesh, Black colour.

.7 Bituminous Coating: Fibred asphalt emulsion.

.8 Thermal Break: Rigid polyamide.

.9 Vapour Retarder: As specified in Section 07 26 00.

.10 Air Barriers: As specified in Section 07 27 00.

.11 Air Sealant Foam: As specified in Section 07 27 36.

.12 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.

.13 Glazing Materials: As specified in Section 08 80 00.

.14 Joint Sealants: As specified in Section 07 92 00, Types as follows:
.1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
.2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
.3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.

.15 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

2.6 COMPONENTS

.1 Frames and Mullions: 2.5 mm thick extruded aluminum; 127 mm deep profile; thermally broken with interior tubular section insulated from exterior; applied glazing stops; drainage holes; internal weep drainage system; eg. 518 Isoport by Kawneer.

.2 Operable Vent Sash: 2.5 mm thick extruded aluminum sections; 81 x 57 mm size profile, top-hinged projecting out (TPO) design; thermally broken with interior tubular section insulated from exterior; applied glazing stops; eg. 526 TPO Isoport Window by Kawneer.

.3 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams.

.4 Metal Flashing: 2.0 mm thick extruded aluminum, finish to match mullion sections where exposed.

.5 Operable Vent Hardware:
- .1 Hinges: Stainless steel 4 bar hinges, complete with limit stop device.
- .2 Operator: Pivot shoe roto operator complete with collapsable crank handle.
- .3 Lockable Handles: Hook bolt lock handle, complete with sash mounted strike plate.
- .4 Weatherstripping: Manufacturers standard type to suit application, finish to match frame.

.6 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.

.7 Glass: As specified in Section 08 80 00, Types as indicated on Drawings.

2.7 FABRICATION

.1 Fabricate Products to AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1.

.2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.

.3 Make joints flush, hairline, and weatherproof.

.4 Arrange fasteners and attachments to conceal from view.

.5 Prepare components with internal reinforcement for operating hardware.

.6 Provide minimum two lockable handles per operable vent sash.

.7 Overlap and seal glazing flanges of abutting members for entire depth and width of flanges to ensure a solid, unbroken air and water barrier. Glass stops shall be screwless, lock-in type.

.8 Provide fully resilient settings for glass and panels by use of EPDM elastomeric glazing gaskets on both sides of glass installed in window frames.

.9 Provide connection flange to full perimeter of frame, attached from interior side of frame with concealed fasteners cut flush with face of flange. Pre-drill fastener holes into flange to accommodate immediate on-site installation.

.10 Insect Screens
- .1 Fabricate screen frames of tubular extruded aluminum, to CAN/CGSB-79.1-M; prefinished to match window frames.
- .2 Secure screen mesh to screen frame with removable polyethylene spline.
- .3 Secure screen assemblies to window frames using mechanical fasteners as required by authorities having jurisdiction.

2.8 FINISHES

.1 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 to match existing.

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

2.9 SOURCE QUALITY CONTROL

.1 Perform shop inspection and testing as specified in Section 01 40 00.

.2 Shop Inspection and Testing: Random tests conducted by independent testing agency on fabricated window framing at point of manufacture, verifying compliance with specified performance criteria.

3 Execution

3.1 PREPARATION

.1 Apply heavy coat of bituminous paint on surfaces of aluminum placed in contact with concrete, mortar, plaster, or dissimilar metals.

.2 Provide fastenings and anchors required to be built in to adjacent work to other Sections.

3.2 INSTALLATION

.1 Install Products to CSA A440.4.

.2 Install Products in correct locations, level, square, plumb, free from distortion, properly aligned, and at proper elevations.

.3 Make joints neat, fine, and weathertight.

.4 Allow for expansion and contraction of components.

.5 Provide additional mouldings and closures necessary.

.6 Use appropriate fasteners compatible with materials being fastened. Conceal fasteners.

.7 Fasten connection flange to wall assembly and connect building envelope air barrier membrane to flange.

.8 Seal connection flange to transition sheet membranes with continuous bead of joint sealant prior to application of air sealant foam.

.9 Provide trim panning and flashings of sufficient size to neatly finish the window frame to the interior and exterior window opening.

.10 Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.

.11 Install glass as specified in Section 08 80 00.

.12 Provide sills in place with anchoring devices located at ends and evenly spaced at 600 mm OC. Fasten expansion joint cover plates and drip deflectors with self-tapping stainless steel screws.

.13 Maintain 6 mm to 9 mm space between butted ends of continuous sills. For sills over 1 220 mm in length, maintain 3 mm to 6 mm space at each end.

.14 Install end dams at each sill.

.15 Grind smooth exposed edges of aluminum sills, ensuring no sharp edges.

.16 Provide joint sealants as specified in Section 07 92 00.

3.3 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Field Inspection and Testing: Random tests conducted by independent testing agency on installed windows, verifying compliance with specified performance criteria.

.3 Make Good Products not meeting specified performance criteria.

.4 Re-test replacement Products at no additional cost to Owner.

3.4 TOLERANCES

.1 Deviation From Plumb and Level: $\leq$ 3 mm in 3 000 mm.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean glass and aluminum surfaces.

.3 Do not scratch or damage surfaces.

.4 Do not remove protective cover from framing until final cleaning operations.

3.6 PROTECTION

.1 Refer to Section 01 76 00.

.2 Provide protective coatings on surfaces subject to damage.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 – GENERAL

1.1 WORK INCLUDED

.1 Furnish, deliver and install finish hardware.

.2 It is intended that the following list of hardware will cover finish hardware to complete the project. Bring to the Consultants attention any omissions, discrepancies that will affect work in this section during the bidding period.

1.2 RELATED SECTIONS

.1 General Requirements Division 1

.2 06 20 00 Finish Carpentry

.3 06 40 00 Architectural Woodwork

.4 08 10 00 Doors and Frames

.5 Division 26 Electrical

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED IN THIS SECTION

.1 Power supplies, compressor/control boxes, junction boxes installed by Division 26.

1.4 REFERENCES

.1 Door and Hardware Institute - Recommended locations for Architectural Hardware for Standard Steel Doors and Frames

.2 Door and Hardware Institute - Recommended locations for Architectural Hardware for Flush Wood Doors

.3 CSDMA-Recommended Dimension Standards for Commercial Steel Doors and Frames (Hardware Locations)

.4 NFPA 80-Standard for Fire Doors and Windows, 1999 Edition

.5 Door and Hardware Institute - Sequence Format for Hardware Schedule

.6 Door and Hardware Institute - Key Systems and Nomenclature

.7 Door and Hardware Institute - Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications

.8 Door and Hardware Institute – Installation Guide for Doors and Hardware

.9 Ontario Building Code

1.5 SUBMITTALS

.1 Updated Finish Hardware Schedule:
Submit submittals in accordance with Section 01 30 00 Submittal Procedures. Prepare detailed hardware schedules in Door and Hardware (DHI) vertical format as detailed in Reference 1.4.5.

.2 Product Data:
Submit in a three-ring binder six (6) copies of product data sheets with the finish hardware schedule showing items of hardware to be used on the project.

.3 Samples:
When requested in writing, provide (to the Consultants Site Office) one sample of each hardware item complete with fasteners, within thirty (30) calendar days of award of a purchase order. Samples to be clearly labeled with their hardware schedule designation and manufacturers' name and model number. Samples will be incorporated into the work.

.5 Templates:
Submit templates within to related trades when requested.

.6 Keying Schedule:
After a keying meeting between representatives of the Owner, furnish a keying schedule listing the levels of keying as well as an explanation of the key system's function, the key symbols used, and the door numbers controlled. Utilize "Door and Hardware Institute - Key Systems and Nomenclature" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

.7 Wiring Diagrams
Co-ordinate with related trades, meet with the owner and security provider and submit a written description of the functional use (mode of operation) of electrical hardware products specified. Include operation for ingress, egress, fire alarm, and after hours use where applicable. Include door and frame elevations showing the location of each item of electrical hardware to be installed, mode of operation including a diagram showing number and size of conductors. Indicate on elevation drawing items provided by related trades, include for back boxes, and 120V power sources. Provide point to point drawings showing terminal connections necessary for a complete installation.

.8 Operations and Maintenance Data
Prior to Substantial Completion, furnish to the owner, two (2) copies of an owner's operation and maintenance manuals in a three-ring binder with the following information:

1. Name of hardware distributor, address and contact name
2. Copy of final "as-built" finish hardware schedule
3. As installed "wiring diagrams, elevations, risers, point to point"
4. Copy of final keying schedule
5. Copy of floor plans with keying nomenclature assigned to door numbers as per the approved keying schedule
6. Catalogue cut sheets and product specifications for each product
7. Parts list for each product
8. Installation instructions and templates for each product

1.7 QUALITY ASSURANCE

.1 Review installation procedures with the Contractor's Designated Installers. Hold instruction meetings with installers prior to installation and subsequent review meetings during the installation period. Submit minutes of meetings to the Consultant.

.2 Substitutions
Only approved products specified are accepted. Make substitution requests in accordance with Division 1. Include product data and indicate benefit to the project.

.3 Supplier Qualifications
Successful hardware distributor to have a minimum of five (5) years' experience in the door and hardware industry. Distributor to have on staff an Architectural Hardware Consultant (A.H.C.) whose name will be listed on the hardware schedule title page submittal and will be responsible for scheduling, detailing, (see Reference 1.5.1) ordering and co-ordination of the finishing hardware for this project. If so, requested by the Consultant and or installer this individual will be required to visit the jobsite for any installation problems that may occur.

.4 Designated Installers
Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. Installers to attend review meetings with the Hardware Distributor.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Marking and Packaging
Mark cartons with heading number, door number, and key-set symbol where applicable in original packaging provided by the manufacturer. Pack packaged hardware in suitable wrappings and containers to protect it from damage during shipping and storage.
Enclose accessories, fastening devices and other loose items with each applicable item of hardware.

.2 Delivery
Deliver hardware to related trades.

.3 Storage
Store in a clean, dry room with lockable man door and adequate shelving to permit organization so item numbers are readily visible.

1.9 WARRANTY

.1 Furnish warranties by the accepted manufacturers:

Hardware Item	**Length of Warranty**
Mortise Hinges	1year
Locks (ND, ALK Series)	10 years
Door Closers - Mechanical	30 years
Door Operators - Electro Mechanical	2 years
Overhead Stops/Holders	1 year
Floor/Wall stops	1 year
Electric Strikes	5 years

1.10 MAINTENANCE

.1 Maintenance Service

After the building is occupied arrange an appointment with the maintenance staff from the Halton Catholic District School Board for instruction of proper use, servicing, adjusting and lubrication of hardware furnished. Submit to the consultant a list of attendees and meeting date.

.2 Extra Materials
Furnish the following items in proper manufacturer's cartons once the job has been completed:

1. 5 of each installation tool used for locks/passage/privacy, type of door closers, and exit devices.

PART 2 – PRODUCTS

2.1 MANUFACTURERS
Products listed in the hardware groups are from the manufacturers listed below:

ITEM	MANUFACTURER NAME
Full Mortise Hinges	Ives
Locksets, Latchsets/Deadbolts	Schlage
Cylinders	Schlage
Door Closers	LCN
Overhead Door Holders/Stops	Glynn Johnson
Door Pulls/Flatware	Ives
Wall/Floor Stops	Ives
Automatic Door Operators/Actuators	LCN
Electric Strikes	Von Duprin

2.1 MATERIALS

1. Screws and Fasteners:
Screws and fasteners to be matching finish to their product and to be manufacturer's standard. Door closers, door holders and exit devices installed on fire rated wood doors and hollow metal doors to be attached with fasteners to meet NFPA 80 requirements.

2. **Materials-Acceptable Manufacturers (Note: Supply products in a given category from the same manufacturer**):

.1 Mortise Hinges

Provide five knuckle bearing hinges with NRP option on reverse bevel doors with locking hardware. Hinge width to accommodate door closer projection, door trim and allow for 180-degree swing. Doors up to 2286mm (90") in height, supply 3 hinges, doors greater than 2286mm in height add one hinge for every additional 760mm of door height. Doors 915mm (36") wide and less furnish 114mm (4-1/2") high hinges, doors greater than 915mm (36") wide furnish 127mm (5") high hinges, heavy weight or standard weight as specified. Supply ferrous (steel), stainless steel material for all interior and/or fire-rated doors and stainless steel for exterior doors.

As Specified: Ives Hinges, 5BB1, 5BB1HW

.2 Locksets/Deadlocks/Privacy Sets:

Cylindrical:
Extra heavy duty residential, commercial, institutional and industrial applications. Latch bolts to be steel with minimum 13mm (½") throw deadlocking on keyed functions. 19mm

(¾") throw anti-friction latchbolt on pairs of fire doors. Provide manufacturer's standard wrought box strike for each latch or lock, with curved lip extended to protect frame. Locks and latchsets tested to exceed 8,000,000 cycles. Provide molex connections for electrified functions as a standard. Lock case to be steel, incorporate one-piece spring cage and spindle. Precision solid brass 6-pin cylinder with nickel silver keys available in Schlage keyways. Levers to be solid with no plastic inserts.

Supply as Specified: Schlage "ND" series

.3 Door Closers:

Door closers to have the following features (see separate closer sections below for further information):

- Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one-piece forged steel pistons.
- Include high efficiency, low friction pinion bearings.
- Hydraulic fluid of a type requires no seasonal adjustments, ULTRA X TM fluid has constant temperature control from -35 degrees Celsius to +49 degrees Celsius.
- Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.
- Separate adjustments for backcheck, general speed and latch speed.
- Door closers with special template (ST-) numbers include required associated product, information sheets and instructions
- Size 1 manual door closers to provide less than 5 pounds opening force on a 900mm door leaf.
- Door closer with Pressure Relief Valves are not accepted.
- Door closer bodies, arms, covers to be powder coated
- Closers with powder coat finishes to exceed a minimum 100-hour salt spray test, as described in ANSI A156.18 and ASTM B117.
- Closers detailed with plated finishes to include plated covers (or finish plates), arms and visible fasteners.

Medium Duty Mechanical (Interior/Exterior):
Non-sized (1-6) and non-handed cylinder body to have 32mm (1 ¼") piston diameter with 16mm (5/8") single heat-treated shaft. Track closer cylinder body non-sized (2-4) or (1-2). Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN1460 series

Heavy Duty Mechanical (Multiple Applications):
Non-sized (1-6) and non-handed cast iron cylinder body to have 38mm (1 1/2") diameter with 19mm (3/4") journal double heat-treated pinion shaft with 16mm (5/8") full complement bearings. XP closer hydraulic regulation controlled by tamper-proof, non-critical screw valves, abrasion resistant Vitron "O" ring, adjustable with a hex wrench. Closer to have "FAST" Power Adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have forged steel main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever forged arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

Supply as Specified: LCN 4040XP series

"NOTE: LOW ENERGY OPERATORS SUPPLIED AND INSTALLED BY THIS SECTION"

Heavy Duty Electric Operator (Push Side Mount):
Non-sized (2-5) and non-handed cylinder body to have 38mm (1 1/2") piston diameter with 17mm (11/16") double heat-treated shaft and certified to exceed ten million (10,000,000) manual full load operating cycles by a recognized independent testing laboratory. Power operator to include:

- Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.
- "Second Chance" function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. If resistance still exists, door will pause and the unit will time out and door will close.
- "Breakaway" drive system: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.
- "Soft Start" motor control: required for controlled start once actuator is depressed to extend the service life of drives components.
- "Built in Power Supply" to deliver 12V and 24V outputs up to a maximum of 1.0 amp.
- Certified by cUL for use on labeled doors.
- Independent adjustments for electrically controlled functions within controller module.
- Provide drop plates, brackets, or adapters for arms, long rod and shoe to suit details.

Supply as Specified: LCN 4640 series

.4 Actuators:

Wall Type
Wall plate switch to be hard-wired actuator with round, stainless steel touch plate in either 114mm (4-1/2") or 152mm (6") diameters. Engraved blue filled handicap symbol conforms to most accessibility codes. Units to include heavy grade components for vandal resistant mounting and weather resistant switch standard.

Supply as specified: LCN 8310-852, (152mm), surface back box 8310-867S

.5 Overhead Door Stops/Holders:

Heavy Duty Surface Mounted:
Surface overhead stops/holders to be stainless steel base, non-handed for single-acting doors with a heavy-duty channel/slide-arm design and offset jamb bracket to allow for simple field modifications of functions. Channel to be surface mounted to the door with thru bolts and the jamb bracket is surface mounted to the frame soffit.

Supply as Specified: Glynn-Johnson 90 series

.6 Door Pulls/Flatware:

Ives 8400, screw mounting for installation (Kickplates 40mm (1-5/8") less door width single door and 25mm (1") less door width double doors)

.7 Floor/Wall Stops:

Floor Stops:
Floor stops to be heavy-duty cast dome stop constructed of brass/bronze with grey, non-marring rubber bumper.

Supply as Specified: Ives FS439

.8 Electric Strikes:

Electric Strikes:
Grade 1, electric strikes to be cUL listed burglary-resistant and electric strike for fire doors and frames. A label for single doors and B label for double doors. Electric strikes to be stainless steel construction, non-handed available in 12V or 24V AC or DC with continuous duty solenoid and accept 19mm (¾") throw latchbolts. Strike box to be adjustable to compensate for any misalignment of the door or frame with two-piece plug connector for ease of installation.

Supply as Specified: Von Duprin 6000 series

Electric Washroom Accessories:
Provide electric washroom accessories to compete the installation of automatic door operators for universal and barrier free washroom requirements

Supply as Specified: Camden - Push to lock, CM-AF550R
Camden – LED annunciator CM-AF500
Camden – Advanced Logic Relay CX-33
Camden – Emerg. Call Kit CX-WEC10K2

2.3 FINISHES

.1 Unless otherwise specified, finishes to be brushed chrome (BHMA 626/652).

Finishes are specified as follows:

ITEM	BHMA#	DESCRIPTION	BASE MATERIAL
Hinges	626	satin chrome plated	brass/bronze
Lock Trim	626	satin chrome plated	brass/bronze
Door Closer	689	powder coat aluminum	steel
Protective Plate	630	satin stainless steel	stainless steel
Door Stops/Holders			
Overhead	630	satin stainless steel	stainless steel
Wall/Floor	626	satin chrome plated	brass/bronze
Electric Strikes	630	satin stainless steel	stainless steel

2.4 CYLINDERS, KEYING SYSTEMS

.1 Meet with the Owner to finalize keying requirements and obtain keying instructions in writing as outlined in Division 1. Interior locks and cylinders shall be furnished to an existing EF keyway, 5 pin

Schlage system managed by Aim Locksmith, Oakville. Contact Aim Locksmith for keying to their existing system with direction from the School Board.

Keying requirements to be confirmed by owner.

PART 3 – EXECUTION

3.1 EXAMINATION

.1 Ensure that doors and frames are prepared and reinforced to receive finish hardware prior to installation.

.2 Ensure that door frames and finished floor are plumb and level to permit proper engagement and operation of hardware.

.3 Verify power is run to door opening requiring electrified hardware.

.4 Submit in writing a list of deficiencies determined as part of inspection required in 3.1.1 and 3.1.2 to supervising consultant prior to installation of finished hardware. Correct door frame installation before proceeding with finish hardware installation.

3.2 INSTALLATION

.1 Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. Installers to attend review meetings conducted by the hardware distributor.

.2 Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation drawings.

.3 Where mounting height is not otherwise specified, install hardware at mounting heights as indicated in 1.4.1, 1.4.2.

.4 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

.5 Ensure locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. **Handing is part of installation procedure.**

.6 Follow manufactures installation instructions. Adjustment of door closers is inclusive of spring power, closing speed, latching speed and back-check, valve screws to achieve backcheck (4040, 4040XP series) at the time of installation.

.7 Adjust delayed action door closers to forty (40) second delay for barrier free accessibility and movement of materials. Time period to be approved by Owner.

3.3 FIELD QUALITY CONTROL

.1 Verify each door leaf opens closes and latches. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation with owner to sign off on verification of operation. Verify electric door release hardware operates to close the door upon activation of the fire alarm system.

.2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports

listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.3 Before completion of the work but after the hardware has been installed, submit a certificate to the Consultant stating that final inspection has been made and that hardware has been checked for installation and operation.

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 Adjust doors with self-closing devices or automatic closing devices for operation after the HVAC system is balanced and adjusted. Adjust spring power of non sized door closers to close and latch the door.

.3 Hardware to be left clean and free of disfigurements.

.4 Instruct owner personnel in the operation, adjustment and maintenance of hardware.

.5 Check locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction. Wrap locks, panic hardware, and fire exit hardware, door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove and reinstall or where necessary, use temporary hardware to maintain finish in new condition and maintain manufacturer’s warranty.

3.6 HARDWARE GROUPS

END

1 General

1.1 RELATED SECTIONS

.1 Section 06 41 00 - Architectural Wood Casework.

.2 Section 07 92 00 - Joint Sealants.

.3 Section 08 14 00 - Wood Doors.

.4 Section 08 51 13 - Aluminum Windows.

.5 Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

.1 AAMA 800-16: Voluntary Specifications and Test Methods for Sealants.

.2 ANSI Z97.1-2009: Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.3 ASTM C509-06(2021): Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.

.4 ASTM C864-05(2019): Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

.5 ASTM 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 C1376-21a: Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.

.8 ASTM C1503-24: Standard Specification for Silvered Flat Glass Mirror.

.9 ASTM E1300-16: Standard Practice for Determining Load Resistance of Glass in Buildings.

.10 CAN/CGSB-12.1-2017: Safety Glazing.

.11 CAN/CGSB-12.2-M91 (R2017): Flat, Clear Sheet Glass.

.12 CAN/CGSB-12.3-M91 (R2017): Flat, Clear Float Glass.

.13 CAN/CGSB-12.8-2017: Insulating Glass Units.

.14 CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

.15 GANA Glazing Manual.

.16 GANA GIB 01-0300: Proper Procedures for Cleaning Architectural Glass.

.17 IGMA TM-3000-90(16): North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

.18 IGMA TM-4510-18(19): IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.

.19 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.

.20 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

.21 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.

.22 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 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Verification Samples: Duplicate 300 x 300 mm size samples of each specified sealed insulating glass unit, illustrating thickness, edge seal, colouration and design.

1.5 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.

1.6 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 two years.

1.7 QUALITY ASSURANCE

.1 Conform to glazing installation methods and quality standards specified in:
.1 GANA Glazing Manual,
.2 IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use, and
.3 IGMA TM-4510, IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.

.2 Select glazing compounds and sealants in accordance with glass manufacturers' instructions.

1.8 WARRANTY

.1 Submit extended warranties in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranties: For a period of 5 years, covering complete replacement of units experiencing:
.1 Sealed Insulating Glass Units: Seal failure or interpane dusting and misting.
.2 Mirrored Glass Units: Deterioration or delamination of reflective coating that affects reflectivity of mirrored unit.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of single pane glass and sealed insulating glass units having Product considered acceptable for use:
.1 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 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 Design Products installed as exterior glazing to contribute to continuity of building enclosure air and vapour seals.

2.4 PERFORMANCE CRITERIA

.1 Sealed Insulating Glass Units: Having the following tested physical properties:
.1 Visible Light Transmittance (VLT): 70 percent.
.2 Visible Light Reflectance:
.1 Exterior: 11 percent.
.2 Interior: 12 percent.
.3 Coefficient of Heat Transmission, Winter, Argon-Filled (ANSI/NFRC 100): U = 1.36 W/m^2 degrees C.
.4 Solar Heat Gain Coefficient (ANSI/NFRC 200): SHGC = 0.39.
.5 Light to Solar Gain Ratio: LSG = 1.79.

2.5 SINGLE PANE GLASS

.1 Float Glass (GL-1): To CAN/CGSB-12.3-M; glazing quality, 6 mm thick unless noted otherwise.

.2 Mirrored Glass (GL-2): To ASTM C1503; clear float glass, with silvered coating evenly applied over rear face; complete with polished edges; sizes as scheduled or noted on Drawings; 4 mm thick unless noted otherwise.

.3 Tempered Safety Glass (GL-3): 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.

.4 Sheet Glass (GL-4): To CAN/CGSB-12.2-M; glazing quality, 3 mm thick unless noted otherwise.

.5 Fire-Rated Ceramic Glass (GL-5): 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; Standard Grade finish; 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 by Nippon Glass.

2.6 SEALED INSULATING GLASS UNITS

.1 Sealed Insulating Glass Units (SIG-CLR-1): To CAN/CGSB-12.8; double pane with warm edge seal; comprised as follows:
.1 Outer Pane: 6 mm thick Clear tempered safety glass (GL-3), sputtered Low-E coating on #2 surface.
.2 Interpane Space: Filled with minimum 90 percent Argon gas.
.3 Inner Pane: 6 mm thick Clear tempered safety glass (GL-3).
.4 Overall Thickness: 25 mm.
.5 Manufacturer's Name and Product: eg. Solarban 60 (2) Clear + Clear by Vitro Architectural Glass.

2.7 COATINGS AND FILMS

.1 Low-E Coating: To ASTM C1376, Kind CV; magnetron sputtered vacuum deposition (MSVD) coating; eg. Solarban 70 Solar Control Low-E by Vitro Architectural Glass.

2.8 ACCESSORIES

.1 Warm Edge Seal: Polyisobutylene primary seal with a secondary seal comprised of either silicone, butyl, polysulphide or urethane, as recommended by sealed insulating glass unit manufacturer for each particular glazing application; and with port at top of unit.

.2 Dense Compression Gasket: Moulded or extruded gaskets, made from neoprene or EPDM to ASTM C864, or thermoplastic polyolefin rubber to ASTM C1115; of profile and hardness required to maintain watertight seal.

.3 Soft Compression Gasket: To ASTM C509, Type II; moulded or extruded, closed-cell, integral-skinned gaskets made from neoprene, EPDM or thermoplastic polyolefin rubber; Black colour; profile and hardness required to maintain watertight seal.

.4 Back-Bedding Mastic Glazing Tapes: To ASTM C1281 and AAMA 800, preformed, butyl-based elastomeric tape with 100 percent solids content; non-staining and non-migrating in contact with non-porous surfaces; with or without spacer rod; packaged on rolls with release paper backing.

.5 Expanded Cellular Glazing Tapes: Closed cell, PVC foam tape, factory-coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; to AAMA 800 for the following types:
.1 Tape Acts as Primary Seal: Type 1.
.2 Tape Used in Combination with Full-Bead of Sealant: Type 2.

.6 Glazing Tape for Fire-rated Glass Applications: Fiberfrax Alumino-Silicate Fiber glazing tape by Unifrax Corporation.

.7 Setting Blocks: Elastomeric material, having a Shore A durometer hardness of 85, plus or minus 5.

.8 Setting Blocks for Fire-rated Glass Applications: Calcium silicate.

.9 Spacers: Elastomeric blocks or continuous extrusions, having a Shore A durometer hardness sufficient to maintain glass lites in place both during and after installation.

.10 Edge Blocks: Elastomeric material of sufficient hardness to limit glass lateral movement.

.11 Glazing Sealant: SEAL-GLZ as specified in Section 07 92 00.

.12 Metal Channel Trim: 0.41 mm thick Series 430 stainless steel J-trim; 7.6 mm deep, 22 mm high back leg, 7.9 mm high front leg, and 6.3 mm deep channel to accommodate 6 mm thick glass; eg. SS960 by C. R. Laurence Co. Inc.

.13 Wall Adhesive: Chemically compatible with glass coating and wall substrate.

.14 Cleaners, Primers and Sealers: Types recommended by sealant and gasket manufacturers.

2.9 FABRICATION

.1 Fabricate sealed insulating glass units to IGMA TM-4510.

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 Install exterior glazing forming part of building envelope to IGMA TM-3000 to achieve airtight and watertight seal.

.3 Protect glass edges from damage during handling and installation. Remove damaged glass Products from 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.

.4 Install setting blocks in sill rabbets, sized and located in accordance with GANA Glazing Manual. Set blocks in heel bead of glazing sealant.

.5 Do not exceed edge pressures stipulated by glass manufacturer for installing glass lites.

.6 Provide spacers for glass lites where length plus width is larger than 1 270 mm.

.7 Provide edge blocking necessary to prevent glass lites from moving sideways in glazing channel, in accordance with GANA Glazing Manual.

.8 Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sight line of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
.1 Cover vertical framing joints by applying tapes first to heads and sills, and then to jambs.

.2 Cover horizontal framing joints by applying tapes first to jambs, and then to heads and sills.
.3 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant.
.4 Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.

.9 Gasket Glazing: Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
.1 Insert soft compression gasket between glass and frame or fixed stop such that it is securely in place, with joints miter cut and bonded together at corners.
.2 Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.
.3 Install gaskets so they protrude evenly past face of glazing stops.
.4 Compress gaskets to produce weather tight seal without developing bending stress in glass.
.5 Seal gasket joints with compatible sealant.

.10 Wall-Mounted Glass Mirrors
.1 Ensure wall surface is flat.
.2 Install top and bottom metal channel trim, secured rigidly to wall construction.
.3 Provide setting blocks and shims as required to level and adjust mirrored glass faces continuously flush with adjacent mirrored glass panels.
.4 Set mirrored glass panels plumb and level on wall surface, using beads of adhesive.
.5 Adjust top metal channel trim to glass edge for snug fit.

.11 Sliding Glass Panels
.1 Site measure casework openings, and fabricate sliding glass panels to sufficient sizes, including adequate overlaps to accommodate locking devices.
.2 Coordinate necessary clearances and sizes with manufacturer of sliding glass track assembly specified in Section 06 41 00.
.3 Drill holes in glass panes as required.
.4 Grind edges smooth and slightly rounded.
.5 Temper glass after fabrication is complete.
.6 Install sliding glass panels in casework on hardware specified in Section 06 41 00. Ensure smooth operation.

.12 Glass Shelves
.1 Polish sheet glass edges prior to installation.
.2 Install shelves in fitments or casework on hardware specified in Section 06 41 00.

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 exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.

.3 Protect glass from contact with contaminating substances resulting from subsequent construction operations.

.4 Protect window film from damage by installing tape warning strips or barricades to prevent contact. Maintain protection until Owner occupancy.

.5 Remove and replace Products that have been damaged, including but not limited to having been broken, chipped, cracked or abraded; regardless of cause, before Owner occupancy.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 06 16 43 - Gypsum Sheathing.

.3 Section 06 20 00 - Finish Carpentry.

.4 Section 07 92 00 - Joint Sealants.

.5 Section 08 31 00 - Access Door and Panels.

.6 Section 09 51 23 - Acoustical Tile Ceilings.

.7 Section 09 81 00 - Acoustic Insulation.

.8 Section 09 90 00 - Painting and Coating.

.9 Section 21 13 13 - Wet Pipe Fire Suppression.

.10 Section 23 37 13 - Diffusers, Registers, and Grilles.

.11 Section 26 51 13 - Lighting Equipment.

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 E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.16 CGC Gypsum Construction Handbook.

.17 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.18 CISCA Ceiling Systems Handbook, 2012 Edition.

.19 GA-214-2021: Levels of Finish for Gypsum Panel Products.

.20 GA-226-2019: Application of Gypsum Board to Form Curved Surfaces.

.21 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.

.22 ULC List of Equipment and Materials.

1.3 QUALIFICATIONS

.1 Installers: A firm specializing in erecting metal support framing and installing gypsum board, and 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 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 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.

.7 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.

.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 C; Level II - Mild to Moderate Duty; 15.9 mm thick gypsum abuse-resistant panel with water- and mould-resistant gypsum core and paper facers, tapered long edges and square ends; eg. Sheetrock Brand Panels Mold Tough AR FireCode C by CGC Inc.

.4 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,Type S, Fine Thread; galvanized steel.

.7 Adhesive: To CAN/CGSB-71.25-M.

.8 Joint Tape - Mould Resistant: Fiberglass joint tape, 50 mm wide, self-adhering type; eg. Mould Resistant Fiberglass Drywall Tape by CGC Inc.

.9 Joint Compound - Mould Resistant: 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 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

.12 Water: Potable.

2.7 MIXING

.1 Thoroughly mix joint and skim coat materials to homogeneous mixture with trowelling consistency.

2.8 FINISHES

.1 Galvanized Coating on Metal Framing Components: To ASTM A653/A653M, Coating Designation Z120; hot dipped zinc alloy coating.

.2 Galvalumed Coating on Metal Framing Components: To ASTM A792/A792M, Coating Designation AZM150; hot dipped aluminum-zinc alloy coating.

3 Execution

3.1 PREPARATION

.1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure.
  .1 Ensure inserts and other provisions for anchorages to building structure have been installed to receive hangers at 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 such that flanges within framing system point in same direction.

.4 Space metal studs along straight runs at maximum 400 mm OC.

.5 Install track floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions of structure.

.6 Where framing extends to overhead structural supports, Provide deflection track to create a slip-type head joints to produce joints at tops of framing system that prevent axial loading of finished assemblies due to deflection of structure.

.7 Screw vertical studs at door opening jambs to jamb anchor clips at door frames. Install track section for cripple studs at head and secure to jamb studs.
  .1 Provide two studs at each jamb.
  .2 Provide cripple studs at head adjacent to each jamb stud, with 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:
  .1 Install framing to comply with fire-resistance-rated assembly indicated.
  .2 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 Partitions: Conform to GA-226, 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.
  .3 Provide studs spaced at 150 mm OC.
  .4 On straight lengths of not less than two studs at ends of arcs, place studs at 150 mm OC.

.12 Direct Furring: Attach 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 Provide acoustic seals in designated sound-rated partitions with beads of joint sealant where indicated on Drawings.

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 metal heavy duty stud and track framing.

.5 Double Layer Applications: Place first layer perpendicular to framing or furring members. Place second layer perpendicular to first layer.

.6 Place corner beads at external corners. Place edge trim where gypsum board abuts dissimilar materials. Fasten with nail attachment, unless specified otherwise.

.7 Provide bulkheads where changes of ceiling or height occur.

.8 Install access panels when and where directed by affected Subcontractors. Refer to Section 08 31 00.

3.6 BOARD FINISHING

.1 Tape, fill, and sand exposed joints, edges, and corners to a smooth surface.

.2 Leave surfaces smooth, even, plumb and true, 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 casework.

3.7 CONTROL JOINTS

.1 Provide control joints where indicated on Drawings, and where:
.1 Ceiling, partition or furring abuts a structural element,
.2 Ceiling, partition or furring abuts dissimilar construction,
.3 Construction changes within plane of the partition or ceiling,
.4 Partition or furring run exceeds 9 000 mm,
.5 Ceiling dimensions exceed 15 000 mm in either direction,
.6 Wings of "L-", "U-" and "T"-shaped ceiling areas are joined, and
.7 Expansion or control joints occur in the structural elements of the building.

.2 Break continuity of gypsum board and framing system at control joints.

.3 Provide continuous control joint profile.

3.8 RELIEF JOINTS

.1 Provide relief joints where indicated on Drawings, and where gypsum board assemblies abut dissimilar construction.

.2 Stop gypsum board 6 mm from abutting construction at dissimilar building elements, unless indicated otherwise.

.3 Provide thermal break where gypsum board comes into contact with frames. Adhere self-adhering tape to casing bead and compress during installation of gypsum board.

.4 Provide reveal mouldings where gypsum board ceilings meet curved wall surfaces, and where indicated on Drawings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 92 00 - Joint Sealants.

.4 Section 09 65 16 - Resilient Sheet Flooring.

.5 Section 09 65 19 - Resilient Tile Flooring.

1.2 REFERENCES

.1 ANSI A108.01-2016: General Requirements: Subsurfaces and Preparations by Other Trades.

.2 ANSI A108.4-2009: Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.

.3 ANSI A108.5-1999: Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar (Reaffirmed 2010).

.4 ANSI A108.10-1999: Installation of Grout in Tilework (Reaffirmed 2010).

.5 ANSI A108.13-2005: Installation of Load Bearing, Bonded, Waterproof Membrane for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).

.6 ANSI A108.17-2005: Installation of Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).

.7 ANSI A118.1-2012: Specifications for Dry-Set Portland Cement Mortar.

.8 ANSI A118.4-2012: Specifications for Modified Dry-Set Cement Mortar.

.9 ANSI A118.7-2010: Specifications for Polymer Modified Cement Grouts for Tile Installation (Reaffirmed 2016).

.10 ANSI A118.10-2014: Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

.11 ANSI A118.12-2014: Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

.12 ANSI A136.1-2008: Specifications for Organic Adhesives for Installation of Ceramic Tile (Reaffirmed 2013).

.13 ANSI A137.1-2012: Specifications for Ceramic Tile.

.14 ASTM C144-18: Standard Specification for Aggregate for Masonry Mortar.

.15 ASTM C207-18: Standard Specification for Hydrated Lime for Masonry Purposes.

.16 ASTM C627-18e1: Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.

.17 ASTM C847-18: Standard Specification for Metal Lath.

.18 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.19 ASTM F3191-23: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

.20 CAN/CGSB-25.20-95: Surface Sealer for Floors.

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

.22 TTMAC Specification Guide 09 30 00 - Tile Installation Manual 2019-2021.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating swim lines, terminal, targets, pool markings, and special patterns. Include locations and details for proposed control joints.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Verification Samples: One 300 x 300 mm size panel for each specified tile, complete with selected grout colour; mounted to 19 mm thick plywood backer.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Maintenance Data: Latest edition of TTMAC Hard Surface Maintenance Guide; sufficient quantities for inclusion in operation and maintenance manual.

1.6 EXTRA STOCK MATERIALS

.1 Supply extra stock materials as specified in Section 01 78 00.

.2 Extra Stock Materials: Two percent or 4.0 m^2, whichever is the greater, of each type and colour of installed tile; clearly marked to identify:
.1 Manufacturer's name,
.2 Product's name,
.3 Product colour and pattern.

.3 Package tiles neatly in original containers, to prevent damage.

1.7 QUALIFICATIONS

.1 Installers: Skilled mechanics trained and experienced in tiling, and members of TTMAC.

1.8 DELIVERY STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Store Products in a dry area, protected from freezing, staining and damage.

.3 Store cementitious materials on a dry surface.

1.9 AMBIENT CONDITIONS

.1 Do not install tiles at temperatures less than 12 degrees C.

.2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers of mortars, grouts and adhesives having Product considered acceptable for use:
- .1 Custom Building Products.
- .2 Flextile.
- .3 Laticrete.
- .4 Mapei.
- .5 Proma Adhesives, Inc.
- .6 TEC.

.2 Manufacturers of tile-setting accessories having Product considered acceptable for use:
- .1 Bengard.
- .2 Profilitec.
- .3 Schlüter Systems (Canada) Inc.

.3 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

.1 Traffic Level Performance (ASTM C627): Moderate Class.

2.3 TILE MATERIALS

.1 Porcelain Floor Tile (PFT): To ANSI A137.1; 305 x 305 mm size, 9 mm thick matte finish porcelain tile; complete with bullnose caps and trim; Spectra Series (Small Grain) as distributed by Olympia Tile International, or Dotti Series as distributed by Centura Floor and Wall Fashions, or Graniti Series as distributed by Daltile; up to premium 3 colours as selected by Consultant.

.2 Cut Base Tile: 100 mm high, full-length, site-cut from floor tile, and having at least one factory-formed edge along each tile's length; type, size, colour and texture to match adjacent flooring material.

2.4 MORTAR AND GROUT MATERIALS

.1 Portland Cement: To CSA A3001, Type GU.

.2 Hydrated Lime: To ASTM C207, Type N-Normal.

.3 Sand: To ASTM C144, passing 16 mesh.

.4 Dry-Set Portland Cement Mortar: To ANSI A118.1.

.5 Latex-Portland Cement Mortar: To ANSI A118.4.

.6 Cementitious Grout: To ANSI A118.7; rapid setting type, polymer-modified sanded grout; eg. Ultracolor Plus FA by Mapei, colours as selected by Consultant.

2.5 ACCESSORIES

.1 Crack Isolation Membrane: To ANSI A118.12, High Performance Rating; loadbearing membrane.

.2 Reinforcing Mesh: 50 x 50 mm size; 1.6 mm thick steel wire mesh; welded fabric, galvanized.

.3 Metal Lath: To ASTM C847; 1.4 kg/m^2 galvanized steel lath.

.4 Organic Adhesive: To ANSI A136.1; Type 1 for wet areas and Type 2 for dry areas.

.5 Latex Additive: Formulated for use in portland cement mortars and grout.

.6 Water: Clean, cold and potable.

.7 Joint Sealant: Interior floor tiling sealant, Type SEAL-INT-FT as specified in Section 07 92 00.

.8 Tile Sealer: To CAN/CGSB-25.20, Type 1 - Penetrating.

2.6 MANUFACTURED COMPONENTS AND ACCESSORIES

.1 Edge and Transition Strips: Roll-formed stainless steel edge strips, 3 mm wide at top edge; with integral perforated anchoring leg for setting the strip into the setting material; height as required; Brushed finish; eg. SCHIENE-EB by Schlüter Systems (Canada) Inc.

.2 Tapered Transition Strips - To Other Floor Finishes: Roll-formed stainless steel transition strips; profile and height as indicated; with integral perforated anchoring leg for setting the strip into the setting material; sloped transition and decorative edge strip for transition from tile to lower finish; Brushed finish; eg. RENO-EBU by Schlüter Systems (Canada) Inc.

.3 Decorative Edge Trim: Extruded aluminum decorative edge trim with integral perforated anchoring leg for setting the strip into the setting material; complete with pre-formed corners; Satin Anodized finish; eg. RONDEC-DB 14 AE by Schlüter Systems (Canada) Inc.

.4 Expansion and Control Joints for Thin-Set Applications: Roll formed stainless steel profiles joined by a soft CPE movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed; height as required to suit application; insert colour as selected by Consultant; eg. DILEX-EKSN by Schlüter Systems (Canada) Inc.

.5 Waterproofing Membrane System: To ANSI A118.10; soft polyethylene membrane with fleece webbing laminated on both sides; use special cut-width rolls and special shapes for corners and pipe sleeves; KERDI by Schlüter Systems (Canada) Inc.

.6 Uncoupling Membrane: To ANSI A118.10; 3 mm thick high density polyethylene membrane with grid structure of 12 x 12 mm square cavities, each cut back in dovetail configuration, and polypropylene anchoring fleece laminated to underside; eg. DITRA by Schlüter Systems (Canada) Inc.

2.7 MIXES

.1 Scratch Coat (by volume): One part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer’s instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.

.2 Slurry Bond Coat: Mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC Detail.

.3 Levelling Coat (by volume): One part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer’s instructions.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Ensure substrates have been prepared to ANSI A108.01.

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

.4 Ensure concrete has cured for minimum 28 days.

.5 Ensure concrete slabs have not been treated with proprietary curing compounds.

.6 Ensure concrete slabs have been steel trowelled to a fine broom finish.

.7 Ensure concrete slabs have been finished with a maximum permissible variation of 3 mm in 3 000 mm from required plane, and not more than 1.5 mm in 305 mm when measured from high points in the surface.

.8 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER $\leq$ 1.45 kg per 100 m^2 for 24 hours.

.9 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

3.2 PREPARATION

.1 Protect surrounding work from damage or disfiguration.

.2 Thoroughly clean existing surfaces which are to receive tile finish to ensure removal of grease, oil and dust film.

.3 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test.

.4 Apply latex modified cementitious levelling coat wherever concrete slab does not meet specified tolerance for flatness and levelness, and where slight irregularities exist. Limit levelling coat thickness to less than 8 mm.

.5 Install crack isolation membrane over suspended concrete slabs to ANSI A108.17. If crack isolation membrane is applied over rough surface, apply 6 mm thick sand-bed under crack isolation membrane.

.6 Install uncoupling membrane as required by TTMAC Details, to ANSI A108.13.

.7 Waterproofing Membrane: To ANSI A108.13, and as follows:
- .1 Fully adhere waterproof membrane to substrate with tile setting adhesive, with no air pockets.
- .2 Overlap and seal membrane seams a minimum 50 mm.
- .3 Alternately, tightly butt adjacent sheets and cover with a 125 mm strip of waterproofing membrane sealed to primary membranes.
- .4 Provide strips of waterproofing where required to span expansion joints or terminate waterproofing into movement-joint type tile-setting accessories, as detailed per manufacturer’s instructions.
- .5 Adhere waterproofing membrane to fixtures, joints around pipes, door and window frames, etc. with transparent waterproof sealant.

3.3 INSTALLATION

.1 Install Products to TTMAC Specification Guide 09 30 00, as scheduled below.

.2 Apply tile using water-resistant organic adhesives to ANSI A108.4.

.3 Apply tile using dry-set Portland cement mortar or latex-Portland cement mortar beds to ANSI A108.5.

.4 Install tiles with straight, uniform joints, to tile manufacturers' recommended joint widths.

.5 Fit tile units around corners, fitments, fixtures, drains and other built-in objects to maintain uniform joint appearance.

.6 Make cut edges smooth, even and free from chipping. Do not split tile.

.7 Lay out tiles according to patterns indicated on Drawings. Ensure perimeter and cut tiles are minimum half size.

.8 Set tiles in place while bond coat is wet and tacky, prior to skinning over. Slide tile back and forth to ensure a proper bond and level surface. Avoid lippage.

.9 Clean backs of tiles and back butter tiles to ensure a 95 percent bond coverage.

.10 Clean excess mortar from surface prior to final set.

.11 Sound tiles after setting materials have cured and replace hollow sounding tile before grouting.

.12 Exterior Surfaces and Wet Areas (Thin Set Method): Notch adhesive in straight lines, backbutter tile and set on freshly trowelled thin-set mortar. Move tile back and forth perpendicular to notches.

.13 Ungauged Slate, Marble, Stone and Large Ceramics: Immediately prior to setting, backbutter tile through a push box or box screed to achieve a uniform thickness of tile and mortar.

.14 Install site-cut tiles with site-cut edges concealed within either a grouted joint or a metal trim. Visually expose only factory-made edges.

.15 Keep two-thirds the depth of grout joints free of setting material.

3.4 MOVEMENT JOINTS

.1 Install control and expansion joints to TTMAC Detail 301MJ.

.2 Keep control joints and expansion joints free of setting materials.

.3 In addition to the guidelines outlined in TTMAC Specification Guide 09 30 00, Provide movement joints over cold joints, saw cuts, at columns and at wall plane changes.

3.5 TILE-SETTING ACCESSORIES INSTALLATION

.1 Install tile-setting accessories in continuous lengths, to level straight lines by pressing the perforated anchoring leg of the accessory solidly into the tile setting adhesive.

.2 Butt ends of units tightly together with hairline joint. Trowel an additional layer of tile setting material over the anchored leg of the accessory prior to placement of tiles.

.3 Unless specified otherwise, solidly embed tiles over anchoring leg of installed trim with surface of tile flush with top of tile-setting accessories.

.4 Leave 3 mm joint between tile and tile-setting accessories for filling with grout.

.5 Install pre-formed corners, end-caps and trim at changes in direction and at terminations. Mitered joints will be rejected.

.6 Expansion and Control Joints: Solidly embed tiles over installed edge strips with joint surface either flush with top of joint or 1 mm below top of tile.

3.6 GROUTING

.1 Allow proper setting time prior to grouting.

.2 Preseal tiles requiring protection from grout staining.

.3 Apply cementitious grout to ANSI A108.10.

.4 Force grout into joints to ensure dense finish.

.5 Remove excess and polish with clean cloths.

3.7 FIELD QUALITY CONTROL

.1 Inspect completed work and replace broken, cracked, or damaged tile.

3.8 TOLERANCES

.1 Level tiles to conform to a 1 mm tolerance over a 3 mm joint.

3.9 CLEANING

.1 Refer to Section 01 74 00.

.2 Apply tile sealer to floor tiles.

3.10 PROTECTION

.1 Protect finished areas from traffic until setting materials have sufficiently cured.

.2 Protect grouted areas from traffic for 24 hours after grouting.

.3 Protect tiled surfaces with temporary protective coverings.

.4 Protect wall tiles and bases from impact, vibration, heavy hammering on adjacent and opposite walls for at least 14 days after installation.

3.11 SCHEDULE

.1 Tile Installed Over Masonry or Concrete Walls - Thin-Set Method: TTMAC Detail 303W.

.2 Tile Bonded to Concrete Slab - Thin-Set Method: TTMAC Detail 311F (A - Interior/Exterior), (C - Crack Concrete Interior/Exterior - Full Coverage) or (D - Uncoupling Over Green/Young Concrete).

.3 Large Format Tile on Interior Floors: TTMAC Detail 329 LFT.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies.

.2 Section 09 81 00 - Acoustic Insulation.

.3 Section 21 13 13 - Wet Pipe Fire Suppression.

.4 Section 23 37 13 - Diffusers, Registers, and Grilles.

.5 Section 26 51 13 - Lighting Equipment.

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 E1264-23: Standard Classification for Acoustical Ceiling Products.

.7 CISCA Ceiling Systems Handbook, 2012 Edition.

.8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 ULC List of Equipment and Materials.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 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 ceiling grid and installing lay-in tile ceiling systems, 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.

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 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: NRC $\geq$ 0.70.
.9 Light Reflectance: LR = 0.85.
.10 Manufacturer and Product Name: eg. School Zone Fine Fissured - Item No. 1714 by Armstrong World Industries.

.2 Suspended Ceiling Grid: To ASTM C635/C635M, Class HD; commercial quality, cold rolled steel, non-fire rated; main tees, cross tees and grid adapters with exposed 24 mm T-shape, 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 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 doors.

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 30 00 - Tiling.

.4 Section 09 65 16 - Resilient Sheet Flooring.

.5 Section 09 65 19 - Resilient Tile Flooring.

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 Straight Base (RB-STR): To ASTM F1861, Type TP, Group 1, Style A - Straight; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; colours as selected by Consultant.

.2 Resilient Coved Base (RB-COVE): To ASTM F1861, Type TP, Group 1, Style B - Cove; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; complete with pre-moulded end stops and external corners; colours as selected by Consultant.

.3 Resilient Transition Strips (RTS): Thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; 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 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, and free of gaps, holes and depressions.

.3 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 filler.
.3 Apply, trowel and float filler to leave smooth, flat, hard surface.
.4 Prohibit traffic until filler is cured.
.5 Vacuum clean substrate.

.3 Prime 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 09 30 00 - Tiling.

.2 Section 09 65 13 - Resilient Base and Accessories.

.3 Section 09 65 19 - Resilient Tile Flooring.

1.2 REFERENCES

.1 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM F710-22: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.3 ASTM F1516-13(2018): Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).

.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 F3441-23a: Standard Guide for Measurement of pH Below Resilient Flooring Installations.

1.3 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate sets of 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: Manufacturers' 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 Supply roll goods in full width rolls.

.4 Store roll goods in upright position, with roll wrapped in protective cover 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 in warm, dry room prior to installation.

1.7 AMBIENT CONDITIONS

.1 Maintain ambient air temperature of 20 degrees C three days prior to, during and 48 hours after installation.

.2 Maintain ambient air relative humidity 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 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Resilient Sheet Flooring (RSF-1): 2.0 mm thick homogeneous vinyl PUR; Classic Mystique PUR by Polyflor Canada, or Mipolan Esprit by Gerflor, or iQ Granit/Micro Granit by Tarkett Johnsonite; two colours as selected by Consultant.

.2 Resilient Sheet Flooring (RSF-2): 3.5 mm thick heterogeneous cushioned vinyl; 0.65 mm PUR wear layer, stabilization load-bearing backing, on foam cushion; Harmony fx U4 Acoustic by Polyflor Canada, or Omnisports Speed by Tarkett Sport, or Taraflex Recreation 30 by Gerflor; two colours as selected by Consultant.

2.3 ACCESSORIES

.1 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.

.2 Adhesive: Two-part resin-based polyurethane adhesive; eg. Johnsonite 975 by Tarkett Johnsonite.

.3 Seam Welding Rods: 4 mm OD vinyl, solid colour; colour matched to sheet flooring.

.4 Cove Filler Strip: 38 x 38 mm size, 44 mm radius, extruded fire rated vinyl; eg. Tarkett Johnsonite CFS-00.

.5 Metal Base Caps for Flash Coved Sheet Flooring: Purpose made stainless steel profiles, to ASTM A240/A240M, Type 304, No. 4 - Brushed finish.

.6 Drain Rings: Stainless steel, mechanically fastened type, diameter to suit floor drain.

.7 Primers: Acrylic, waterproof type; as recommended by flooring manufacturer.

.8 Sealers and Wax: As recommended by flooring manufacturer.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 71 00.

.2 Verify substrates are dry, true, even and smooth.

.3 Verify substrates are free of gaps, holes and depressions.

.4 Verify substrates are free of paint, grease and oil.

.5 Verify concrete slabs have cured for minimum 28 days.

.6 Verify concrete slabs have pH level between 7 and 10, 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 $\leq$ 1.4 kg per 100 sm for 24 hours.

.8 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with 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 Spread only enough adhesive to permit installation of materials before initial set.

.2 Set flooring in place, press with heavy roller to attain full adhesion.

.3 Lay flooring with joints and seams parallel to building lines to produce minimum number of seams.

.4 Provide minimum one-third full roll width.

.5 Double cut sheets and continuously seal seams to ASTM F1516 with matching seam welding rods.

.6 Lay flooring continuously from wall to wall in each area, including beneath casework.

.7 Where adjacent floor finish is dissimilar, terminate resilient sheet 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.

.10 Connect sheet flooring to floor drain assembly with mechanically-fastened stainless steel drain ring. Secure in accordance with drain manufacturer's recommendations.

.11 Flash Coved Base
- .1 Install cove filler strip at wall-to-floor junction.
- .2 Flash cove sheet flooring over cove filler strip and up wall surface minimum 150 mm.
- .3 Cap upper edge with metal base cap.

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 09 30 00 - Tiling.

.2 Section 09 65 13 - Resilient Base and Accessories.

.3 Section 09 65 16 - Resilient Sheet Flooring.

1.2 REFERENCES

.1 ASTM F710-22: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.2 ASTM F1344-21a: Standard Specification for Rubber Floor Tile.

.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 F3441-23a: Standard Guide for Measurement of pH Below 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 of resilient tile flooring having Product considered acceptable for use:
.1 Gerflor.
.2 Patcraft.
.3 Polyflor Canada, Inc.

.2 Manufacturers of rubber tile having Product considered acceptable for use:
.1 Armstrong World Industries.
.2 Mannington.
.3 Roppe Corporation.
.4 Tarkett Johnsonite.

.3 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Resilient Tile Flooring (RTF-1): To ASTM F1700, Class III, Type B, Embossed Surface; heterogeneous vinyl plank, as follows:
.1 Size: 152 x 914 mm.
.2 Thickness: 2.5 mm.
.3 Wear Layer: 0.55 mm thick PUR.
.4 Colours: As selected by Consultant.
.5 Product and Manufacturer Names: eg. Expona Commercial Wood by Polyflor Canada, Inc.

.2 Rubber Tile Flooring (RT): To ASTM F1344, Class 1-B; as follows:
.1 Size: 610 x 610 mm.
.2 Thickness: 3.2 mm.
.3 Texture: Hammered.
.4 Colours: As selected by Consultant.
.5 Hardness (ASTM D2240, Shore A): $\geq$ 85.
.6 Abrasion Resistance (ASTM D3389): < 1.0 gm weight loss.
.7 Slip Resistance (ASTM D2047): Static coefficient of friction $\geq$ 0.8.
.8 Manufacturer and Product Name: eg. Johnsonite MicroTone Speckled Rubber Floor Tiles by Tarkett Johnsonite.

.3 Tactile Walking Surface Indicator - Rubber Tiles (TWSI-RT): To ASTM F1344, Class 1-A and 1-B; 610 x 610 mm size, 3.2 mm thick rubber tile, complete with 4 mm high truncated domes evenly spaced over tile surface; Safe Sense Tactile Walking Surface Indicator Tiles TW1-XX by Tarkett Johnsonite, colours as selected by Consultant.

2.3 ADHESIVES

.1 Adhesive for Resilient Tile Flooring: As recommended by flooring manufacturer.

.2 Adhesive for Rubber Tile and Tactile Walking Surface Indicator - Rubber Tiles: Water based acrylic adhesive, White colour; eg. 965 Flooring and Tread Adhesive by Tarkett Johnsonite.

2.4 ACCESSORIES

.1 Underlayment: Self-drying, hydraulic cement-based underlayment, with trowel-applied consistency; mould- and mildew-resistant; capable of achieving true feather edge; zero VOC content; eg. Feather Finish by Ardex Americas.

.2 Primers: Acrylic, waterproof type; as recommended by flooring manufacturer.

.3 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, and free of gaps, holes, depressions, paint, grease and oil.

.3 Verify concrete slabs have cured for minimum 28 days.

.4 Verify concrete slabs have pH level between 7 and 9, to ASTM F3441.

.5 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate the following:
.1 Resilient Tile Flooring: MVER $\leq$ 2.26 kg per 100 m^2 for 24 hours.
.2 Rubber Tile: MVER $\leq$ 3.17 kg per 100 m^2 for 24 hours.

.6 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with installation until tests indicate RH $\leq$ 75 percent.

.7 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 tactile walking surface indicator tiles, 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.

.10 Lay out game lines and special graphics in accordance with accepted Shop Drawings.

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 material, 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, without gaps and voids.

.2 Fit acoustic insulation tight within spaces, around cut openings, behind and around facility service components within or behind partitions, and tight to items passing through partitions.

3.2 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect acoustic insulation at end of each Working Day.

.3 Protect acoustic insulation in areas where welding will be carried out.

.4 Replace acoustic insulation damaged by others.

.5 Protect acoustic insulation requiring a thermal barrier in accordance with authorities having jurisdiction.

END OF SECTION

1 General

1.1 PRODUCTS FURNISHED OR INSTALLED UNDER OTHER SECTIONS

.1 Carefully examine the scope of the Work as indicated on Drawings, and include all finishing, whether specifically mentioned or not, except as specifically excluded below:
- .1 Section 06 24 00 - High Pressure Decorative Laminate: Integral colour.
- .2 Section 06 41 00 - Architectural Wood Casework: Shop finishing.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim: Shop finishing.
- .4 Section 07 84 00 - Firestopping: Integral colour.
- .5 Section 07 92 00 - Joint Sealants: Integral colour.
- .6 Section 08 14 00 - Wood Doors: Laminate-clad door faces.
- .7 Section 08 31 00 - Access Doors and Panels: Shop priming.
- .8 Section 08 51 13 - Aluminum Windows: Anodized coating.
- .9 Section 08 71 00 - Door Hardware: Shop finishing.
- .10 Section 09 51 23 - Acoustical Tile Ceilings: Shop finishing.
- .11 Section 10 11 00 - Visual Display Surfaces: Shop finishing.
- .12 Section 10 14 00 - Signage: Shop finishing.
- .13 Section 10 28 13 - Toilet Accessories: Shop finishing.
- .14 Section 10 51 13 - Metal Lockers: Shop finishing.
- .15 Do not paint glass surfaces.
- .16 Do not paint plastic components.
- .17 Do not paint plated, polished or anodized metal components.
- .18 Do not paint stainless steel components.

1.2 RELATED SECTIONS

.1 Section 04 00 00 - Masonry.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 06 20 00 - Finish Carpentry.

.4 Section 08 14 00 - Wood Doors.

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

.6 Section 09 21 16 - Gypsum Board Assemblies.

.7 Section 20 05 53 - Identification of Mechanical Services.

1.3 REFERENCES

.1 MPI Architectural Painting Specification Manual.

.2 MPI Maintenance Repainting Manual.

.3 SSPC Painting Manual, Volume 2 - Systems and Specifications.

1.4 SCHEDULING

.1 Schedule painting operations to prevent disruption to the Work.

.2 Schedule painting and coating operations in occupied facilities to prevent disruption of occupants at existing facility. Conduct painting and coating after facility working hours 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 an acceptable alternate 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, and 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 a properly enclosed and heated space, satisfactory to Consultant, to be used as a 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 a volatile organic compound (VOC) content as follows:
.1 Gloss Level G1: < 50 g/L.
.2 Gloss Levels G2-G7: < 150 g/L.

.2 Volume Solids Content (VOL SOL): Use only paints and coatings having a volume solids (VOL SOL) content as follows:
.1 Alkyd Paints and Coatings: $\geq$ 45 percent.
.2 Latex Paints and Coatings: $\geq$ 40 percent.

2.4 MATERIALS

.1 Paints and Coatings: Use only Products meeting specified performance criteria and listed in most current Approved Products List included in MPI Architectural Painting Specification Manual, for each specified paint and finish system.

.2 Paint Accessory Materials: Linseed oil, shellac, turpentine, and other materials of commercial quality.

2.5 MIXING

.1 Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage, that can and will be dispersed readily and uniformly by paddle to a complete, homogeneous mixture.

.2 Carefully mix and prepare paint materials according to manufacturer's directions.

.3 Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

.4 Stir material before application to produce a mixture of uniform density. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

.5 Use only thinners approved by paint manufacturer, and only within recommended limits.

.6 Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of same material are applied. Tint undercoats to match colour of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 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, previously finished surfaces designated for re-finishing to MPI Maintenance Repainting Manual.

.3 Mask out surrounding surfaces not to receive paint, to protect from overspray or overbrushing.

.4 Remove hardware and accessories, plates, machined surfaces, lighting fixtures and similar items already installed but not intended to be painted.

.5 Remove mildew, efflorescence and foreign 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 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.

.3 Make Good damage caused by failure to protect surfaces.

.4 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work areas as required.

.5 Use methods best suited for substrate and type of material being applied.

.6 Do not use compressed air or aerosol methods of application without prior written approval of Consultant.

.7 Spread finishes evenly and flow on smoothly without runs or sags.

.8 Apply Products no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.

.9 Apply Products under adequate illumination.

.10 Sand lightly between coats to achieve required finish.

.11 Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

.12 Back prime interior wood work with enamel primer sealer paint.

.13 Back prime exterior wood work with exterior primer paint.

.14 Pigmented (Opaque) Finishes: Completely cover substrate to a smooth, opaque surface of uniform finish, colour, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be accepted.

.15 Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, colour irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.

.16 Match approved samples for colour, texture, and coverage. Remove, refinish or repaint work not complying with specified requirements.

.17 Finish wood door stiles, top rails, bottom rails and glass stops to match decorative laminate-clad door faces.

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 as specified in Section 20 05 53. Keep sprinkler heads free of paint.

.7 Paint yellow or band natural gas piping as specified in Section 20 05 53.

.8 Backprime and paint face and edges of plywood service panels a semi-gloss, gray colour before installation of telephone and electrical equipment. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.9 Paint exterior steel electrical light standards. 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. Refer to Section 20 05 53.

.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 same 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 and wood preservative finishes and related materials (thinner, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from authorities having jurisdiction.

.2 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and deliver to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary 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 Repair damage.

3.10 FINISH SCHEDULE

.1 Provide the following paint or finish systems for the various substrates indicated, in accordance with MPI Architectural Painting Specification Manual.

.2 Refinishing Existing, Previously Finished Surfaces:
  .1 Refer to MPI Maintenance Repainting Manual Section for refinishing existing finishes.
  .2 Use finish coat of respective new surface finish system for minor repair of existing finishes.
  .3 Use system primer where existing finishes are damaged down to bare surface.

.3 Exterior Painting and Finishing Schedule
  .1 Structural Steel
    .1 Corrosion-Resistant Opaque Painted Finish: EXT. 5.1B - W.B. LIGHT INDUSTRIAL COATING (over inorganic zinc), Premium Grade; Gloss Level G5.

.2 Metal Fabrications
  .1 Opaque Painted Finish: EXT. 5.1D - ALKYD (over alkyd metal primer), Premium Grade; Gloss Level G5.
.3 Galvanized and Galvannealed Metal
  .1 Opaque Painted Finish: EXT. 5.3B - ALKYD (over cementitious primer), Premium Grade; Gloss Level G6.
.4 Aluminum (Not Anodized)
  .1 Opaque Painted Finish: EXT. 5.4H - LATEX (over q.d. metal primer), Premium Grade, Gloss Level G6.
.5 Dimension Lumber and Panels
  .1 Opaque Painted Finish: EXT 6.2A - LATEX (over alkyd/oil primer), Premium Grade; Gloss Level G5.
  .2 Opaque Stained Finish: EXT. 6.2B - SOLID COLOR STAIN, W.B. (over alkyd/oil primer), Premium Grade; Gloss Level G1.
  .3 Semi-Transparent Stained Finish: EXT. 6.2E - VARNISH, S.B. (over s.b. stain), Premium Grade; Gloss Level G5.
.6 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 All Other Applications: G3.

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, 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: One 1 000 x 1 000 mm size mock-up panel; comprised of one markerboard and one tackboard; demonstrating quality of materials, 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 the 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 9800 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.
.1 Provide permanent music score lines to one markerboard in each Music Room.

.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; having 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 millwork units designated to incorporate visual display surfaces are installed.

3.2 INSTALLATION

.1 Install components to ensure a rigid, straight, square, 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. Ensure 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 08 14 00 - Wood Doors.

.3 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.

.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 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.6 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.

.7 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.8 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.9 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.10 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

.11 ASTM B85/B85M-18e1: Standard Specification for Aluminum-Alloy Die Castings.

.12 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.13 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.14 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.15 ASTM D3363-20: Standard Test Method for Film Hardness by Pencil Test.

.16 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

.17 ASTM F844-19: Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

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, fonts 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, font size, and factory-applied 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 Exterior Building Signage: Individual die cut or die cast metal letters, numbers and symbols; prefinished; securely attached to building face; design as indicated on Drawings.

.2 Stairwell Signage: To applicable regulatory requirements.

.3 Braille: Raised bead type, to AODA requirements.

2.2 MATERIALS

.1 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 316.

.2 Stainless Steel Bar and Shapes: To ASTM A276/A276M, Type 316.

.3 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel.

.4 Galvanized Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel; galvanized.

.5 Extruded Aluminum: To ASTM B221M, 6061 alloy, T6 temper.

.6 Cast Aluminum: To ASTM B85/B85M, 6063 alloy, T5 temper.

.7 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.

.8 Fasteners - Exterior Applications: To ASTM A307, Grade A; carbon and alloy steel, galvanized where noted; concealed types.

.9 Fasteners - Interior Applications: Countersunk screw-type with tamperproof heads, complete with plastic wall plugs when required for securement to wall surfaces; suitable sizes for intended application. Do not use through-fastening types.

.10 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.

.11 Hardened Washers: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; hardened steel; circular, bevelled and clipped types as required.

.12 Unhardened Washers: To ASTM F844; punched from cold-rolled steel, plain (flat) type; diameter to suit bolt size; galvanized.

.13 Adhesive: As recommended by sign manufacturer.

2.3 MANUFACTURED UNITS

.1 Text Door Sign Plates: Surface engraved type; 2.0 mm thick dual-layered acrylic with 30 degree bevelled edges; as follows:
- .1 Length: As required to fit text, minimum 300 mm.
- .2 Height: 57.2 mm.
- .3 Text: 25 mm high Helvetica upper and lower case letters.
- .4 Fastening: Pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges.
- .5 Colours: As selected by Consultant.
- .6 Text: As determined by Owner.

.2 Pictogram Door Sign Plates: 3.2 mm thick plexiglass, square edged, hot stamped or silk screened image on rear face, 150 mm high; pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges; sizes, colours, and graphic symbols as selected by Consultant.

2.4 FABRICATION

.1 Fabricate sign plates with letters and numbers centered within sign plate's length and height.

.2 Provide countersunk holes for screw fasteners.

2.5 FINISHES

.1 Stainless Steel: To AISI No. 6 - Matte.

.2 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

.3 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.

.4 Monochromatic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc.; colour as selected by Consultant.

.5 Metallic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, complete with metal flakes incorporated in the colour coat; factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc.; colour as selected by Consultant.

.6 Powder Coated Finish on Metal Components: To AAMA 2605; electrostatically sprayed polymer powder, factory-applied to 0.075 mm dry film thickness, with 4H Hardness rating to ASTM D3363; colour as selected by Consultant.

.7 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.8 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.9 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

3 Execution

3.1 INSTALLATION

.1 Install signs straight, plumb, level, and secured in a manner to prevent distortion or displacement.

.2 Finished work shall be free of defects, warping, open seams, and rattles.

.3 Provide double-sided foam tape adhesive on rear face of sign plates prior to securing with mechanical fasteners.

.4 Provide routing or mortising for items required to be mortised, rebated or otherwise housed within material.

.5 Replace Products that are bent, scratched or damaged.

.6 Provide fasteners to the full required complement, properly tightened.

.7 Exposed fasteners shall be neatly executed and shall match adjacent surfaces.

.8 Install braille signage adjacent to sign plates.

.9 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 09 21 16 - Gypsum Board Assemblies.

.3 Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

.1 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.5 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.6 ASTM E84-23c: Standard Test Method for Surface Burning Characteristics of Building Materials.

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, sizes and thicknesses, typical panel construction, hardware and accessories.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings as specified in Section 01 33 00.

.2 Shop Drawings: Project-specific drawings, illustrating partition layouts, dimensions, no sightline privacy fittings, door swings, internal reinforcement and details of supports.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 60 00.

.2 Do not deliver Products until Project is enclosed, with complete protection from outside weather.

.3 Store Products indoors in manufacturer's original containers and packaging, with labels clearly identifying Product name and manufacturer.

.4 Lay cartons flat, with adequate support to ensure flatness and prevent damage.

.5 Do not store Products where ambient air temperature is less than 16 degrees C or exceeds 49 degrees C.

1.6 AMBIENT CONDITIONS

.1 Maintain ambient air temperature, relative humidity, and ventilation within limits recommended by manufacturer for optimum results.

.2 Do not install Products under environmental conditions beyond manufacturer's absolute limits.

1.7 WARRANTY

.1 Submit extended warranty in accordance with General Conditions of the Contract.

.2 Manufacturer's Extended Warranty: For a period of 10 years, covering against delamination, breakage or corrosion under normal operating conditions.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ASI Group Global.
.2 Hadrian Manufacturing Inc.
.3 Mills Partitions.
.4 Scranton Products.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

.1 Toilet Compartments: Solid polymer construction, floor-mounted headrail-braced design; complete with no sightline privacy option.

2.3 REGULATORY REQUIREMENTS

.1 Surface Burning Characteristics (ASTM E84): Class B.

2.4 MATERIALS

.1 Solid Polymer: Single sheet solid, homogeneous high density polyethylene plastic, formed from waterproof, non-absorbent HDPE resins; mark-resistant, self-lubricating surface; Pebble face texture with Smooth edges; colour as selected by Consultant.

.2 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 304.

.3 Stainless Steel Bar and Shape: To ASTM A276/A276M, Type 304.

.4 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B and C; galvannealed.

.5 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy, unless noted otherwise.

.6 Fasteners: Stainless steel; tamper-resistant; complete with plastic anchors.

2.5 COMPONENTS

.1 Doors - Standard Stalls: 610 mm wide, 1 397 mm high; 25 mm thick solid polymer with 6 mm radius machined edges.

.2 Doors - Accessible Stalls: 860 mm wide, 1 397 mm high; 25 mm thick solid polymer with 6 mm radius machined edges.

.3 Panels: 1 379 mm high, width to suit application; 25 mm thick solid polymer with 6 mm radius machined edges.

.4 Privacy / Urinal Screens: 610 mm wide, 1 220 mm high, 25 mm thick solid polymer with 6 mm radius machined edges.

.5 Pilasters: Floor-to-ceiling height, width to suit application; 32 mm thick solid polymer with 6 mm radius machined edges.

.6 Head Rails: Hollow, 32 x 62 mm size aluminum tubing, with anti-grip strips and cast socket wall brackets.

.7 Heat Sink: Extruded aluminum U-channel profile.

.8 Floor Mounting Bar: 6 x 25 mm stainless steel mounting bar.

.9 Pilaster Shoes: 125 mm high, formed stainless steel.

.10 Splash Plates: 760 mm wide, 1 066 mm high; 1.2 mm thick stainless steel sheet; rounded corners; for double-sided tape application.

.11 Hinges: 203 mm wrap-around aluminum hinge, fabricated from heavy duty 6463-T5 alloy extruded aluminum with brush anodized finish; complete with adjustable nylon cams capable of being set in 30 degree increments.

.12 Latch: Extruded aluminum, anodized finish; with housing, slide bolt and button.

.13 Strike and Keeper: 152 mm wrap-around flanges fabricated from heavy duty 6463-T5 alloy extruded aluminum, brushed anodized finish.

.14 Privacy Astragal: Chrome-plated non-ferrous metal privacy astragal; sizes and profiles to suit application.

.15 Door Pull: Chrome-plated cast zinc alloy handle; through-door fastening.

.16 Panel and Pilaster Brackets: 3.0 mm thick heavy-duty extruded aluminum stirrup brackets, 50 mm long; pre-drilled; brightened and polished finish.

.17 Headrail Brackets: Die cast aluminum alloy brackets, pre-drilled.

.18 Door Bumper: Chrome-plated non-ferrous casting with rubber shock absorbing bumper insert.

2.6 FABRICATION

.1 Mount brackets and reinforcements securely to panels.

.2 Provide heat sinks securely fastened to bottom of doors and panels.

.3 Fabricate doors, pilasters and panels to receive no sightline privacy fittings.

.4 Fabricate accessible stall doors to swing out.

2.7 FINISHES

.1 Stainless Steel: To AISI No. 4 - Brushed.

.2 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF03; zinc-iron coating with streak-free matte grey appearance.

.3 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

3 Execution

3.1 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

3.2 INSTALLATION

.1 Install partitions secure, plumb and level.

.2 Attach panel brackets securely to walls using anchor devices.

.3 Install splash panels on compartment panels located adjacent to urinals. Fasten with double-sided tape.

.4 Anchor privacy / urinal screens to walls with two panel brackets and vertical upright consisting of tubular head rail stock and sockets rigidly anchored to floor and ceiling.

.5 Provide headrail fitted snugly over top of each pilaster and secured to pilasters and wall using recommended fittings.

.6 Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.

.7 Equip each door with two hinges, one door latch and one door bumper.

.8 Provide continuous full-height privacy astragals on pilasters and panels as follows:
- .1 At door latch side.
- .2 At door hinge side.
- .3 Where panels meet adjacent wall surfaces.
- .4 Where pilasters meet adjacent wall surfaces.
- .5 Where panels meet adjacent pilasters.

.9 Surface mount and through bolt hinges to panels and doors.

.10 Install door strike keeper on pilasters in alignment with door latch.

.11 Equip out-swinging doors with two door pulls, mounted one on each side.

3.3 TOLERANCES

.1 Deviation From Plumb and Level: $\leq$ 3.2 mm.

.2 Clearance Between Wall Surface and Panels and Pilasters: 38 mm.

3.4 ADJUSTING

.1 Adjust and align hardware to uniform clearance at vertical edge of doors.

.2 Adjust adjacent components for consistency of line or plane.

3.5 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean finish surfaces just prior to Owner occupancy.

3.6 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect installed Products from damage.

.3 Remove factory-applied protective coverings, and Make Good damage prior to 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 07 92 00 - Joint Sealants.

.4 Section 08 80 00 - Glazing.

.5 Section 09 21 16 - Gypsum Board Assemblies.

.6 Section 09 30 00 - Tiling.

.7 Section 10 14 00 - Signage.

.8 Section 10 21 13.21 - Solid Plastic Toilet Compartments.

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 A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.4 ASTM A269/A269M-22: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.5 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.

.6 ASTM A1008/A1008M-23: 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.

.7 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

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, sizes, finishes, details of function, and attachment methods.

1.4 SAMPLES

.1 Submit samples as specified in Section 01 33 00.

.2 Selection Samples: Duplicate sets of 300 x 300 mm size samples, demonstrating available colours and finishes.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals as specified in Section 01 78 00.

.2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and standard care, maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

.3 Keys: Two keys for each lockable accessory, master keyed.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:
.1 ASI Group Canada.
.2 Bobrick Washroom Equipment, Inc.
.3 Bradley.
.4 Frost Products Limited.

.2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

.1 Steel Sheet: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet in thicknesses as specified below.

.2 Stainless Steel Plate, Strip and Sheet: To ASTM A240/A240M, Type 304; sizes and thicknesses as specified below.

.3 Stainless Steel Tubing: To ASTM A269/A269M, Grade TP316; thicknesses, diameters, and sizes as specified below.

.4 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304; sizes and profiles as indicated.

.5 Mirrored Glass: Type GL-2 as specified in Section 08 80 00.

.6 Adhesive: Two-component epoxy type, waterproof.

.7 Fasteners, Screws, and Bolts: Galvanized steel, tamper-proof, security type; sizes to suit applications.

.8 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.

.9 Joint Sealant: Interior mildew-resistant sealant, Type SEAL-INT-MR as specified in Section 07 92 00.

2.3 MANUFACTURED UNITS

.1 Towel Dispenser: Surface-mounted stainless steel dispenser with concealed wall mounting screws; battery-operated hands-free operation; eg. Code 109-70S by Frost Products Ltd.

.2 Waste Receptacle: Semi-recessed design; 438 mm wide, 762 mm high, 100 mm deep; 0.76 mm thick stainless steel body; 50 L capacity removable waste bin; eg. Code 330 by Frost Products Ltd.

.3 Soap Dispenser: Wall-mounted stainless steel dispenser with concealed wall mounting screws; battery-operated hands-free operation; 1 L capacity for lotion-type soaps; with low battery indicator; eg. Code 714S by Frost Products Ltd.

.4 Toilet Tissue Dispenser: Surface mounted, large capacity design; 1.2 mm thick stainless steel construction with twin moulded plastic spindles; capable of holding two jumbo toilet tissue rolls; 520 mm long, 283 mm high, 145 mm deep; with spring loaded access tray, tumbler lock and viewing slot; eg. Code 169 by Frost Products Ltd.

.5 Sanitary Napkin Disposal: Surface mounted design, 203 mm wide, 337 mm high, 115 mm deep; complete with 0.76 mm thick welded stainless steel construction, with self-closing lid and pivoting bottom with friction catch, and permanent die embossed bilingual lettering; eg. Code 622 by Frost Products Ltd.

.6 Grab Bars: 38 mm OD, 1.2 mm thick stainless steel tubing; peened non-slip finish; round or oval concealed flange attachments, straight and L-shaped configurations in sizes indicated on Drawings.

.7 Flat Framed Mirror: 610 x 915 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; vandal-resistant three-way mounting; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941-2436 by Frost Products Ltd.

.8 Fixed-Tilt Framed Mirror: 406 x 762 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; fixed tilt; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941FT by Frost Products Ltd.

.9 Stainless Steel Shelf: 460 mm long, 140 mm deep, 102 mm high; 0.76 mm thick stainless steel with rounded corners, surface mounted; eg. Code 950-18 by Frost Products Ltd.

.10 Custodial Towel Dispenser: 267 x 241 mm size; 170 mm deep; surface mounted; piano hinged top; combination finger pull and level indicator; serrated safety cutting edge; eg. Code 103 by Frost Products Ltd.

.11 Custodial Utility Shelf: 1.2 mm thick stainless steel, 914 x 203 mm size, surface mounted; complete with 3 mop / broom holders, two pail hooks and an 8 mm OD chrome plated drying rod; eg. Code 1115 by Frost Products Ltd.

2.4 FABRICATION

.1 Weld and grind smooth, joints of fabricated components.

.2 Use mechanical fasteners only where approved.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Do not apply manufacturer's or brand names on face of units.

2.5 FINISHES

.1 Shop Primed Coating on Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

.2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.

.3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.

.4 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

.5 Stainless Steel: To AISI No. 4 - Brushed.

.6 Baked Enamel Coating on Steel Components: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

3 Execution

3.1 PREPARATION

.1 Provide templates and rough-in measurements as required.

3.2 INSTALLATION

.1 Install Products rigidly in place using tamper-proof fasteners, as follows:
- .1 Stud Walls: Install steel back plate to stud prior to application of wall board. Provide plate with threaded studs or plugs.
- .2 Hollow Masonry Units: Use toggle bolts drilled into cell or wall cavity.
- .3 Solid Masonry Units or Concrete: Use bolt with lead expansion sleeve set into drilled hole.
- .4 Toilet Compartments: Use male-female through bolts.

.2 Install grab bars using built-in anchors.

.3 Set square items plumb.

.4 Install framed mirrors on concealed wall hangers, and secure in place with theft-proof locking screws.

.5 Install batteries in battery-operated accessories. Ensure proper operation.

3.3 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect Product surfaces with removable protective film.

.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 04 00 00 - Masonry.

.3 Section 06 10 00 - Rough Carpentry.

.4 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 A1008/A1008M-23: 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.

.3 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.4 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 trim 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, base, and end panels, sufficient quantity to reconstruct 10 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: Full-size mock-ups consisting of minimum 3 bays, demonstrating anchoring and finishing details, colours, metal sloping top, metal base, and metal 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 Buddsteel.
- .3 General Storage Systems.
- .4 Hadrian Manufacturing Inc.
- .5 Lincora Group.
- .6 Shanahan Manufacturing Ltd.

.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 plastic compartment bottoms, and metal sloping tops, bases, end panels, fillers and jamb trim.

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.

2.4 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; 1.52 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 Metal Base: 1.52 mm thick sheet steel, recessed construction; 100 mm high; powder coated finish.

.8 Metal Sloping Top: 1.52 mm thick sheet steel; powder coated finish.

.9 End Panels and Miscellaneous Trim: 1.52 mm thick sheet steel; complete with necessary clips and other attachment devices; powder coated finish.

.10 Latching: Single-point, padlock type flange; in recessed chrome-plated steel pocket.

.11 Coat Hooks: Zinc-plated metal coat hooks.

.12 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 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, numbering as directed by Owner.

.12 Provide hidden nylon friction door stop to ensure proper door closure and quiet operation.

2.6 FINISHES

.1 Powder Coated Finish on 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 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 true to dimensions.

.2 Accurately secure joints, and intersecting members with concealed attachment system.

.3 Install Products square and plumb, and forming a rigid structure.

END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The Mechanical Supplemental Tender Form must be submitted to the architect and consultant (admin@deiassociates.ca) within 2 hours of tender closing. Mechanical contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the Mechanical Supplemental Form not be submitted then the contractor shall use Base Bid manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

_____	_____
COMPANY NAME	AUTHORIZED SIGNATURE
_____	_____
ADDRESS	PRINTED SIGNATURE
_____	_____
CITY	TITLE
_____	_____
TELEPHONE NUMBER	DATE
_____	
FAX	

SUB-CONTRACTORS

The Contractor shall state below the name of the Site Services, Insulation, Fire Protection, Sheet Metal, Temperature Controls and TAB Sub-contractor he intends to use, which shall not be changed without the consent of the Consultant.

Site Services _____

Insulation _____

Fire Protection _____

Sheet Metal _____

Temperature Controls _____

TAB _____

.4 The Stipulated Bid Sum shall be for the base bid manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. Where no choice is indicated, the base bid supplier or equipment shall be used.

.5 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Mechanical Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.6 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.7 Submit the following list of Base Bid and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Base Bid**	**Acceptable Alternate Manufacturer Or Supplier**	**Indicate Manufacturer Or Supplier**
20 05 31	Flexible Connectors, Expansion Joints, Guides	Flexonics		
20 05 32	Thermometers Pressure gages	Trerice	Wiess Winters	
20 05 34	Hangers	Grinnell	Myatt	
20 05 49	Vibration Control	Vibro Acoustics	Vibron Korfond IAC Acoustics	
22 07 19	Thermal Insulation for Plumbing Piping	Fibreglass Canada	Knauf Manson Pittsburg Corning	
22 11 20	Backflow Devices	Watts	Wilkins Conbraco	

CONTRACTOR'S NAME:_____ DATE:_____

22 11 22	Domestic Water Circulation Pump	Bell & Gossett	Armstrong	
22 11 22	Hot Water Recirc Pump	Bell & Gossett	Armstrong Taco	
22 11 31	Hydrants	Zurn	Ancon	
22 11 31	Water Make Assembly	Watts	Conbraco	
22 11 31	Water Meter	Neptune		
22 11 31	Strainers	Watts	Crane/Powers Colton Wilkins	
22 11 31	Solenoid Valves	Asco		
22 13 13	Drainage Supplies	Zurn	Ancon Smith Mifab Watts Contour Enpoco	
22 13 14	Valves	Canadian Wooster	Puritan Bennett Ohio Medical Products	
22 34 36	Fuel Fired Domestic Water Heaters	A.O. Smith	Ruud J. Wood Bradford White	
22 44 13	Plumbing Fixtures	American Standard	Kohler Crane	
22 44 13	Flush Valves	Delta	Cambridge Brass Sloan Zurn Moen Commercial	
22 44 13	Water Closet Seats	Bemis Centoco	Moldex Olsonite	
22 44 13	Stainless Steel Lavs/Sinks	Kindred	Steel Queen Elkay Novanni	

22 44 13	Waste and Water Pipe Insulation	McGuire	Truebro	
22 44 13	Faucet Supplies	Delta	Sloan Moen Chicago Zurn	
22 44 13	Thermostic Mixing Valves	Symmons Powers		
22 44 13	Emergency Eyewash/Shower	Bradley	Haws Guardian	
22 44 13	Fixture Traps/Waste	Delta	McGuire	
22 44 13	Fixture Stops	Delta	McGuire	
22 44 13	Fixture Carriers	Zurn	Ancon Smith	
23 07 13	Thermal Duct Insulation	Fibreglass Canada Johns Manville	Knauf Manson Roxul	
23 07 19	Thermal Insulation for HVAC Piping	Fibreglass Canada	Knauf Manson Pittsburg Corning	
23 11 23	Regulator	Singer	Schlumberger	
23 11 24	Valves, Lubricate Plug	Newman Hattersley	Jenkins/Crane Milwaukee Toyo	
23 21 11	Closed Expansion Tank	Bell & Gossett	Armstrong Clemmer	
23 21 11	Diaphragm Type Expansion Tank	Amtrol		
23 21 11	Air Separator	Same as pump manufacturer		
23 21 11	Pipe Line Strainer			

23 21 13	Valves	Newman Hattersley	Jenkins/Crane Milwaukee Toyo Kitz	
23 21 13	Balancing Valves	Bell & Gossett	Taco Armstrong Tour & Anderson	
23 21 13	Air Vents	Maidomist	Spirax Sarco	
23 21 23	Pumps Hydronic	Bell & Gossett	Armstrong	
23 22 16	Pipe Line Strainers	Braukmann	Kunkle Spirax Sarco	
23 23 13	Flexible Connectors	Anamet	Packless Superior Vibration Mountings	
23 32 13	Acoustic Plenums	Vibron	BVA VAV Systems IAC Acoustics	
23 33 13	Access Doors	Nailor	E.H. Price Titus	
23 33 13	Ductwork Accessories	Duro Dyne	Ductmate	
23 33 16	Fire Dampers	Ruskin	Ruskin Nailor National Controlled Air (NCA) Ventox T.A. Morrison Greenheck	
23 33 17	Smoke Control Dampers	Ruskin	E.H. Price NCA Ltd. Nailor Industries Alumavent United Enertech Safeair-Dawco (stainless steel)	

23 33 18	Operating Dampers	Honeywell	Johnson T.A. Morrison Nailor Ventex National Controlled Air (NCA) Trane Tamco	
23 33 46	Flexible Ductwork	Flexmaster	Duckmate	
23 33 53	Acoustic Duct Lining	Duro Dyne Johns Manville	Ductmate Owen Corning	
23 34 23	Packaged Exhausters	Greenheck	Penn-Barry Cook Jenn Zonex	
23 37 13	Grilles and Diffusers	Krueger	Nailor Titus E.H. Price Carnes Seiho Metalaire	
23 37 23	Louvres/Brick Vents	Greenheck	Construction Specialties Airolite Co. Krueger Ventex Ruskin Ventmaster Nailor	
23 52 13	Stainless Steel Condensing Boilers	Lochinvar	PK	
23 65 16	Closed-Circuit Forced Draft Cooling Tower	Baltimore Air Coil	EVAPCO	
23 75 24	Indirect Fired Outdoor Make Up Air Units	Daikin	Engineered Air	
23 81 46	Water Source Heat Pumps	Daikin	JCI Trane	

23 82 29	Radiators, Convectors, and Cabinet Heaters	Engineered Air	Sigma Slant Fin Dunham Bush	

1.2 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Superintendent	$_____/hr
Journeymen	$_____/hr
Labourers	$_____/hr
Plumbers	$_____/hr
Sheet Metal	$_____/hr
Insulation	$_____/hr
Other	$_____/hr

1.3 UNIT PRICES

.1	Add one dry system sprinkler head	$ _____	Extra
.2	Delete one dry system sprinkler head	$ _____	Credit
.3	Add one wet system sprinkler head	$ _____	Extra
.4	Delete one wet system sprinkler head	$ _____	Credit

1.4 MECHANICAL TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Products

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Mechanical Division.

.2 Conform to Division 1 General Conditions.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

.4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 TENDERS AND BONDING (REMOVE TENDERS & BONDING SECTION FOR WRDSB JOBS)

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

1.4 REGULATIONS, PERMITS, AND FEES

.1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.

.2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

.3 In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor’s expense.

.4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

1.5 DRAWINGS

.1 Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes, or additions to runs of piping, conduits, and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.2 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings, or obtain directions for exact location of such equipment and fittments.

.3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.

.5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels, and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.8 Relocate equipment and/or material installed but not coordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.9 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant's request submit copies of interference drawings to consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, mechanical, and electrical systems for the consultant's review prior to fabrication.

.2 Detailed layout drawings, clearly showing fasteners and hangers.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all mechanical systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

.2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.8 ALTERNATES AND SUBSTITUTIONS

.1 Throughout Mechanical Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space alloted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers

listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

.5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.9 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings:

.1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.10 SEQUENCING SCHEDULING AND COORDINATION

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Mechanical Division caused by neglect to do so shall be made at no cost to Owner.

.3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by Mechanical Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Mechanical Division.

.5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.6 Adjust locations of pipes, ducts, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.

.1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.

.7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.11 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit an RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number

.2 Name of project

.3 Date of initiation

.4 Date response required by (minimum two (2) weeks)

.5 Subject

.6 Submitter's name

.7 Drawing/specification reference

.8 Photograph of the issue (if applicable)

.9 Description of the issue

.10 Contractor's proposed resolution

1.12 CONTRACT BREAKDOWN

.1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.

.2 Provide labour and material cost for each item.

.3 Breakdown shall indicate total contract amount.

.4 Contract breakdown shall be as follows as a minimum.

Mobilization and shop drawings (max. $2,000.00)
Demolition
Inside buried plumbing and drainage
Above grade rough-in plumbing and drainage
Plumbing Fixtures
Plumbing Equipment
Boilers
Heat Pumps
MUA Units
Cooling Tower
Circulation pumps
Heating piping
Piping Insulation
Ductwork
Duct Insulation
Grilles & Diffusers
Fire Stopping
Fans & Equipment
Building Automation Systems
Testing Adjusting and Balancing
HVAC system commissioning
VRF/Heat Pump Equipment
Refrigeration Piping
Mechanical contractor closeout requirements (min. of 3% for the first $500,000.00, 1% from $500,000.00 to $5,000.000.00, and 0.5% beyond. Shall not be less than $5,000.00)

.5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.13 COMMISSIONING CONTRACT BREAKDOWN

.1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

1.14 SHOP DRAWINGS AND PRODUCT DATA

.1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.

.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or their Engineer shall not supersede Contract Documents.

.8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.9 Check work described by catalog data with Contract Documents for deviations and errors.

.10 Shop drawings and product data shall show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances. e.g., access door swing spaces.

.11 Shop drawings and product data shall be accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify as to current model production.
- .5 Certification of compliance to applicable codes.

.12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.13 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site provide one copy of the “reviewed” shop drawings in a binder as noted above.

.6 Contractor to print copies of “reviewed” shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.15 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.3 Submit 1 copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant. Submission can be done electronically in pdf format or as a hardcopy.

.1 Electronic submission/pdf file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hardcopy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as 'Operation and Maintenance Manual' with project name and location. Dividers are to be used for binder organization.

.4 Make changes as required and re-submit as directed by Consultant.

.5 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.8 Spare parts equipment list.

.9 Manufacturers standard or extended warranty information.

.6 Maintenance data shall include:

.1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.7 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.

.5 Copy of all substantial performance final certificates.

.8 Miscellaneous data to include:

.1 Letter of contractor's warranty and guarantee.

.2 Index sheet.

.3 Tabbed format for each section.

.4 Manufacturers approved shop drawings.

.5 Spare parts list and source.

.6 List of Manufacturers and suppliers address for each piece of equipment.

.9 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the Consultant provide the following:

.1 Provide two (2) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and as-built drawings.

1.16 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 TAB to be performed using as-built drawings.

.1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.

.2 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

1.17 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

.2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

.3 If mechanical sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local mechanical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.

.4 Contractor shall rectify any installation deficiencies in the boiler or pressurized other systems identified by a TSSA Inspector for a period of three (3) years from ready for takeover.

.5 Warranty period shall start from date of ready for takeover.

1.18 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.

- .1 As-Built Drawings.
- .2 Maintenance Manuals
- .3 System Start up
- .4 TAB Reports
- .5 HVAC System Commissioning
- .6 Instructions to Owners
- .7 Final Certificates (required prior to consultant’s release of conformance letter).
  - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
  - .2 Mandatory TSSA Gas Pressure Test (CSA B149.1)
  - .3 Backflow Test Certificate (for all testable devices)
  - .4 Mechanical Seismic Restraint Engineers’ Letter
  - .5 TSSA report for new boiler/pressure vessel installation or written confirmation from TSSA that they opted to not inspect the system. (Low pressure systems that have either a wetted heating surface of 30 sq ft (2.89 sq m) or less, or a power rating of 100 MBH (30 kW) or less are exempt.

1.19 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

.2 Mandatory TSSA Gas Pressure Test (CSA B149.1)

.3 Backflow Test Certificate (for all testable devices)

.4 Mechanical Seismic Restraint Engineers' Letter

.5 TSSA report for new boiler/pressure vessel installation or written confirmation from TSSA that they opted to not inspect the system. (Low pressure systems that have either a wetted heating surface of 30 sq ft (2.89 sq m) or less, or a power rating of 100 MBH (30 kW) or less are exempt.

1.20 REVISION TO CONTRACT

.1 Provide the following:

.1 Itemized list of material with associated costs.

.2 Labour rate and itemized list of labour for each item.

.3 Copy of manufacturers/supplier's invoice if requested.

1.21 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

1.22 DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS

.1 If designated substances and/or hazardous materials are suspected or identified cease all work in the immediate area in accordance with OHSA and notify consultant.

.2 Each contractor and on site employee of the contractor shall have "asbestos awareness training".

.3 The Contractor shall ensure that employees who may come into contact with designated substances and/or hazardous materials due to the nature of the work that they perform, have received training that enables them to recognize designated substances and/or hazardous materials and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with designated substances and/or hazardous materials occur during the course of their work.

.4 It is the responsibility of the contractor to review the designated substances and/or hazardous materials book in the building prior to starting any work.

.5 Existing occupied buildings (depending upon their age) may contain designated substances and/or hazardous materials in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain designated substances and/or hazardous materials and shall not be disturbed.

.6 A survey of each building documenting the location and condition of designated substances and/or hazardous materials -containing materials is available for your mandatory review prior to commencing any work on premises.

1.23 PHASING OF WORK

.1 This work for this project shall be constructed in phases. Refer to the architectural drawings for phasing information and details. Misinterpretation of the drawings with respect to the extent of the phasing of the work shall not relieve the contractor of the work required to complete the entire contract.

.2 Provide all necessary services or temporary services to suit phasing of construction with respect to all mechanical services and fire protection.

.3 Life safety systems in the building are to remain fully operational in occupied areas for building staff and occupants during renovations.

.4 Provide all necessary tests and certificates at completion of each phase to suit requirements of local authorities and consultants for occupancy of completed areas.

1.24 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.25 CONFINED SPACES

.1 Certain areas of the building may be defined as a “Confined Space”. Any personnel working in these areas must have confined space training, appropriate equipment, and undertake all work in conformance with appropriate codes and standards.

.2 Refer to building documentation for any spaces deemed “Confined Space”.

1.26 ENERGY EFFICIENCY

.1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.

.2 All equipment, products, and installations must conform to the Codes and Standards.

END OF SECTION

Part 1 General

1.1 TESTS

.1 Give 48 hours written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:

.1 General: maintain test pressure without loss for 4 h unless otherwise specified.

.2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.

.3 Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.

.4 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.

.5 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.

.6 Equipment: test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.2 SYSTEM START UP

.1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide consultant with written notice verifying all equipment operation and installation is complete.

.3 Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours notice for start up procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.

.3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.4 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 HVAC

.2 Exhaust air

.3 Domestic water

.4 Plumbing and drainage.

1.5 DEFICIENCIES

.1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.

.2 Instruction to correct work shall be done within the work period before the next review.

.3 The contractor shall not conceal any work until inspected.

.4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.

.5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

1.6 EQUIPMENT INSTALLATIONS

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts, and similar items parallel to or perpendicular to building lines.

1.7 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install mechanical equipment at following heights unless indicated otherwise.

.1	Standard water closets	350 (14") to top of bowl
.2	Barrier-free water closets	400 (16") to top of bowl
.3	Barrier-free water closets	450 (18") to top of seat lid
.4	Wall hung lavatory	787 (31") to rim
.5	Barrier-free wall hung lavatory	840 (33") max to top of rim 737 (29") min underside of rim front 685 (27") clear at 400 (8") from basin front 350 (14") min clear under waste trap
.6	Urinals (Adult)	± 600 (24)
	Urinals (Senior Elementary)	**475 (19") to rim**
	Urinals (Junior Elementary)	**425 (17") to rim**
	Urinals (Barrier-free)	425 (17") to rim
	Urinals (Barrier-free)	1000 (40") to flush lever or sensor
.7	Hose bibbs	+/- 600 (24")
.8	Fire extinguisher	1350 (4'– 0") to hanger
.9	**Backflow preventors**	**900 – 1200 (3'– 4') to centerline of unit**
.10	Thermostats: Barrier Free (operable)	1200 mm (47.25")
	Non Barrier Free	1500 mm (59")

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.8 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.9 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.10 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings

.2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Follow Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.11 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer's requirements and recommendations.

.2 All electrical wiring, mechanical wiring and installations shall comply with local and national electrical and mechanical codes.

.3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.

.4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.

.5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in mechanical or service rooms.

.6 Free-run plenum rated cable shall be run in cable hangers where provided by electrical division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring "as the crow flies".

1.12 MOTORS

.1 Provide high efficiency motors for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.

.4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.13 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW 10 hp: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW 10 hp and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.6 Motor slide rail adjustment plates to allow for centre line adjustment.

.7 Provide sheave changes as required for final air balancing.

1.14 GUARDS

.1 Provide guards for unprotected devices.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm (18 gauge) thick sheet metal tops and bottoms.

.3 40 mm (1 1/2") diameter holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm (16 gauge) thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

.7 Duct Openings in Floor

.1 Provide reinforced expanded mesh grating, style 3 (3 lbs/sq.ft.) cover on accessible unprotected duct openings over 300 mm (12") wide and as indicated. This includes all ductwork terminating in air handling units and plenums.

.2 Securely Fasten in place.

.3 Removable for servicing.

1.15 PIPING AND EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Division.

.2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.

.4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.16 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.3 Through fire rated walls and floors.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors, and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

.7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.17 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation, and adjacent fire separation and/or fire rating.

.3 Do not use cementitious or rigid seals around penetrations for pipe, ductwork, or other mechanical items.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

.5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.

.6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide “fire wrap” blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

.8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.

.11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.12 Install material and components in accordance with ULC certification, manufacturer’s instructions and local authority.

.13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.

.14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.

.15 Acceptable Alternate Manufacturers to approval of local authority:
Minnesota Mining and Manufacturing

.16 Fryesleeve Industries Inc.
General Electric Pensil Firestop Systems
International Protective Coatings Corp.
Rectorseal Corporation (Metacaulk)
Proset Systems
3M
AD Systems
Hilti

.17 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.18 ESCUTCHEONS

.1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.19 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.

.4 Prime and touch up marred finished paintwork to match original.

.5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.20 SPARE PARTS

.1 Furnish spare parts in accordance with general requirements and as follows:

.1 One set of packing/mechanical seals for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One set of belts for each type or each size of machinery.

.6 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

1.21 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

1.22 ACCESS DOORS

.1 Provide access doors to concealed mechanical equipment for operating, inspecting, adjusting, and servicing.

.2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.3 Fire rated areas: provide ULC listed access doors.

.4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable materials:
Le Hage
Zurn
Acudor
Nailor Industries Inc.

1.23 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes NPS 50 mm (2") and under: isolating unions.

.3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

1.24 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.

.3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.25 REPAIRS, CUTTING, AND RESTORATION

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.26 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.27 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.28 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.29 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.30 DEMOLITION

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

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

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

1.31 VIDEO RECORDING OF NEW & EXISTING UNDERGROUND SERVICES

.1 Prior to final acceptance of the new underground plumbing system and prior to pouring the floor this contractor shall retain a qualified contractor to video tape the new, existing, and revised sanitary and storm drainage piping and branch piping. Transfer all videotape information to USB.

.2 This contractor shall flush the new and existing storm and sanitary system to remove all debris prior to final video taping of systems.

.3 Provide 1 copy of USB.

.4 Identify video routing on As-built drawings.

1.32 LOCATION OF EXISTING UNDERGROUND SERVICES

.1 This contractor shall locate existing services prior to starting any work in the affected area.

.2 This contractor shall use a video camera for the existing storm and/or sanitary drainage at the indicated connection point to confirm location, size, and invert of the existing piping.

1.33 EXISTING CONCRETE SLAB X-RAY/SCANNING

.1 This contractor shall retain the services of a qualified company to provide and X-ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.

.2 Failure to locate existing piping, conduit rebar etc., shall not relieve this contractor of repair of same prior to installing his service.

.3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

1.34 EXCAVATING AND BACKFILLING

.1 Provide all excavating and backfilling inside and outside the building for plumbing pipes, drains and equipment. All backfilling shall be new clean granular 'A' fill brought in specifically for the purpose of backfilling to the underside of floor slab. All backfilling shall be compacted at intervals not more than 150 mm (6") layer to the satisfaction of the Consultant.

.2 Provide excavating and backfilling outside the building with granular A brought in specifically for backfilling to a minimum of 450 mm (18") over the pipe. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the Mechanical Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the mechanical contractor shall provide new clean granular 'A' fill to grade level.

.3 Bottoms of trenches shall be excavated so that the pipe will be supported on a 150 mm (6") compacted bed of clean granular 'A' fill. Provide all necessary pumping to maintain excavation free of water.

.4 Should water be encountered during excavation, the mechanical contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.

.5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.

.6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

1.1 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.2 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Mechanical systems in this building, including but not limited to smoke control dampers, smoke control fans, high speed low velocity ceiling fans, makeup air units, heat tracing for fire protection systems and fire protection system components may be subject to Integrated Life Safety Systems testing.

.2 The Mechanical Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:

.1 Confirm which mechanical systems are to be included as part of the testing process.

.2 Verify in writing to the Integrated Life Safety Systems Testing Agent that mechanical commissioning of the affected systems/devices is complete prior to the scheduled testing date(s).

.3 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all associated systems.

.4 This contractor shall work with the Integrated Life Safety Systems Testing Agent to reset all systems back to normal operating mode after the testing is complete.

.3 Include all costs associated with Integrated Life Safety System Testing in the tender value.

.4 Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to the General Provisions of General Requirements Section.

.2 This project is one of a retrofit nature in part, and which will require some demolition.

.3 Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Electrical Division.

1.3 SCOPE OF WORK

.1 The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, piping ductwork etc. as indicated or required to complete the work.

Part 2 Products

2.1 GENERAL

.1 This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the owner.

.2 This Division to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

Part 3 Execution

3.1 GENERAL

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

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

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

.10 Disconnect and/or remove equipment piping, ductwork, etc. as indicated.

.11 Cap and conceal all redundant and obsolete connections.

.12 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site which the owner does not retain.

.13 Maintain equipment to be retained by owner on site where directed by consultant.

.14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.

.15 Demolished areas of the existing building will remain in their current use in some cases. Demolition in these areas must be kept to the minimum required to complete the work.

.16 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.

.17 Co-ordinate making safe electrical devices, capping plumbing, and removal of fixtures prior to commencement of demolition.

.18 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.

3.2 EXISTING SYSTEM DRAINAGE

.1 Drain all existing piping and drainage systems including all related equipment as required to facilitate system renovations.

.2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society for Testing and Materials

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate for each item as applicable:

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled; axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with general requirements.

.2 Data to include:

.1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1Mpa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe and with raised face slip-on flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, P7FE (teflon) or graphite impregnated non-asbestos fiber.

.9 Thermal plastic packing: P7FE (teflon) or graphite impregnated non-asbestos fiber slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa (2900 psi) forged steel to ASTM A105. Include half coupling with drain plug.

.15 Lubricant fittings, plunger, gun not required for low friction self lubricating packing.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.

.2 Maximum operating pressure: 1034 kPa (150 psi).

.3 Maximum operating temperature: 200°C (392°F).

.4 Type A: free flexing, factory tested to 1½ times maximum working pressure. Furnish test certificates.

.5 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1.5 times maximum working pressure. Furnish test certificates.

SPEC NOTE: Re 2.2.6. Use monel or inconel when fluorides or caustics are present in the fluid.

.6 Bellows:

.1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.7 Reinforcing or control rings:

.1 2 piece nickel iron.

.8 Ends:

.1 Slip-on flanges to match pipe.

.9 Liner:

.1 Austenitic stainless steel in direction of flow.

.10 Shroud:

.1 Carbon steel, painted.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: as indicated.

.6 Operating conditions:

.1 Working pressure: 1034 kPa (150 psi).

.2 Working temperature: 250°C (482°F).

.3 To match system requirements.

2.4 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as indicated.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

2.5 EXPANSION COMPENSATORS (EXP)(2"-4")

.1 All welded packless guided construction complete with multi ply stainless steel bellows.

.2 Operating temperature (700°F).

.3 Provide model HP3 for steel pipe and model HBFF3 for copper pipe.

.4 Movement capability of 4" axial. Welded ends.

.5 Material to match piping system.

.6 Acceptable materials:
Metraflex HP
Mark David Canada
Senior Flexonics

Part 3 Execution

3.1 INSTALLATION

.1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

3.2 APPLICATION

.1 Provide on all vibration isolated equipment.

.2 Provide where requested by equipment manufacturers installation manuals.

.3 Install in accordance with manufacturer’s recommendations.

.4 Provide expansion compensators (exp.) on radiation heating element exceeding 3.6 M (12' – 0") in length. Provide one expansion compensators on each length of return piping in cabinet.

3.3 THERMAL EXPANSION

.1 Provide in long runs of heating mains exceeding 100 ft. in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

.3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

.1 Thermometers.

.2 Pressure gauges.

.3 Stop cocks.

.4 Syphons.

.5 Wells.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: suitable for application.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.

.1 Acceptable materials:

.1 Trerice

.2 Winters 91T

.3 Wiess

2.3 REMOTE READING THERMOMETERS

.1 100 mm (4") diameter liquid filled activated dial type: to CAN/CGSB-14.5, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished stainless steel case for wall mounting.

.1 Acceptable materials:

.1 Trerice

.2 Winters Contractor

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

.1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable materials:

.1 Winters

.2 Trerice

.3 Wiess

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on all piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Heat exchangers.

.2 Water heating and cooling coils.

.3 Water Boilers

.4 Chillers.

.5 Cooling towers.

.6 DHW tanks.

.7 Boiler Room HWS and HWR.

.8 In other locations indicated.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of coils.

.5 Inlet and outlet of liquid side of heat exchangers.

.6 Outlet of boilers.

.7 Inlet and outlet of water meters.

.8 Inlet and outlet of backflow prevention.

.9 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts, and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut, and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed.
Note: Rapidex and Siporex are <u>not</u> considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A 563.

.1 Finishes for steel pipework: black

.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.

.3 Bolts: to ASTM A 307.

.4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m² (13.12 lbs/ft²) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.

.2 Insulated hot piping:

.1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/- 5% spring rate tolerance, tested for free height, spring rate, loaded height, and provided with CMTR.

.2 Load adjustability: [10] % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm (1") minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 15 mm (1/2") minimum, 50 mm (2") maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm (2"): use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 HOUSE-KEEPING PADS

.1 For base-mounted equipment: Reinforced concrete, at least 100 mm (4") high, 150 mm (6") larger all around than equipment, and with chamfered edges as indicated.

.2 Size of housekeeping pads shall be determined from approved shop drawings.

.3 Concrete: 30 Mpa concrete with reinforced wire mesh.

.4 Install all housekeeping pads not indicated on architectural drawings.

2.10 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.11 MANUFACTURER

.1 Acceptable materials:

.1 Grinnell

.2 Anvil

.3 Myatt

.4 Taylor

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 15 mm (1/2") or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25% of total load.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').

.4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

.7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Do “NOT” support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.

.2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon, and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

.5 CSA B272-93 – Prefabricated Self-Sealing Roof Vent Flashings

.6 CRCA (Canadian Roofing Contractor’s Association)

.7 SPRI (Single Ply Roofing Institute)

.8 CUFCA (Canadian Urethane Foam Contractor’s Association) and CGSB-51-GP-46MP, Manual for “Installers of Spray Polyurethane Foam Thermal Insulation”

.9 CSA G40.21-M1987, M350W, and M300W (Structural Quality Steels)

.10 CSA W47.1-1983 (Certificate of Companies for Fusion Welding of Structural Steel)

.11 CSA W59-M1989 (Welded Steel Construction – Metal Arc Welding)

.12 CSA G164-M1981 (Hot Dip Galvanizing of Irregularly Shaped Articles)

1.2 RELATED SECTIONS

.1 Section 03300 – Cast-in-place Concrete

.2 Section 05210 – Steel Joists

.3 Section 05300 – Metal Deck

.4 Section 06100 – Rough Carpentry

.5 Section 07200 – Thermal Protection

.6 Section 07500 – Membrane Roofing

.7 Section 07900 – Joint Sealers

1.3 DESIGN REQUIREMENTS

.1 Construct support systems to manufacturer's recommendations utilizing manufacturer's regular production components, parts, and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Design supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Manufacturer’s installation instruction.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.6 QUALITY ASSURANCE

.1 Roof accessories manufactures to have minimum five (5) years documented experience in the design and fabrication of roofing specialties and accessories.

1.7 SPECIAL WARRANTY

.1 Warrant products installed under this section of work to be free of leaks, condensation, and defects in materials and/or manufacture for a period of twenty (20) years when installed in accordance with the manufacturer’s written instructions.

Part 2 Products

2.1 PIPE/SUPPORT

.1 Pipe/Support:

.1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51mm) diameter.

.2 Stack Jack Flashing:

.1 Height to suit application.

.2 Fully urethane insulated.

.3 Aluminum construction.

.4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.

.3 Provide appropriate stainless steel mounting hardware to suit supported pipe/equipment.

.4 Provide appropriate system support as specified in this section to suit application.

.1 Single Plain Pipe: Type 304 stainless steel pipe roller assembly to suite actual 0.D pipe.

.2 Double Plain Pipe: Type 304 stainless steel pipe roller assemblies sized to suit actual 0.D pipe.

.3 Single Insulated Pipe: Type 304 stainless steel pipe cradle assembly sized to suit actual 0.D of insulated pipe.

.4 Double insulated Pipe: Type 304 stainless steel pipe cradle assemblies sized to suit actual 0.D of insulated pipe.

.5 Basis of design/Acceptable Manufacturer

.1 Thaler MERS 600 series.

.2 Acceptable equals if submitted during tender period.

2.2 ROOFED IN MECHANICAL UNIT SUPPORT (SMALL UNITS)

.1 Mechanical Unit supports:

.1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51mm) diameter.

.2 Stack Jack Flashing:

.1 Height to suit application.

.2 Fully urethane insulated.

.3 Aluminum construction.

.4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.

.3 Provide appropriate stainless steel mounting hardware to suit application.

.4 Cross-bar carrier of length to suit application with EPDM end caps, anti-vibration pads and 1 1/2" (38mm) diameter pipe section reinforcing ties.

.5 Basis of design/Acceptable Manufacter:

.1 Thaler MERS-900 series.

.2 Acceptable equals if submitted during tender period.

2.3 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.4 ROOF CURB MOUNTED EQUIPMENT

.1 Install as per manufacturer's instructions on roof curbs provided by manufacturer as indicated.

.2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

2.5 MANUFACTURED ROOF SUPPORTS

.1 Single piece injection moulded polypropylene support.

.2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.

.3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.

.4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.

.5 Acceptable materials:
Quick Block
Erico

2.6 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

2.7 ROOF MOUNTED DUCT SUPPORT

.1 Provide zero penetration duct support on roof where indicated.

.2 Base shall be made of high density polypropylene with UV protection.

.3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.

.4 Provide shop drawings as specified. Install to manufacturers recommendations.

.5 Acceptable materials:
Portable pipe hanger
Bigfoot systems
Miro rooftop support
Trikon Systems
Walravin BIS Yeti

Ecofoot

2.8 ROOF MOUNTED PIPE SUPPORT

.1 Provide zero penetration pipe support on roof where indicated.

.2 Base shall be made of high density polypropylene with UV protection. Maximum loading shall be 50 lb/sq.ft.

.3 Frames shall be galvanized. All fastenings, rods, nuts, washers, hangers, etc. shall be stainless steel.

.4 Provide shop drawings as specified. Install to manufacturers recommendations.

.5 Acceptable material:
Portable pipe hanger
Bigfoot systems
Miro rooftop supports
Walravin BIS Yeti

Ecofoot

Part 3 Execution

3.1 INSTALLATION

.1 Roof support install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Provide protection against deterioration due to contact of dissimilar metals.

.2 Flashing Installation:

.1 Install roof support flashing in accordance with manufacturer’s printed instructions.

.3 Vibration Control Devices:

.1 Install as indicated and at all roof mounted mechanical equipment that is not internally isolated.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 PIPE SUPPORT SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Gas and fuel oil piping: every 1.8 m (6').

.3 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.4 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

.5 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 EXAMINATION

.1 Report to the contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of work will imply acceptance of prepared work.

3.4 ADJUSTING

.1 Verify that all manufactured units have been installed in accordance with specifications and details and will function as intended. Adjust any items where necessary to ensure proper operation.

3.5 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaning techniques which could impair performance of the roofing system.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

.2 To be of the same manufacturer for all isolation.

.3 Acceptable materials:
Korfund
Vibro-Acoustics
Vibron

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 10 mm (3/8") minimum thick; 50 durometer; maximum loading 350 kPa (50.8 psi).

.2 Type EP2 - rubber waffle or ribbed; 10 mm (3/8") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60.2 psi).

.3 Type EP3 - neoprene-steel-neoprene; 10 mm (3/8") minimum thick neoprene bonded to 1.5 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50.8 psi).

.4 Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).

.5 Acceptable materials:
Korfund
IAC Acoustics
Vibro-Acoustics
Vibron

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of [60]; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

Acceptable materials:
Vibro-Acoustics
Korfund
IAC Acoustics
Vibron

2.4 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.

.3 Cadmium plate for all installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; leveling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg (2100 lbs) maximum.

.6 Performance: as indicated.

.7 Acceptable materials:
Korfund
IAC Acoustics
Vibron
Vibro-Acoustics

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing, which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element with pre-compression washer and nut [with deflection indicator].

.5 Performance as indicated.

.6 Acceptable materials:
Vibron
IAC Acoustics
Korfund
Vibro-Acoustics

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm (1") minimum thick heavy-duty duct and neoprene isolation material.

.2 Acceptable materials:
Vibron
IAC Acoustics
Vibro-Acoustics

2.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 10 mm (3/8").

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

.3 Acceptable materials:
Korfund
IAC Acoustics
Vibron
Vibro-Acoustics

2.9 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm (96") on smallest dimension, split for field welding on sizes over 2400 mm (96") on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm (1") minimum.

.4 Acceptable materials:
Korfund
IAC Acoustics
Vibron
Vibro-Acoustics

2.10 ROOF CURB ISOLATION RAIL

.1 General: complete factory assembled without need for sub-base.

.2 Lower member: continuous extruded aluminum channel.

.3 Upper member: continuous extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene rubber bushings 6 mm (1/4") thick to resist wind [and seismic] forces.

.4 Springs: steel, adjustable, removable, selected for 25 mm (1") maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.

.5 High frequency isolation: 6 mm (1/4") minimum thick [continuous gasket on top and bottom of complete assembly] [or] [pads on top and bottom of each spring]. Material: closed cell neoprene.

.6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: [aluminum] [neoprene].

.7 Hardware: cadmium plated or galvanized.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:

.1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.

.2 Vibration measurements shall be taken for equipment-listed below:

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 Canadian Standards Association (CSA).

.1 Natural Gas and Propane Installation Code CSA B149.1.

.4 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

.1 Submit product literature in accordance with General Requirements.

.2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned, and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size #5.

.2 Equipment in Mechanical Rooms: Use size #9.

.3 Roof top equipment: use size #9.

.4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES/FIRE SMOKE DAMPER

.1 Colours:

.1 Black letters, yellow background.

.2 Construction:

.1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.

.3 Locations:

.1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

2.4 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Consultant.

.4 Upon completion of this project all references to room names and numbering shall be to the Owner’s requirements which may or may ‘NOT’ be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.

.5 All equipment shall be identified in sequence from the existing equipment and “NOT” duplicate numbering of equipment.

2.5 PIPING SYSTEMS GOVERNED BY CODE

.1 Identification:

.1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.

.2 Sprinklers: To NFPA 13.

.3 Standpipe and hose systems: To NFPA 14.

2.6 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.3 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.

.2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.

.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.8 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	LEGEND
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Heat Pump Supply	Yellow	HEAT PUMP SUPPLY
Heat Pump Return	Yellow	HEAT PUMP RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Domestic tempered supply	Green	DOM. TEMPERED
Trap Primer	Green	TRAP PRIMER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Condensate	Green	CONDENSATE
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	Yellow	NATURAL GAS
Gas regulator vents		to Codes
Instrument air	Green	INSTRUMENT AIR
Control air tubing	White	CONTROL AIR
Conduit for low voltage Control wiring	White	CONTROL WIRING___VOLTS

2.7 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

.1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.9 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

.3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

2.10 LANGUAGE

.1 Identification to be in English.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate, or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section is to be read in conjunction with Division 1, the General Conditions and Section 20 02 51, the General Requirements of the Mechanical Trades, and the documents required by the BIDDING REQUIREMENTS and CONDITIONS OF THE CONTRACT sections.

.2 All pricing shall be in accordance with Catholic School Board Services Association (CSBSA) Agreement.

.3 All pricing submissions shall include the following supporting documents; Detailed List Summary, Poteau Analysis, Project schedule and summary letter.

.4 The balancing contractor will work for the Owner.

.5 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

1.2 APPROVED TAB AGENCIES

.1 Bids for the balancing contractor will be tendered separately by the School Board.

1.3 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

.2 This contractor must co-ordinate their work with that of the TAB contractor.

1.4 QUALIFICATIONS OF TAB AGENCIES

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.

.2 Provide documentation confirming qualifications, successful experience.

.3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:

(WRDSB: USE ONLY AIR AUDIT, CLARKE BALANICNG, AIRWASO, DYNAMIC FLOW BALANCING, AIR VELOCITIES CONTROL, FLOWSET BALANCING)

.1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, Ontario
N1T 1K6
(519) 740-0871

.2 Air Velocities Control Ltd.
100 Premium Way
Mississauga, Ontario
L5B 1A2
(905) 279-4433

.3 Flowset Balancing Ltd.
431 Willis Dr.
Oakville, Ontario
L6L 4V6
(416) 410-9793

.4 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, Ontario
L0G 1T0
(416) 254-3004

.5 (Auxiliary Choice)
John Price Enterprise Corp.
763 Warden Ave Unit #9
Scarborough, Ontario
M1L 4B7
(416) 755-4676
Contact: Joshua Price
Cell #: 647-447-5003

.6 Clark Balancing Ltd. **(Not for School Boards)**
8094 Esquesing Line
Milton, Ontario
L9T 2X9
(905) 693-1518

.7 (Auxiliary Choice – Small Projects only, does not hold certifications)
Red Leaf Technical Inc.
5249 Ament Line,
Linwood, Ontario
N0B 2A0
(519) 504-1617

.8 (**Simcoe Board ONLY)**
VPG Associates
2062 King Road
King City, Ontario
L7B 1K9
(905) 833-4334

1.5 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.7 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

1.8 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

.4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

1.9 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

1.10 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.11 START OF TAB

.1 Notify Consultant in writing 3 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather-stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.

.4 All provisions for TAB installed and operational.

.5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 All outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

.7 Control valves are properly piped.

.8 Coils and radiation are properly piped.

.9 BAS in operation.

1.12 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10%, minus 5%.

.2 Hydronic systems: plus or minus 10%.

1.13 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.14 INSTRUMENTS

.1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.15 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.17 TAB REPORT

.1 Format to be in accordance with NEBB, AABC, or SMACNA.

.2 The following additional information shall be provided for all air systems:

.1 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE occupied ventilation requirements.

.2 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE unoccupied ventilation requirements.

.3 Static pressure reading for each HVAC/AHU unit with VAV/VVT boxes open to 80% of design airflow and bypass damper closed to 0%. Provide reading at normal MAD/economizer damper position, dampers fully closed and dampers fully open.

.3 TAB report to show all results in SI or imperial units as indicated on plans and to include:

.1 Project as-built drawings.

.2 System schematics.

1.18 VERIFICATION

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.19 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.20 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.21 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.

.2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:

.1 Air handling systems and equipment

.2 Duct testing to SMACNA standards.

.3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.4 Quality assurance: Perform TAB under direction of qualified supervisor.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.22 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.

.2 Standard: TAB to be the most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.

.3 Do TAB of all systems, equipment, components, controls specified in Mechanical Division including but not limited to hydronic equipment testing.

.4 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.5 Quality assurance: perform TAB under direction of qualified supervisor.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power voltage, noise, vibration.

.7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.

.2 At each controller, controlled device.

.8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.

1.23 DUCT LEAKAGE TESTING

.1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

1.24 DOMESTIC HWC SYSTEMS

.1 Meet all requirements as specified for hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.25 OTHER SYSTEMS

.1 Plumbing systems:

.1 TAB procedures:

.2 Recirculating Systems pump flows, pressures

1.26 OTHER TAB REQUIREMENTS

.1 General requirements applicable to all work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.3 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.

.2 TAB procedures:

Positive	Negative
Corridors	Washrooms
Corridors	Industrial Areas

.4 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish air pressure differentials, with all systems in all possible combinations of normal operating modes.

.5 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers installed as component parts of air systems specified.

.6 Provide duct testing as specified.

.7 Provide AHU testing as specified.

.8 Provide plenum testing as specified.

.9 Changing of air handling equipment sheave and belts as required for specified air flow sheaves and belts supplied by unit manufacturer. Retest equipment after sheave change.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The Mechanical Contractor shall provide the labour and material to conduct the closeout process as outlined in this specification section.

.2 The mechanical contractor shall perform the closeout requirements specified in conjunction with the independent commissioning consultant (CC) retained by the owner.

Part 2 Products

2.1 GENERAL

.1 The mechanical contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Mechanical Contractor shall advise the Mechanical Consultant of instrumentation to be used and the dates the instruments were calibrated.

Part 3 Execution

3.1 THE CONTRACT CLOSE OUT PROCESS

.1 The mechanical contractor close out process shall consist of:

- Shop Drawings and As-built Drawings
- Installation inspection and equipment verification
- Plumbing and drainage system testing
- Testing of piping systems
- Independent contractor balancing of water systems
- Testing of air systems
- Independent contractor balancing of air systems
- Testing of equipment and systems
- BAS Commissioning
- Commissioning Consultant performance testing
- Commissioning meetings
- Operating and maintenance manuals
- Training
- Systems Demonstration and turnover
- Testing forms
- Warranties
- Contractor to provide list of equipment maintenance including schedule of maintenance parts, quantities, and model fixtures, etc.

3.2 SHOP DRAWINGS AND AS-BUILT DRAWINGS

.1 Conform to General Requirements Section for shop drawings and as-built drawings requirements.

3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Mechanical Contractor shall co-ordinate with the Consultant who will inspect the mechanical installation.

.2 The Mechanical Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

- Manufacturers name, address, and telephone number
- Distributors name, address, and telephone number
- Make, model number and serial number
- Pumps - RPM, impeller sizes, rated flow
- Fans - belt type and size, shive type and size
- Electrical - volts, amps, fuse size, overload size
- Any other special characteristics.

3.4 PLUMBING AND DRAINAGE SYSTEM TESTING

.1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the specification.

.2 The Mechanical Contractor shall notify the Building Inspector when systems are available for testing. The Mechanical Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Consultant.

3.5 THE CONTRACTOR'S TESTING OF PIPING SYSTEMS

.1 Test all piping systems in accordance with all applicable plumbing codes and General Requirements section.

.2 All tests for the systems shall be performed in the presence of the Consultant or Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.6 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF WATER SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.7 THE CONTRACTORS TESTING OF AIR SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 All tests shall be performed in the presence of the Mechanical Consultant or the Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.8 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF AIR SYSTEMS

.1 Conform with specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.9 TESTING OF EQUIPMENT AND SYSTEMS

.1 General:

.1 The Mechanical Contractor shall hire the services of the manufacturers technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms. The tests shall be witnessed by the Consultant or Owners representative. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms. A copy of the forms shall be forwarded to the Consultant. The original shall be inserted into the operating and maintenance manual.

.2 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed.

.3 Tests which have not been witnessed shall not be accepted and shall be repeated.

.4 The equipment and systems to be tested shall include:

- Heat Pumps
- Boilers and Pumps
- Air Handling Units
- Cooling Tower
- Life Safety and Fire Protection Systems
- Water Treatment Systems
- Building Automation Systems (BAS)

.2 BAS Testing:

.1 The BAS Contractor shall test the system as described in General Requirements and/or Controls Sections.

.2 Co-ordinate with the Consultant and submit completed test forms monthly.

.3 Demonstrate to the Owner and Consultant the operation of the BAS when all tests have been completed.

3.10 CLOSEOUT SCHEDULE

.1 The Mechanical Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.

.2 All testing forms and reports associated with the mechanical systems shall be directed to the Consultant with copies to the Owner and Consultant.

.3 The forms and reports to be issued shall include:

- Shop drawings, issued and accepted
- Equipment verification forms
- Testing forms
- Reports resulting from tests
- Testing schedule
- Equipment Start-up Forms

3.11 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

3.12 OPERATOR TRAINING

.1 Conform to General Requirements section for requirements for Instruction to Operating Staff.

.2 The training shall be conducted in a classroom and at the equipment or system.

.3 Training will begin when the operating and maintenance manuals have been delivered to The Owner and approved by the Consultant.

.4 Each training session shall be structured to cover:

The operating and maintenance manual
- Operating procedures
- Maintenance procedures
- Trouble-shooting procedures
- Spare parts required
- Submit a course outline to the Mechanical Consultant before training commences. Provide course documentation for up to eight people.

.5 The training sessions shall be scheduled and co-ordinated by the Mechanical Contractor.

.6 Training shall be provided for the following systems:

System	Minimum Training Times
Cooling Tower	2 hours
Heat Pumps	2 hours
Boilers	2 hours
Air Handling Units	2 hours
Life Safety & Fire Protection Systems	2 hours
Water Treatment Systems	2 hours
The Mechanical System	8 hours
Boilers	½ hour
Life Safety & Fire Protection	½ hour

.7 The minimum training for the BAS shall be 16 hours. The training shall include:

- A walk through of the installation for the Building Owner to review the installation and equipment
- Operation of the central computer
- Operation of portable terminals
- Control sequences
- Report set-up and generation
- Managing the system
- Maintenance requirements

Refer to Controls specification section for further information.

.8 The training requirement for the mechanical system shall include a walk-through of the building by the Mechanical Contractor. During the walk through the Mechanical Contractor shall:

- Identify equipment
- Identify starters associated with equipment
- Identify valves and balancing dampers
- Identify access doors
- Review general maintenance of equipment

- Review drain points in pipework systems
- Identify maintenance items

.9 When each training session has been completed The Owner shall sign the associated form to verify completion.

3.13 COMMISSIONING CONSULTANT

.1 A Commissioning Consultant (CC) reports to the Owner.

.2 The CC responsibilities shall include:

- preparing the commissioning plan
- co-ordinating with the contractor to schedule tests
- preparing a test form manual
- witnessing selected tests
- receiving all test forms
- conducting performance test
- co-ordinating the contractors training
- chair commissioning meetings

.3 The Mechanical Contractor shall co-operate with the CC.

.4 The Mechanical Contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each mechanical system shall be tested in the operational mode.

.5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Contractor and the Consultant has completed their final review.

3.14 MECHANICAL SYSTEM DEMONSTRATION AND TURNOVER

.1 Refer to General Requirements section, Mechanical Project Completion.

.2 The system demonstration and turnover to The Owner shall occur when:

- The installation is complete
- The acceptance test conducted by the Mechanical Consultant has been completed successfully
- The Commissioning Consultant system performance testing has been completed successfully
- Training has been completed
- Operating and Maintenance Manuals have been accepted
- Shop-drawings have been updated
- As-built drawings have been completed

.3 The systems demonstration shall be conducted by the Mechanical Contractor and the manufacturers. The demonstration shall cover a demonstration of equipment installation and operation.

3.15 TESTING FORMS

.1 The Mechanical Contractor and manufacturers shall provide forms for testing. The forms must be approved by the Consultant and The Owner before they are used.

3.16 WARRANTIES

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by The Owner.

.2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to the general conditions specification section for the requirements during the warranty period.

3.17 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be shall be as follows:

.1 3% for the first $500,000 of contract value.

.2 1% of the contract value for value between $500,000 to $5,000,000.

.3 0.5% of contract value for the value in excess of $5,000,000.

.4 Minimum Allocation for Close Out Documents is $5,000.

.2 The Mechanical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The monies shall not be paid out until the performance testing, O & M manuals, systems demonstration, and training including all required paperwork have been completed to the satisfaction of the consultant. Refer to General Requirements section for contract breakdown.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C547, Type I and IV, Standard Specifications for Mineral Fibre Pipe Insulation.

.2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded Hot-Plate Apparatus.

.4 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.5 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.6 ASTM C1695, Standard Specification for Fabrication of Flexible, Removable, and Reusable Blanket Insulation for Hot Service.

.7 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC), North American Commercial and Industrial Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

.3 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

Part 2 Products

2.1 MATERIAL LIMITATIONS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTM C177 or ASTM C518.

.3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547 Type I and IV.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" factor: to ASTM C547.

.4 Type A-2: Mineral fibre faced with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 Type A-3: Tubular flexible elastomeric closed cell foam.

.1 Insulation to ASTM C534 Type I.

.2 Maximum “k” factor: to ASTM C534.

.3 To be certified by manufacturer to be free of potential stress corrosion cracking corrodents.

.6 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

.1 Johns Manville

.2 Knauf

.3 Manson

.4 Owens Corning

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

2.5 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 Minimum thickness: 20 mm (0.020")

.2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.3 Colours: white.

.4 Minimum service temperatures: -29°C (-20°F).

.5 Maximum service temperature: 65°C (150°F).

.6 Moisture vapour transmission: 0.05 perm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks are not to be used below ambient temperature (cold) operating systems.

.3 Pressure sensitive vinyl tape of matching colour.

2.9 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC, North American Commercial and Industrial Insulation Standards.

.2 Apply materials in accordance with manufacturers' instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.5 Below ambient/chilled water installation:

.1 All pipes, valves, strainers, flanges, unions, and other pipe system components and spec must be properly insulated with correctly completed vapor retarder applied.

.2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.

.3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a 0.02 or lower perm rating.

.4 Vapor stops must be installed at 18' intervals at all pipe insulation termination points including fittings, flanges, and other changes in direction or other types of piping specialties.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricate from the same material as the pipe insulation. Full thickness must be maintained over all fitting surfaces. Blanket insulation with a factory applied vapor retarder facing is unacceptable.

.6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder of the pipe insulation.

.7 Additional fitting covers, PVC, or metal must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.

.8 Additional field applied to jackets must not use staples, screws, tacks, or rivets for attachment to avoid puncturing vapor retarder underneath.

.9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Flexible removable blanket insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material, that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.

.3 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.4 Insulation:

.1 Insulation, fastenings, and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table:

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.2 All storm piping including all vertical and horizontal piping shall be insulated.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Domestic Water Piping	A-1	25 (1")	25 (1")	40 (1½")	40 (1½")	40 (1½")
Storm Piping	A-1	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")
Horizontal Cast Iron Sanitary Piping	A-1	N/A	N/A	25 (1")	25 (1")	25 (1")
Trap Primer Piping	A-1	15 (½")	15 (½")	25 (1")		

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).

.7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.10 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.11 MSS-SP-67, Butterfly Valves.

.12 CSA B137.1 Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.13 CSA B137.5, cross linked polyethylene (PEX) tubing systems for pressure applications.

.14 ASTM International

- .1 ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing
- .2 ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems
- .3 ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing

.15 German Institute for Standards (Deutsches Institut fur Normung e.V., DIN)

- .1 DIN 4726 Warm Water Surface Heating Systems and Radiator Connecting Systems – Plastics Piping Systems and Multilayer Piping Systems.

.16 National Sanitation Foundation (NSF) International

- .1 NSF-rfh: Evaluated for use in Radiant Floor Heating (NSF-rfh) Applications

.17 Canadian Standards Association (CSA)

- .1 CAN/CSA B137.5 Standard Specification for Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications

.18 Uponor, Inc.

- .1 Uponor Pre-insulated Pipe Systems Design and Installation Manual, current edition

Part 2 Products

2.1 COPPER PIPING

.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 Tee drill NPS 25 mm (1") and larger.

.6 NPS 80 mm (3") and larger: roll grooved to CSA B242.

.3 JOINTS

.1 Solder: 95/5.

.2 Teflon tape: for threaded joints.

.3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.

.4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

.5 Rubber gaskets, 1.5 mm (16 gauge) thick: to ANSI/AWWA C111/A21.11.

.6 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.7 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.4 VALVES

.1 All valves shall be of commercial grade and of same manufacturer.

.2 Acceptable materials:
Milwaukee
Crane
Neuman Hattersley
Kitz

.5 BALL VALVES

.1 All valves shall be of commercial grade and of same manufacturer.

.2 NPS 80 mm (3") and under, soldered:

.1 To ANSI B16.18, Class 150.

.2 Bronze body, full port stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

.6 GATE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.2 NPS 50 mm (2") and under, screwed:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.3 NPS 65 mm (2-1/2") and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, OS&Y bronze trim.

.4 NPS 65 mm (2-1/2") and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, bronze trim, bolted bonnet.

.7 GLOBE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS SP-80, Class 150, 1.03 MPa (150 psi), bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

.8 SWING CHECK VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.3 NPS 65 mm (2 1/2") and over, flanged:

.1 To MSS SP-71, Class 125, 860 kPa (125 psi), cast iron body, flat flange faces, [regrind] [renewable] seat, bronze disc, bolted cap.

.9 BUTTERFLY VALVES

.1 Provide copper tubing grooved valves where indicated.

.2 NPS 100 mm (4") and over:

.1 Bronze body per CDA-836.

.2 EPDM/Bronze disk and trim.

.3 Two position handle.

.3 Acceptable material:
Victaulic Series 608

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Bent tubing is not acceptable.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of general requirements.

.2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

3.4 FLUSHING AND DISINFECTING

.1 Maintain testable RP backflow preventor between municipal water and new plumbing system.

.2 Ensure a minimum of 90% of plumbing fixtures are installed.

.3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves and operate fixtures to ensure thorough flushing.

.6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.

.7 Rate of chlorine application to be proportional to rate of water entering pipe.

.8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.

.9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

.10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.

.11 Measure chlorine residuals at extreme end of pipe-line being tested.

.12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.

.13 Take water samples at remote fixtures and service connections.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA – B64.10/B64.10.1 – Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

1.2 SUBMITTALS

.1 Complete the required cross connection survey form and submit to authority having jurisdiction. Provide a copy to the consultant.

.2 Incorporate data into maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Provide backflow prevention devices in all new and existing fixtures and equipment as indicated and as required by the authority having jurisdiction.

.2 Acceptable materials:
Watts
Wilkins

Part 3 Execution

3.1 INSTALLATION

.1 Install devices in accordance with acceptable engineering practices, the requirements of the Ontario Building Code and the requirements of the authority having jurisdiction.

3.2 TESTING

.1 Provide testing to requirements of authority having jurisdiction.

.2 Provide copy of test report for each device in the maintenance manual.

.3 Provide tag on each device.

.4 Provide a list of devices complete with tag number on a framed chart. Locate chart in Water Entrance Room.

.5 Provide additional testing on all devices at one year warranty period. Provide documentation to owner and consultant.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section general requirements

.2 Data to include:

.1 Manufacturers name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS

.1 Capacity: 0.6 l/s (9.5 gpm) against total differential head of 10 kPa (1.45 psi or 3.35 ft. wc.) as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel, or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105C continuous service.

.3 Motor: 124 W (1/6 hp), drip-proof, with thermal overload protection. Provide multi-speed motor.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable materials:

.1 Bell & Gossett Model

.2 Armstrong

.3 Taco

Part 3 Execution

3.1 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

.4 Place 150 mm (6") sand under sump pit tank.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 PDI-WH201, Water Hammer Arresters.

.5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.6 ANSI/AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.

.7 ANSI/AWWA C701, Cold Water Meters-Turbine Type, for Customer Service.

.8 ANSI/AWWA C702, Cold Water Meters-Compound Type.

.9 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 INTERIOR HOSE BIBB

.1 20 mm (3/4") diameter brass construction, 200 psi, 180°F pressure and temperature limits, complete with hose connection, and wheel handle straight/angle pattern to suit.

.2 Provide vacuum breaker complete with hose connection.

.3 Acceptable manufacturers:
Exposed on wall; Watts BD series
Surface mounted (piping in wall); Watts SC-3 series
Delta
Waltec
Wilkins
Emco

2.2 WATER HAMMER ARRESTORS

.1 Copper construction, bellows type: to PDI-WH 201.

.2 Acceptable material:
Zurn Z-1700
Mifab MWH-100
Ancon No. 15

2.3 BACK FLOW PREVENTORS

.1 The backflow preventor shall prevent backflow by either backpressure or backsiphonage from a cross-connection between potable water lines and substances that are objectionable.

.2 To CAN/CSA-B64.

.3 Application: as indicated.

.4 Reduced pressure principle type up to 50 mm (2") (RP):
Rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be SILICONE. The first and second check shall be orientated at a 45° angle up-wards and accessible for maintenance without removing the relief valve. Supplied with an air gap adapter.

.1 Acceptable materials:
Watts 009 ½" - 2"
Wilkins 975 XL ½" - 2"
Conbraco 40-200 Series

.5 Reduced pressure principle type from 65 mm (2½") to 250 mm (10") (RP):

The reduced pressure principle backflow preventer shall be ASSE 1013 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The first and second checks shall be accessible for maintenance without removing the relief valve or the entire device from the line.
If installed indoors, the installation shall be supplied with an air gap adapter, strainer, and integral monitor switch.

.1 Acceptable materials:
Watts 909 2½" - 10"
Wilkins 975 2½"- 10" or 375 4"- 6"
Conbraco 40-200 Series

.6 Double check valve assembly (DCVA):
The double check type backflow preventer shall be ASSE 1015 approved, and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat rings and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone. The first and second checks shall be accessible for maintenance without removing the device from the line.

.1 Acceptable materials:
Watts 007 ½"- 2"
Wilkins 950XL ¾ "- 2"
Conbraco 40-100 Series

.7 Double check valve assembly (DCVA)
The double check backflow preventer shall be ASSE 1015 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line.

.1 Acceptable materials:
Watts 709 2½" - 10"
Wilkins 950 2" - 10", 350 4" - 6"
Conbraco 40-100 Series

.8 Back flow preventor with intermediate atmospheric vent:

.1 Acceptable material:
Watts Series 9D
Wilkins 750
Conbraco 40-4A Series

2.4 VACUUM BREAKERS

.1 To CAN/CSA-B64 Series.

.2 Atmospheric vacuum breaker (A-VB):

.1 Acceptable materials:
Watts 288A
Conbraco 38-103 Series
Wilkins 35

.3 Hose connection vacuum breaker (HCVB):

.1 Acceptable materials:
Watts Series 8
Conbraco 38-304-AS
Wilkins BFP-8

.4 Laboratory faucet intermediate vacuum breaker (LFVB):

.1 Acceptable materials:
Watts N-LF9
Conbraco 38-502-01

2.5 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa (150 psi).

.2 Outlet pressure: 41 kPa (5.9 psi).

.2 Up to NPS 40 mm (1 1/2") bronze bodies, screwed: to ASTM B62.

.1 Acceptable material:
Watts Series 25AUB (1/2" - 2")

.3 NPS 50 mm (2") and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class [B].

.1 Acceptable materials:
Watts PV-10
Conbraco 36 Series

.4 Semi-steel spring chambers with bronze trim.

.1 Acceptable materials:
Watts PV-10
Conbraco 36 Series

2.6 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

.1 Acceptable materials:
Watts BD series
Emco
Chicago
Zurn

2.7 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventor, pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

.1 Acceptable materials:
Watts
Conbraco

2.8 WATER METERS (CHECK METERS)

.1 To latest AWWA Standard C700-77

.2 Direct reading registrar, cast bronze main case, positive displacement.

.3 Acceptable material:
Neptune t-10

2.9 STRAINERS

.1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.

.2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.

.1 Acceptable materials:
Watts Series 777SI
Crane/Powers
Colton 125 YTB
Wilkins S Series

.3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.

.1 Acceptable materials:
Watts 77F-D (77F-D-FDA for water service)
Crane/Powers
Colton 125 YTB
Wilkins FS Series

2.10 WATER FILTERS

.1 Five (5) micron filter assembly for taste/odour and dirt/rust.

.2 The unit shall be constructed of molded transparent plastic housing and a bottom pressure relief for cartridge change.

.3 Install as per manufacturer's recommendations

.4 Supply a spare set of cartridges.

.5 Acceptable material:
Aqua Puro AP11B

2.11 SOLENOID VALVES

.1 Two (2) way normally closed all bronze construction.

.2 Voltage shall be suitable for controlling function.

.3 Acceptable material:
Asco

2.12 OWNER SUPPLIED EQUIPMENT

.1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.

.2 Provide flexible riser stops to all sinks and ball valves to all other equipment.

.3 Provide backflow preventors on equipment required by the local plumbing inspector.

.4 Provide flexible gas piping to all gas equipment.

.5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.

.6 Coordinate all rough-ins and connection with the supplier on site.

.7 Owner supplied equipment includes existing relocated equipment.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 WATER HAMMER ARRESTORS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.3 BACK FLOW PREVENTORS

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

.3 Provide test results in manual and leave tag with test results on device.

3.4 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.5 STRAINERS

.1 Install with sufficient room to remove basket.

.2 Strainer size to match pipe size.

3.6 WATER METERS

.1 Install water meter provided by local water authority **and/or this contractor.**

.2 Install water meter as indicated.

.3 Install remote readout to acceptance of local water authority and as indicated.

.4 Install check meter(s) as indicated.

3.7 WATER MAKE-UP ASSEMBLY

.1 Install with valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.8 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Water hammer arrestors:

.1 Verify accessibility.

.2 Backflow preventors, vacuum breakers:

.1 Verify installation of correct type to suit application.

.2 Adjust as necessary to ensure proper operation.

.3 Verify visibility of discharge.

.3 Pressure regulators:

.1 Adjust settings to suit installed locations, required flow rates.

.4 Hose bibbs, sediment faucets:

.1 Verify operation.

.5 Water make-up assembly:

.1 Verify operation.

.6 Water meters:

.1 Verify operation.

.7 Pipeline strainers:

.1 Verify accessibility of basket.

.2 Clean out during commissioning until system clean.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor drains and trench drains: to CAN/CSA-B79.

.2 Type FD-: As per schedule.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable material:
Zurn ZSS-1469
Mifab C1400-RD
Watts CO-480-RD-3
Jay R. Smith 4710

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable material:
Zurn ZN-1400 – HD or Zurn ZXN-1612
Mifab C1100-XR-6
Watts CO-200-RX-1-6
Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-Z
Mifab C1100-UR-6
Watts CO-200-U-1-6
Jay R. Smith SQ-4-1753-NBRT-SP-U

.3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-T – HD
Mifab C1100-TS-6
Watts CO-200-TS-1-6
Jay R. Smith 4200-U

.4 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable material:
Zurn ZN-1400 – T-HD or Zurn ZXN-1612
Mifab C1100-S-6
Watts CO-200-S-1-6
Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

.5 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-HD-CM or ZN-1612-CM
Mifab C1100C-S-1-6
Ancon CO-200-RC-1-6
Smith
Contour C3000RMNB

2.3 TRAP SEAL PRIMER STATIONS

.1 Provide trap primer stations where indicated complete with solenoid valve, backflow preventor, vacuum breaker, NPS 15 mm (1/2") solder ends, NPS 15 mm (1/2") drip line connections.

.2 Solenoid valve electric characteristics shall be suitable for controlling function.

.3 Coordinate location and number of trap primer stations with Building Automation System (BAS) contractor.

2.4 SOLENOID VALVES (HEADER TRAP SEAL PRIMER)

.1 Two (2) way normal closed all bronze construction.

.2 With integral adjustable cycle time clock control. Timer control to have two dial functions, time between cycles and time held in “open position”.

.3 Suitable for 120V.

.4 Acceptable material:
Asco

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 TRAP SEAL PRIMERS

.1 Install for all floor, hub and trench drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.

.3 Install soft copper tubing to floor drains above grade and polyethylene piping to floor drains below grade.

3.4 TRAP SEAL PRIMER STATIONS

.1 Provide primer stations where indicated.

.2 Install for all floor drains and elsewhere, as indicated.

.3 Install copper piping to floor drains above grade. Install polypropylene piping to floor drains on grade.

3.5 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Floor, hub and trench drains:

.1 Verify proper operation of trap primer, flushing features.

.2 Verify security and removability of strainers.

.2 Cleanouts:

.1 Verify covers are gastight, secure and easily removable.

.2 Verify that cleanout rods can probe as far as next cleanout.

.3 Backwater valves:

.1 Verify accessibility of cover, valve.

.4 Trap seal primers:

.1 Verify operation.

.2 Adjust flow rate to suit site conditions.

.5 Acid dilution devices:

.1 Verify operation.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM B32, Specification for Solder Metal.

.3 ASTM B306, Specification for Copper Drainage Tube (DWV).

.4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CAN/CSA-B125.3, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, and vent, maximum 65 mm (2½") Type DWV copper to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA B125.3.

.2 Wrought copper: to CAN/CSA B125.3.

.2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary, and vent, minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.

.1 Mechanical joints (vents)

.1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.

.2 Stainless steel clamps (2 band).

.2 Mechanical joints (sanitary)

.1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.

.2 Stainless steel clamps (4 band min).

2.3 VENT FLASHINGS

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.4 FORCED MAINS

.1 Above and below ground sewage pump discharge, size as indicated, type ‘L’ copper to ASTMB88M.

.2 Cast copper, solder fitting to ANSI B16.18.

.3 Cast bronze threaded fittings, class 125 to ANSI/ASME B16.15.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.3 Place Cleanouts

- .1 Where shown on Drawings and near bottom of each stack and riser.
- .2 At every 90 degree change of direction for horizontal lines.
- .3 Every 15 m (50') of horizontal run.
- .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system, so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Vent entire waste system to atmosphere.

- .1 Discharge 500 mm (20") above roof. Join lines together in fewest practicable number before projecting above roof.
- .2 Set back vent lines so they will not pierce roof near an edge or valley.
- .3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.
- .4 Provide copper vent piping through roof as per detail.

.6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.7 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.

- .1 Flashing base shall be at least 600 mm (24") square.
- .2 Flashing may be a 24 kg/m^2 (5 lb/ft^2) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.

.8 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

- .1 Do not caulk threaded work.
- .2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried sanitary, and vent piping to:

.1 80 mm (3”) and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.

.2 100 mm (4”) and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.

.3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.2 Above grade sanitary and vent piping:

.1 80 mm (3”) and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.

.2 100 mm (4”) and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.

.3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.

.4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

2.3 EXPANSION

.1 Provide solvent welded expansion joints as required by manufacturer's recommendations.

2.4 VENT FLASHINGS

.1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50 ft) of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

.6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to taken to accommodate ambient temperatures at time of install.

.7 Vent entire waste system to atmosphere.

.1 Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.

.2 Set back vent lines so they will not pierce roof near an edge or valley.

.3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.

.8 Flash pipes passing through roof with Thaler insulated Stack Jack flashing.

.1 Flashing base shall be at least 600 mm (24") square.

.9 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM B32, Specification for Solder Metal.

.3 ASTM B306, Specification for Copper Drainage Tube (DWV).

.4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CAN/CSA-B125.3, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground storm maximum 65 mm (2½") Type DWV copper to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA B125.3.

.2 Wrought copper: to CAN/CSA B125.3.

.2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground storm minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.

.1 Mechanical joints (storm)

.1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.

.2 Stainless steel clamps (4 band min).

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50') of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

.4 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Do not caulk threaded work.

.2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried storm piping to:

.1 80 mm (3”) and smaller: ABS drain pipe to CAN/CSA-B181.1.

.2 100 mm (4”) and larger: SDR-35 PVC drain pipe to CAN/CSA-B181.2.

.2 Above grade storm piping:

.1 80 mm (3”) and smaller: IPEX: PVC-XFR fire rated drain storm pipe to CAN/CSA-B181.1.

.2 100 mm (4”) and larger: IPEX: PVC-XFR storm pipe to CAN/CSA-B181.2.

.3 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50 ft) of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable material:
Zurn ZSS-1469
Mifab C1400-RD
WATTS CO-480-RD-3
Jay R. Smith SQ-A-1753-XNBCO-SP-U

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable material:
Zurn ZN-1400 – HD or Zurn ZXN-1612
Mifab C1100-XR-6
WATTS CO-200-RX-1-6
Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-Z
Mifab C1100-UR-6
WATTS CO-200-TS-1-6
Jay R. Smith SQ-4-1753-NBRT-SP-U

.3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-T – HD
Mifab C1100-TS-6
WATTS CO-200-S-1-6
Jay R. Smith 4200-U

.4 Cover for ceramic tile floors: 15 (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable material:
Zurn ZN-1400 – T-HD or Zurn ZXN-1612
Mifab C1100-S-6
WATTS CO-200-RC-1-6
Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

.5 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable materials:
Zurn ZN-1400-HD-CM or ZN-1612-CM
Mifab C1100C-S-1-6
Ancon CO-200-RC-1-6
Smith
Contour C3000RMNB

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

.3 Install roof drains in lowest point of roof. Co-ordinate location with architectural, structural, and mechanical drawings.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

- .1 Cleanouts:
  - .1 Verify covers are gastight, secure, and easily removable.
  - .2 Verify that cleanout rods can probe as far as next cleanout.

.5 Commissioning reports:

- .1 Record all results on approved report forms.
- .2 Include signature of tester and supervisor.
- .3 To be countersigned by Consultant.

.6 Verification:

- .1 Notify Consultant 48 h before commencing tests.
- .2 All tests and procedures to be witnessed by Consultant.
- .3 All reported results subject to verification by consultant.

.7 Training:

- .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.

.8 Demonstrations:

- .1 Demonstrate full compliance with Design Criteria.
- .2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI Z21.10.1/CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters with Inputs Ratings of 75,000 Btuh, or less.

.3 ANSI Z21.10.3/CSA 4.3, Gas Water Heaters Volume III; Storage Water Heaters with Input Ratings above 75,000 Btuh, circulating and Instantaneous.

.4 CSA-B149.1, Natural Gas and Propane Installation Code.

.5 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.6 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

.7 CAN/CSA-B140.0, Oil Burning Equipment: General Requirements.

.8 CSA B140.12, Oil Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.

.9 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer’s name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 GAS FIRED HIGH EFFICIENCY WATER HEATER (WH-1)

.1 To ANSI Z21.10.3/CSA 4.3 with a recovery rate of 523 l/h (138 gal/h) based on 56°C (100°F) rise and 35 kW (120 MBH) input. Efficiency of 94%.

.2 Tank: 227 l (60 gal), glass, lined steel, 692 mm (27¼") dia. x 1359 mm (53½") high fibreglass insulation, enameled steel jacket.

.3 Gas burner: complete with high limit control, gas valve, gas pressure regulator, 100% safety shut-off, firepower gas burner with air distribution ring, 120V /1/60.

.4 3 year warranty certificate.

.5 Vent kit complete with wall vent and vent pipe.

.6 Provide 80 mm (3") ULC S636 approved CPVC piping and fittings for combustion and exhaust. Install as per manufacturers recommendations. Support piping at 1.5 m maximum.

.7 Provide neutralizing cartridge for each hot water tank as supplied by equipment manufacturer.

.8 Acceptable materials:
A. O. Smith Cyclone XI BTH-120
Ruud
Bradford White

2.2 WATER HEATER TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 25 mm (1") with hose end.

.2 Thermometer: 100 mm (4") dial type with red pointer and thermowell filled with conductive paste.

.3 Thermowell filled with conductive paste for control valve temperature sensor.

.4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

Part 3 Execution

3.1 WATER HEATER

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal (vertical) mounted tanks.

.3 Provide insulation between tank and supports.

.4 Provide neutralizing cartridge on each vent drain.

.5 Install oil burning domestic water heaters in accordance with CAN/CSA B139.

.6 Install natural gas or propane gas fired domestic water heaters in accordance with CSA-B149.1-00.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature, and other protective devices.

.6 Demonstrate equipment operation as directed by consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer’s name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 DOMESTIC HOT WATER EXPANSION TANK

.1 Pre-charged 6.4 gal (3.2 gal accept volume) hydropneumatic steel expansion tank complete with internal butyl diaphragm.

.2 Tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 250°F.

.3 Tank volume: 24 l (4.5 gallons) with 0.73 acceptance factor.

.4 Acceptable material:
Amtrol ST-12C
Well-X-Trol

2.2 THERMOSTATIC WATER CONTROLLER (3 Port)

.1 3/4" inlets 3/4" outlets thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows mounted out of water. Volume control shut off valve, bimetal dial thermometer (3" face, range 20° – 240°F), brass pipe, fittings, and unions. Standard valve and piping finish is rough bronze.

.2 Acceptable materials:
Symmons 7-200A-ASB-W
Powers

2.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other Divisions.

Part 3 Execution

3.1 DOMESTIC HOT WATER EXPANSION TANK

.1 Adjust expansion tank pressure to suit system pressure.

.2 Provide an expansion tank on the cold water feed to each water heater complete with lockshield type shutoff valve at inlet to tank.

.3 Provide an expansion tank at the water entrance.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature, and other protective devices.

.6 Adjust flow from water-cooled bearings.

.7 Adjust impeller shaft stuffing boxes, packing glands.

.8 Demonstrate equipment operation as directed by consultant.

.9 Demonstrate water softener regeneration controls.

3.3 CENTRAL VACUUM SYSTEM

.1 Install to manufacturers’ recommendations.

.2 Provide control wiring between outlets to vacuum unit.

.3 Provide line cleanouts at each change in direction.

.4 Mount wall outlets at receptacle height (350 mm AFF).

.5 Pipe vacuum exhaust to building exterior.

.6 Mount hose and accessories on rack adjacent to vacuum unit.

3.4 FIRE CISTERN CONTROL PANEL

.1 Install to manufacturer's recommendations.

.2 Wire three floats and one solenoid valve.

.3 Install floats on mast in reservoir.

.4 High and low level alarms connected to fire alarm system.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Conform to Sections of Division 1 and to General Mechanical Requirements Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Perform work in accordance with the recommendations of and the requirements of:

.1 Local and district bylaws and regulations.

.2 N.F.P.A.14 “Installation of Standpipe and Hose Systems".

.3 The Ontario Building Code.

.4 U.L.C. or Factory Mutual approval for hose, valve and extinguisher requirements.

.5 N.F.P.A.10 “Standard for Portable Fire Extinguishers”.

.6 The Ontario Fire Code.

1.3 SUBMITTALS

.1 Submit shop drawings and maintenance data in accordance with general requirements.

1.4 COORDINATION

.1 Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.

.2 Coordinate location of cabinet with other trades and provide protection against damage during construction.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)

.1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:

.1 Mechanical Rooms 10 lb ABC rating

.2 Storage Rooms 10 lb ABC rating

.3 Corridor/Gym/Finished Areas 5 lb ABC rating complete with cabinet

.4 Acceptable materials:

.1 Wilson & Cousins

.2 National

2.2 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

Part 3 Execution

3.1 INSTALLATION

.1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.

.2 Hang extinguishers in cabinets with wall mounting bracket.

.3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').

.4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.

.5 Caulk perimeter of fire extinguisher cabinets after acceptance.

3.2 TESTS

.1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.

.3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.

.4 CAN/CSA-B125.3, Plumbing Fittings.

.5 CAN/CSA-B651, Accessible Design for the Built Environment.

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 For water closets, urinals: minimum pressure required for flushing.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped with valves for future connection by others.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 FIXTURE CARRIERS

.1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

.2 Acceptable materials:

.1 Zurn

.2 Smith

.3 Ancon

2.3 PLUMBING FIXTURES

.1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

2.4 FIXTURE PIPING

.1 Hot and cold water supplies to each fixture/faucet:

Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

.1 Acceptable materials:

.1 Delta 47T900 Series

.2 McGuire

.2 Waste:
Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.

.1 Acceptable materials:

.1 Delta 33T200 Series

.2 McGuire

.3 'P' Traps:

Cast brass P trap with cleanout on each fixture not having integral trap.

Chrome plated in all exposed places.

.1 Acceptable materials:

.1 Delta 33T300 Series

.2 McQuire

Part 3 Execution

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.

.2 Wall-hung fixtures: measured from finished floor.

.3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 Drinking fountains:

.1 In accordance with CAN/CSA B45S1.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.

.3 Checks.

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventors: operation under all conditions.

.4 Wash fountains: operation of flow-actuating devices.

.5 Refrigerated water coolers: operation, temperature settings.

.4 Thermostatic controls.

.1 Verify temperature settings, operation of control, limit, and safety controls.

.5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make watertight, colour to match fixture.

.6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

END OF SECTION

Part 1 General

1.1 REFERENCE

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 National Air Duct Cleaners Association (NADCA): “Assessment, Cleaning & Restoration of HVAC Systems (ACR).

.3 National Air Duct Cleaners Association (NADCA): “Understanding Microbial Contamination in HVAC Systems”.

.4 National Air Duct Cleaners Association (NADCA): “Introduction to HVAC System Cleaning Services”.

.5 National Air Duct Cleaners Association (NADCA): Standard 05 “Requirements for the Installation of Service Openings in HVAC Systems”.

.6 Underwriters’ Laboratories (UL): UL Standard 181.

.7 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62, "Ventilation for Acceptable Indoor Air Quality".

.8 Environmental Protection Agency (EPA): "Building Air Quality".

.9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): “HVAC Duct Construction Standards - Metal and Flexible”.

.10 North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems".

1.2 SPECIAL PROVISIONS

.1 Qualification of the HVAC System Cleaning Contractor

.1 Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.

.2 Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

.3 Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.

.4 Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only be considered from firms, which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

.5 Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labour to adequately perform the specified services.

.1 The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.

.2 The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification

.3 Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

.6 Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.3 STANDARDS

.1 NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).

.1 All terms in this specification shall have their meaning defined as stated in the NADCA Standards.

.2 NADCA Standards must be followed with no modifications or deviations being allowed.

1.4 DOCUMENTS

.1 Mechanical Drawings: The owner shall provide the HVAC system cleaning contractor with one copy of the following documents:

.1 Project drawings and specifications.

.2 Approved construction revisions pertaining to the HVAC system.

.3 Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

Part 2 Products

2.1 SCOPE OF WORK

.1 This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

.2 The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

.3 The HVAC system includes any interior surface of the facility's existing air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts to the air handling units (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems. **The scope of work is to include all the existing ductwork & grilles.**

2.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS

.1 HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air-handling units, a representative sample of the units should be inspected.

.2 The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented

.1 Damaged system components found during the inspection shall be documented and brought to the attention of the consultant.

.3 Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

.4 Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

2.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

.1 Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

.2 Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

.3 Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.

.4 Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

.5 Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

.6 Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.

.1 Contractor shall utilize the existing service openings already installed in the HVAC system where possible.

.2 Other openings shall be created by this contractor where needed and they must be created so they can be sealed by this contractor in accordance with industry codes and standards.

.3 Closures must not significantly hinder, restrict, or alter the airflow within the system.

.4 Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.

.5 Openings must not compromise the structural integrity of the system.

.6 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

.7 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.

.8 Rigid fiberglass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiberglass duct system closures.

.9 All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the consultant in project report documents.

.7 Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

.8 Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.

.9 Air handling units, terminal units (VAV, Dual duct boxes, etc.), blowers and exhaust fan: The contractor shall ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:

.1 Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.

.2 Assume that a suitable operative drainage system is in place prior to beginning wash down procedures.

.3 Clean all coils and related components, including evaporator fins.

.10 Duct Systems: This Contractor shall:

.1 Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas. Provide access doors specified in duct accessories to replace openings.

.2 Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

2.4 HEALTH AND SAFETY

.1 Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.

.2 Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

.3 Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

2.5 MECHANICAL CLEANING METHODOLOGY

.1 Source Removal Cleaning Methods:

.1 The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

.1 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.

.2 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

.3 All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

.4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

.2 Methods of Cleaning Fibrous Glass Insulated Components:

.1 Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

.2 Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).

.3 Damaged Fibrous Glass Material:

.1 Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

.2 Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.

.3 Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.

.4 Replacement of damaged insulation is not covered by this specification.

.4 Cleaning of Coils:

.1 Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

.5 Antimicrobial Agents and Coatings:

.1 Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

.2 Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.

.3 When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturer's written recommendations and EPA registration listing.

.4 Antimicrobial coatings shall be applied according to the manufacturer's written instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

2.6 CLEANLINESS VERIFICATION

.1 General:

.1 Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

.2 Visual Inspection:

.1 The HVAC system shall be inspected visually to ensure that no visible contaminants are present.

.1 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the consultant reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.

.2 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

.3 NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature through the HVAC commissioning contract.

.3 Verification of Coil Cleaning:

.1 Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

2.7 PRE-EXISTING SYSTEM DAMAGE

.1 Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

2.8 POST-PROJECT REPORT

.1 At the conclusion of the project, the Contractor shall provide a report to the consultant indicating the following:

.1 Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.

.2 Areas of the system found to be damaged and/or in need of repair.

Part 3 Execution

.1 Not Applicable

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section is to read in conjunction with Division 1, the general condition, and the General Requirements of the mechanical trades.

1.2 REFERENCES

.1 Tested to ANSI/UL Standard 508.

.2 UL-508 certified for the building and assembly.

.3 CSA or C-UL stickers shall be applied to both the VFD and option panels.

.4 Manufacturers shall be ISO 9001 certified facilities.

1.3 SUBMITTALS

.1 Submit manufacturer’s performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalogue information.

.2 The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

.3 Harmonic filtering. The manufacturer shall, with the aid of the buyer’s electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will met the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

1.4 WARRANTY

.1 The VFD shall be warranted by the manufacturer for a period of five (5) years from date of substantial completion. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Danfoss Graham.

.2 ABB.

.3 AC Tech.

2.2 GENERAL

.1 The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

.2 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFD's utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.3 Include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

.4 Provide DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFD's without DC link reactors shall provide a minimum 5% impedance line reactor.

.5 Full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

.6 Provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

.7 An automatic energy optimization selection feature shall be provided in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

.8 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

.9 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

.10 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFD's not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

.11 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

.12 VFD's operating 600/3/60 motors not designed to meet Nema MG1 Part 31 should include Output dv/dt (LC) Reactors.

2.3 PROTECTIVE FEATURES

.1 VFD shall be provided with an integral disconnect and Integral Fast Blow Semi-Conductor fuses sized as specified by ULC. Fuses shall be Bussman JJS type or equivalent.

.2 A minimum of Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

.3 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over-voltage, under-voltage, VFD over-temperature and motor over-temperature. The VFD shall display all faults in plain English. Codes are not acceptable.

.4 Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal.

.5 The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

.6 To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Motors shall have inverter rated insulation (1600V).

.7 VFD shall include a “signal loss detection” circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

.8 VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

.9 VFD shall catch a rotating motor operating forward or reverse up to full speed.

.10 VFD shall be rated for 100,000 amp interrupting capacity (AIC).

.11 VFD shall have externally mounted EMI electromagnetic suppressor to limit the EMI and RFI output from the VFD. VFD to be mounted in an all metal cabinet to limit radiated RFI.

.12 VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

.13 VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VFD’s, and 701V AC on 575 volt VFD’s.

.14 For remote VFD installations, provide an output filter (load side reactor) at each VFD to protect the equipment motor. Coordinate installation with equipment manufacturer.

2.4 INTERFACE FEATURES

.1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

.2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

.3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

.4 Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

.5 The keypads for all sizes of VFD's shall be identical and interchangeable.

.6 To set up multiple VFD's, it shall be possible to upload all set-up parameters to the VFD's keypad, place that keypad on all other VFD's in turn and download the set-up parameters to each VFD. To facilitate setting up VFD's of various sizes, it shall be possible to download from the keypad only size independent parameters.

.7 Display shall be programmable to display in 9 languages including English, Spanish and French.

.8 The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

.9 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

.10 A quick set-up menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.

.11 The VFD shall include a standard RS-485 communications port for connection to a Johnson Controls N2 and Siemens FLN serial communication system. The connection shall be software selectable and addressable by the user. The option for Lonworks and BacNet communication must also be available.

.12 As a minimum, the following points shall be controlled and/or accessible:

VFD Start/Stop, Speed reference, Fault diagnostics, and Meter points as follows;

Motor power in HP, Motor power in kW, Motor kW-hr, Motor current, Motor voltage, Hours run, Feedback signal #1, Feedback signal #2, DC link voltage, Thermal load on motor, and Thermal load on VFD, Heat sink temperature.

.13 Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.

.14 Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

.15 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

.16 Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFD's unable to show these four displays simultaneously shall provide panel meters.

.17 Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.

.18 The sleep mode shall be functional in both follower mode and PID mode.

.19 Run permissive circuit shall be provided to accept a “system ready” signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

.20 The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

.21 The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (oF) for a cooling tower application.

.22 VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

.23 If the temperature of the VFD’s heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD’s heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.

.24 The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.

.25 The VFD shall store in memory the last 10 faults and related operational data.

.26 Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

.27 Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.

.28 Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

.29 Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

.30 Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

.31 A contact/relay shall be provided to shut the fans down upon fire alarm signal.

2.5 ADJUSTMENTS

.1 VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

.2 Sixteen preset speeds shall be provided.

.3 Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

.4 Four current limit settings shall be provided.

.5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under-voltage, over-voltage, current limit and inverter overload.

.6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

.7 An automatic “on delay” may be selected from 0 to 120 seconds.

2.6 SERVICE CONDITIONS

.1 Unit shall operate in ambient temperature of -10 to 40°C (14 to 104°F).

.2 Unit shall operate in 0 to 95% relative humidity, non-condensing.

.3 Operate in elevation up to 3,300 feet without derating.

.4 Maximum AC line voltage variation, -10 to +10% of nominal with full output.

.5 No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

2.7 FACTORY TESTING

.1 To ensure quality and minimize infantile failures at the jobsite, the manufacturer shall test the complete VFD. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.

.2 All optional features shall be functionally tested at the factory for proper operation.

2.8 BYPASS SWITCH

.1 Bypass Controller - Automatic transfer to line power via contactors. When in the “Drive” mode, the bypass contactor is open and the drive output contactor is closed. In the “Bypass” position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be Dry type 115V compatible and shall function in both the “Drive” and “Bypass” modes. The design shall include single-phase protection in both the VFD and bypass modes.

Part 3 Execution

3.1 START-UP SERVICE

.1 The manufacturer shall provide start-up and commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.2 EXAMINATION

.1 Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

3.3 INSTALLATION

.1 Install to manufacturer’s recommendations.

.2 Install to the requirements of the local Hydro codes. Obtain hydro permits and pay all fees.

.3 Install in an accessible location and proper service height from floor.

.4 Install in clean, dry, and conditioned environment.

.5 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

.6 Wiring of devices to be to the standards of Electrical Division.

.7 Provide one manufacturer of VFD’s throughout the project.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B31.1, Power Piping.

.3 ANSI/ASME Boiler and Pressure Vessel Code:

.1 Section 1: Power Boilers.

.2 Section V: Nondestructive Examination.

.3 Section IX: Welding and Brazing Qualifications.

.4 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.5 CSA W48, Filler Metals and Allied Metals for Arc Welding.

.6 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.

.7 CAN/CSA-W117.2, Safety in Welding, Cutting and Allied Processes.

.8 CSA W178.1, Certification of Welding Inspection Organizations.

.9 CSA W178.2, Certification of Welding Inspectors.

.10 AWS B2.1, Specification for Welding Procedure and Performance Qualification.

.11 AWS C1.1, Recommended Practices for Resistance Welding.

.12 AWS W1, Welding Inspection.

.13 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

1.2 WELDERS QUALIFICATIONS

.1 Welding qualifications to be in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure to be performed from authority having jurisdiction.

.3 Furnish welder's qualifications to Consultant.

.4 Each welder to possess identification stamp issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum to be in accordance with CSA W47.2.

1.3 INSPECTORS QUALIFICATIONS

.1 Inspectors to be qualified to CSA W178.2.

1.4 WELDING PROCEDURES

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures to be available for inspection at all times.

.3 Safety in welding, cutting and allied processes to be in accordance with CAN/CSA-W117.2.

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

.1 Welding to be in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

.2 Protect all adjacent areas.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification stamp.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 50 mm (2") and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review all weld quality requirements and defect limits of applicable codes and standards with Consultant before any work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Consultant.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect all welds during early stages of welding procedures in accordance with AWS W1. Repair or replace all defects as required by codes and as specified herein.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 General.

.1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Consultant.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test 25% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or full gamma ray radiographic (hereinafter referred to as "radiography") tests as specified.

.2 Hydrostatically test all welds to requirements of ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and (wherever possible) internally.

.4 Failure of visual examinations:

.1 Upon failure of any weld by visual examination, perform additional testing as directed by Consultant of a total of up to 10% of all welds, selected at random by Consultant by radiographic tests.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, hydronic water systems:

.1 Undercutting greater than 0.8 mm (1/32") adjacent to cover bead on outside of pipe.

.2 . Undercutting greater than 0.8 mm (1/32") adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm (1/32") at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 40 mm (1 1/2") in any 1500 mm (60") length of weld depth of such defects being greater than 0.8 mm (1/32").

.5 Repair all cracks and defects in excess of 0.8 mm (1/32") in depth.

.6 Repair defects whose depth cannot be determined accurately on the basis of visual examination or particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.7 CLAIMS AGAINST OWNER FOR DELAYS

.1 Claims against Owner for delays in completion of project will not be entertained for reasons of failures of welds to pass examinations.

3.8 OCCUPIED AREAS

.1 Do not do any “Hot Work” in occupied areas.

.2 Obtain “Hot Work” permits for working in existing building.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.

.3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.

.4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM).

.1 ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Mean of the Guarded Hot-Plate Apparatus.

.2 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.3 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.

.5 ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

.6 ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes And Tanks.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations.

.1 Thermal Insulation Association of Canada (TIAC)

.2 North American Commercial and Industrial Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

.3 Submit completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specification section.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

.5 “FSK” – Foil Scrim Kraft – vapor retarder laminate of aluminium foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

1.7 QUALITY ASSURANCE

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

Part 2 Products

2.1 LIMITATION ON MATERIALS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C177 or ASTM C518.

.3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket meeting the requirement of ASTM C1136 Type II and IV (FSK):

.1 Jacket: to ASTM C1136 Type II and IV (FSK)

.2 Maximum "k" value: .033 W/M•°C (.23 BTU•IN/HR•FT^2•°F)

.4 Type C-2: Mineral fibre blanket to ASTM C553 Type I, II, and III, ASTM C1136 Type II and IV, and ASTM C1290 Type III:

.1 Jacket: to ASTM C1136, Type II and IV.

.2 Maximum "k" value: 042 W/M•°C (.29 BTU•IN/HR•FT^2•°F)

.9 Manufacturers:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

.1 Johns Manville

.2 Fibreglass Canada

.3 Knauf

.4 Manson

.5 Roxul

2.4 JACKETS

.1 Canvas:

.1 220 g/m^2 (6 oz/yd^2) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.2 Self adhesive aluminum:

.1 Aluminum skin with adhesive, minimum thickness 1.5 mm (60 mils).

.2 Modified SBS membrane.

.3 Ultra violet light resistance.

.4 Puncture and tear resistant.

.5 Multi standard colours (selected by architect).

.6 Overlap joints minimum of 50 mm (2") or larger as noted.

.7 Acceptable manufacturer:
Alumaguard

2.5 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 g/m² (6oz/yd^2) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.

.6 Contact adhesive: quick-setting Childers CP-82 or equal.

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm (16 gauge) stainless steel.

.9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation

.10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

.11 Outdoor Vapour Retarder Mastic:

.1 Reinforcing fabric: Open weave fibreglass fabric, with maximum weave of 10x10 squares per inch.

.12 Banding: 15 mm (1/2") wide, 0.5 mm (26 gauge) thick stainless steel.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with North American Commercial and Industrial Insulation Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers in accordance with general requirements.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.

.6 Provide rigid insulation for exposed ductwork.

.7 Use two layers with staggered joints when required nominal thickness exceeds 75 mm (3").

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Round supply air ducts	C-2	25 mm (1")
Supply, return and fan exhaust ducts exposed (visible) in space being served	none	
Outdoor air ducts (exterior ductwork)	C-1	80 mm (3")
Outdoor air intake ductwork and plenums	C-1	50 mm (2")
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	none	
Last 1.5m of Exhaust duct	C-1	25 mm (1")
Indoor AHU relief air ducts	C-1	25 mm (1")
Exterior ductwork	C-1	80 mm (3")

.2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct or type C-6.

.3 Finishes: Conform to following table:

Application	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas
Outdoor, exposed to Precipitation	Aluminum	Aluminum

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels, and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C547, Type I and IV Standard Specification for Mineral Fiber Pipe Insulation.

.2 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded-Hot-Plate Apparatus.

.3 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus to recognize the correct thermal insulation performance testing for blanket.

.4 ASTM C1393, Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks

.5 ASTM C1695, Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service.

.6 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.7 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.8 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.

.9 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.10 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC)

.2 North American Commercial and Industrial Insulation Standards

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

.3 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

.5 “FSK” – Foil Scrim Kraft – vapor retarder laminate of aluminum foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner liner.

.6 "PSK" – Poly Scrim Kraft – vapor retarder laminate of polypropylene outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.

.7 "PVC" – Poly Vinyl Chloride – polymer used to manufacture a non-metallic final protective finish jacket over insulation systems.

1.7 QUALITY ASSURANCE

.1 Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds or PBDE fire retardants.

Part 2 Products

2.1 MATERIAL LIMITATIONS

.1 Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTMC177 or ASTM C518.

.3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547 Type I and IV.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" factor: to ASTM C547.

.4 Type A-2: High temperature mineral fibre blanket:

.1 Mineral fibre: to ASTM C553, Type V, flexible, non-combustible.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" value: .040 W/M•°C@ 38C mean (.28 BTU•IN/HR•FT^2•°F @ 100F mean)

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:
Knauf
Manson
Owens Corning

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 **Tie wire: 1.5mm (16 gauge) diameter stainless steel.**

.5 **Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (0.020") thick.**

2.5 CEMENT

.1 Thermal insulating and finishing cement:

.1 Air drying on mineral wool, to ASTM C 449M.

.2 Hydraulic setting on mineral wool, to ASTM C165

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

.2 Reinforcing fabric: Open weave fibreglass fabric, with maximum weave of 10 x 10 squares per inch.

2.9 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 Minimum thickness: 20mil (0.020")

.2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.3 Colours: white.

.4 Minimum service temperatures: -29°C (-20°F).

.5 Maximum service temperature: 65°C (150°F).

.6 Moisture vapour transmission: 0.05 perm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks (not to be used on below-ambient temperature systems)

.3 Pressure sensitive vinyl tape of matching colour.

.2 Canvas:

.1 220 g/m^2 (6oz/sq yd) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.3 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.

.4 Fittings: 0.50 mm (0.020") thick die-shaped fitting covers with factory-attached protective liner.

.5 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (0.020") thick at 300 mm (12") spacing.

2.10 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with North American Commercial and Industrial Insulation Standards.

.2 Provide continuous insulation for complete systems including all valves, air separators, fittings, and other equipment.

.3 Apply materials in accordance with manufacturers' instructions and this specification.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.6 **Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm (3").**

.7 Below ambient/chilled water installation:

.1 All pipes, fittings, valves, strainers, flanges, unions, and other pipe system components and specialties must be properly insulated with correctly completed vapor retarded applied.

.2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.

.3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a .02 or lower perm rating.

.4 Vapor stops must be installed at 18' intervals, at all pipe insulation termination points, including fittings, flanges, and other changes in direction or other types of piping specialities.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricated from the same material as the pipe insulation. Full thickness must be factory-applied, vapor-retarder facing is unacceptable.

.6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder or pipe insulation.

.7 Additional fitting covers, PVC or metal, must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.

.8 Additional field applied jackets must not use staples, screws, tacks or rivets for attachment, to avoid puncturing vapor retarder underneath.

.9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Flexible removable insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.

.3 Insulation:

.1 Insulation, fastenings, and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, air separators, and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Hot Water Heating	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Within 300 mm (12") of boiler	CANVAS	CANVAS

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

.6 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.7 ASTM A53/A53M, and A106, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded ERW and Seamless.

.8 ASTM B32, Specification for Solder Metal.

.9 ASTM B75M, Specification for Seamless Copper Tube [Metric].

.10 CSA B149.1, Natural Gas and Propane Installation Code.

.11 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings product data in accordance with general requirements.

.2 Indicate on manufacturers catalogue literature.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GAS SERVICE

.1 Arrange with the local utility to have the gas service upgraded to a high-pressure gas meter.

.2 Fees and charges requested by the local utility to provide the gas service and meter.

.3 Submit all plans as requested by the local utility.

.4 Utility supplied gas meter shall be complete with pulse signal for connection to BAS system (co-ordinate pulse representation in m^3 of gas used on meter specifications.

.5 Provide approved pulse gas meter in all locations where indicated on the drawings.

2.2 PIPE

.1 Steel pipe: to ASTM A106, Schedule 40, seamless as follows:

.1 NPS 15 mm to 50 mm (1/2" to 2"), screwed.

.2 NPS 65 mm (2 1/2") and over, plain end.

.2 Buried pipe: CGA approved polypropylene complete with tracer wire and marker.

.3 Copper tube: to ASTM B75M.

2.3 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Soldered: to ASTM B32, tin antimony 95/5.

.5 Screwed brass fittings: Teflon Tape.

2.4 FITTINGS

.1 Steel pipe fittings, screwed, flanged, or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ANSI B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M/A106.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ANSI B16.18.

.3 Brass fittings: To ASTM B16.

2.5 BALL VALVES

.1 NPS 50 mm (2") and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

.3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel solid ball and teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

2.6 LUBRICATED PLUG VALVES

.1 All sizes

.1 Provincial Code approved, lubricated plug type.

.2 Body: cast iron to ASTM A 126 Class B semi-steel.

.1 Rating: Class 125 psig.

.3 Plug: tapered, with regular pattern port – 90 from full open to fully closed.

.4 Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.

.5 Lubrication system, nickel-plated.

.6 Lubricant: to suit type, temperature and pressure of contained fluid.

.7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film.

.8 Lubricant screw for lubrication.

.9 O-rings between body and plug.

.10 Operator: removable manual lever handle.

.11 Acceptable materials:
Newman Hattersley
Crane
Jenkins
Milwaukee
Toya

2.7 GAS REGULATOR

.1 Reduce pressure from 34.5 kPa (5 psi) to 1.74 kPa (7" WC) capacity as indicated.

.2 Acceptable products:
Singer
Schlumberger

.3 Vent interior relief valve to outdoors with gooseneck and stainless steel insect screen. Vent piping shall be sized as per manufacturers' requirements and recommendations.

.4 Isolate with lubricated plug valve and union connection.

2.8 MANUFACTURED ROOF SUPPORTS

.1 Single piece injection moulded polypropylene support.

.2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.

.3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.

.4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.

.5 Acceptable materials:
Quick Block
Erico

2.9 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

Part 3 Execution

3.1 PIPING

.1 Install in accordance with applicable Provincial/Territorial Codes.

.2 Install in accordance with CAN/CSA B149.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.5 Slope piping down in direction of flow to low points.

.6 Install drip points:

.1 At low points in piping system.

.2 At each connection to equipment.

.7 Use eccentric reducers at pipe size change installed to provide positive drainage.

.8 Provide clearance for access and for maintenance.

.9 Ream pipes, clean scale, and dirt, inside and out.

.10 Install piping to minimize pipe dismantling for equipment removal.

.11 Install regulator vents to code. Terminate in open air with Gooseneck fitting complete with stainless steel screen.

.12 Paint gas piping with two (2) coats yellow paint. Banding of gas will not be accepted.

3.2 PIPING ON ROOF

.1 Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:
≤ 40 mm (1½") 2.4 M (8' – 0") O.C.
≥ 50 mm (2") 3.0 M (10' - 0") O.C.

.2 Provide support at each elbow and fitting.

.3 Provide support at each regular and/or isolating valve.

.4 Provide support within 600 mm (24") of each piece of equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.

.2 Install valves at branch take-offs to isolate each piece of equipment, and as indicated.

.3 Provide lubricated plug type when gas line is exterior of building or 65 mm (2½") and larger.

.4 Provide ball valve when gas line is interior of building and 50 mm (2") or smaller.

3.4 FIELD QUALITY CONTROL

.1 Test system in accordance with CAN/CSA B149. Requirements of authorities having jurisdiction.

.2 Provide copy of TSSA tag to the consultant.

3.5 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

3.6 GAS SERVICE

.1 Arrange with local gas distributor to install gas service and gas meter. Pay all fees and charges to provide the gas service and gas meter.

.2 Install all the gas meters where indicated.

3.7 GAS FIRED EQUIPMENT START-UP

.1 Start-up of all new and existing gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 American Society for Testing and Materials (ASTM).

.1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A278/A278M, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (350°C).

.3 ASTM A516/A516M, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

.4 ASTM A536, Specification for Ductile Iron Castings.

.5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME, Boiler and Pressure Vessels Code (BPVC).

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate on manufacturers' catalogue literature the following:

.1 Sizes, orientation, capacities, performance, etc.

.2 Accessories

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 BLADDER TYPE EXPANSION TANK

.1 Vertical galvanized steel pressurized bladder type expansion tank.

.2 Model: 300 L (Heating System) & 300L (Heat Pump System)

.3 Size: 1330 (52⅜") x 600 (24") diameter.

.4 Working pressure: 860 kPa (125 psi) with ASME stamp and certification.

.5 Air precharged to 84 kPa (12 psi) (initial fill pressure of system).

.6 Base mount for vertical installation.

.7 Acceptable materials:

.1 Amtrol

.2 Armstrong

.3 Bell & Gossett

2.2 COMBINATION SEPARATORS STRAINERS

.1 Steel, tested and stamped in accordance with ANSI/ASME BPVC, for 860 kPa (125 psi) operating pressure, with galvanized steel integral strainer with 5 mm (3/16") perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

.2 Size: to match piping.

.3 Acceptable material:

To be of the same manufacturer of base mounted pumps.

2.3 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa (30 psi) relief, 55 to 172 kPa (8.0 to 25 psi) reducing.

.2 Low inlet pressure check valve.

.3 Removable strainer.

2.4 PIPE LINE STRAINER

.1 NPS 15 mm to 50 mm (1/2" to 2"): bronze body to ASTM B62, screwed connections.

.2 NPS 65 mm to 300 mm (2 1/2" to 12"): cast steel body to ASTM A278M, Class 30, flanged connections.

.3 NPS 50 mm to 300 mm (2" to 12"): T type with malleable iron body to ASTM A47M, grooved ends.

.4 Blowdown connection: NPS 25 mm (1").

.5 Screen: stainless steel with 1.19 mm (50 mil) perforations.

.6 Working pressure: 860 kPa (125 psi).

Part 3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines (and blow off connections) to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve and as indicated.

3.3 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit system pressure at installed location or noted design pressure. Where discrepancies between plans and system pressure exist notify consultant.

.2 Set pressure in accordance with ASME Boiler and Pressure Vessel Code.

.3 Ensure boiler temperature and pressure relief is adequate for system at high temperature and pressure. Test operation on site.

.4 Maintain a minimum of105 kpa (15 psig) as the lowest pressure point.

.5 Install isolation ball valve and union at inlet to tank.

3.4 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.5 AIR SEPARATOR

.1 Provide independent support from structure.

.2 Provide high capacity air vent as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.3 American National Standards Institute (ANSI).

.1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

.2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.

.3 **ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS½ through NPS24 Metric/Inch.**

.4 **ANSI/ASME B16.9, Factory-Made Wrought Steel Buttwelding Fittings.**

.5 **ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).**

.6 **ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).**

.7 **ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.**

.4 American Society for Testing and Materials (ASTM).

.1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM A536, Specification for Ductile Iron Castings.

.4 ASTM B61, Specification for Steam or Valve Bronze Castings.

.5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate on manufacturers' catalogue literature the following:

.1 Piping

.2 Valves

.3 Accessories

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 STEEL PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 NPS 150 mm (6") and smaller: Schedule 40.

.2 **NPS 200 mm (8") and [over,] [10] Schedule 30.**

.3 **NPS 300 mm (12") and over, 10 mm (3/8") wall thickness.**

.2 Final connection to copper heating elements.

.1 Type “L” copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

.3 Pipe Joints

.1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.

.2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: plain or raised face, slip-on.

.4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).

.5 Pipe thread: taper.

.6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

.4 Fittings

.1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ANSI/ASME B16.1, Class 125.

.2 Steel: to ANSI/ASME B16.5.

.3 Butt-welding fittings: steel, to ANSI/ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

2.2 VALVES

.1 Connections:

.1 NPS 32 mm (1 1/4") and smaller: screwed ends.

.2 NPS 50 mm (2") and smaller: screwed ends.

.3 NPS 65 mm (2 ½") and larger: flanged ends.

.2 Gate valves: Application: Isolating equipment, control valves, pipelines:

.1 NPS 50 mm (2") and under:

.1 Mechanical Rooms: Class 125, rising stem, solid wedge disc.

.2 Elsewhere: Class 125, non-rising stem, solid wedge disc.

.2 NPS 65 mm (2 1/2") and over:

.1 Mechanical Rooms:

.1 Rising stem, solid wedge disc, bronze trim.

.1 Operators: handwheel.

.2 Non-rising stem, solid wedge disc, bronze trim.

.1 Operators: handwheel.

.3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.

.1 NPS 32 mm (1 1/4") and smaller: screwed ends.

.2 NPS 50 mm (2") and smaller: screwed ends.

.3 NPS 65 mm (2 1/2") and over: Flanged ends.

.4 Globe valves: Application: Throttling, flow control, emergency bypass:

.1 NPS 50 mm (2") and under:

.1 With PFTE disc, as specified. Bronze.

.2 NPS 65 mm (2 1/2") and over:

.1 With solid bronze disc, bronze trim, cast iron body.

.5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.

.6 Swing check valves:

.1 NPS 50 mm (2") and under:

.1 Class 150, swing, with PFTE disc, as specified. Bronze. Jenkins 4475TJ.

.2 NPS 65 mm (2 1/2") and over:

.1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check.

.7 Ball valves:

.1 NPS 80 mm (3") and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

.3 Connections:

.1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.

.2 NPS 65 mm (2½") and over flanged or grooved ends.

.4 Stem: stainless steel tamperproof ball drive.

.5 Ball and seat: replaceable stainless steel solid ball and teflon seats.

.6 Operator: removable lever handle.

.7 Extended handles on chilled water valves.

.8 Full port.

.8 All valves shall be of commercial grade and of same manufacturer.

.9 Acceptable Manufacturers:

.1 Newman Hattersley Canada Ltd.

.2 Jenkins/Crane

.3 Milwaukee

.4 Toyo

.5 Kitz

2.3 BALANCING VALVES

.1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.

.2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.

.3 Differential pressure readout ports with internal EPT inserts and check values, 6 mm (¼") NPT tapped drain/purge ports, memory stop and calibrated nameplate.

.4 Acceptable materials:

.1 Bell & Gossett Circuit Setters

.2 Armstrong

.3 Taco

.4 Tour & Anderson

.5 Oventrop

2.4 TRIPLE DUTY VALVE

.1 Straight pattern, combination check, throttling shut off and calibrated balancing valve, heavy duty cast iron construction with standard 125 psig ANSI flanged connections rated for maximum working pressure of 175 psig at 250ºF.

.2 Valve shall be fitted with a replaceable bronze disk with EPDM seat insert, stainless steel stem and chatter preventing spring. Valve design shall permit replacing under full system pressure.

.3 Valve shall be equipped with brass readout valves (with integral check valves).

.1 Acceptable material
Bell & Gossett
Armstrong

2.5 AUTOMATIC AIR VENT

.1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.

.2 Float: solid material suitable for 115°C (240°F) working temperature.

.3 Plastic vents are not acceptable.

.4 Acceptable materials:

.1 Maid-O-Mist No. 67

.2 Spirax Sarco

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Installation shall be by a licensed pipe fitter.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

.8 Assemble piping using fittings manufactured to ANSI standards.

.9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install butterfly valves on chilled water and condenser water lines only.

.3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.4 Install globe valves for balancing and in by-pass around control valves as indicated.

.5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

.6 Provide swing check valves in horizontal lines as indicated.

.7 Install chain operators on valves NPS 65 mm (2½") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

.8 Provide ball valves for glycol service.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Install ball valve on automatic air vent inlet.

.3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

3.4 CIRCUIT BALANCING VALVES

3.5 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated and as follows:

.1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).

.2 On return side of all water or glycol cooling coils.

.3 On return side of all reverse return piping loops and/or branch circuits.

.1 Install to manufacturers requirements. **Provide minimum pipe length of five valve diameters downstream of a fitting and 10 valve diameters downstream of a pump or control valve must be installed at the entering end of each CBV for accurate balancing.**

.2 Provide valve sizing schedule (including all balancing valves labelled with servicing equipment/terminal unit, valve sizes, pipe size, flow) with balancing valve shop drawing submittal for approval. Balancing valve size to follow manufacturer size recommendations and to the approval of the consultant.

.3 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment as specified.

.2 Co-ordinate filling of system with HVAC water treatment contractor.

3.7 TESTING

.1 Test system in accordance with Mechanical General Requirements Section.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

3.8 FLUSHING AND CLEANING

.1 Scope:

.1 Drain and flush entire existing system and new piping.

.2 Refer to Water Treatment Section

.3 Procedure:

.1 Flushing and cleaning should only take place after successful piping pressure testing.

.2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.

.3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.

.4 Timing:

.1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.

.2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.

.3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.

.5 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.

.6 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.

.7 Flush and clean new piping system in presence of Consultant.

.8 Flush after pressure test for a minimum of 4 hrs.

.9 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.

.10 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.

.11 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.12 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.13 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

.14 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.15 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.

.16 Repeat system drain and flush as often as necessary to have a clean system.

.17 Disposal of cleaning solutions to be approved by authority having jurisdiction.

.18 Isolate new piping system from existing system as required for system cleaning.

.19 After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.

3.9 EXISTING SYSTEM DISPOSAL

.1 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with General Requirements.

.2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, and controllers.

.3 Submit product data of pump curves for review showing point of operation.

.4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 IN-LINE CIRCULATORS

.1 Volute: bronze radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: bronze.

.3 Shaft: alloy steel with copper sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135°C (275°F).

.5 Coupling: flexible self-aligning.

.6 Motor: resilient mounted, drip proof, sleeve bearing, as indicated.

.7 Capacity: as indicated.

.8 Design pressure: 1207 kPa (175 psi).

.9 Acceptable material:

.1 Bell & Gossett Model

.2 Armstrong

2.2 VERTICAL IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.

.2 Impeller: brass or bronze.

.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135°C (275°F).

.5 Coupling: flexible self-aligning.

.6 Motor: resilient mounted, drip proof, sleeve bearing, as indicated

.7 Capacity: as indicated.

.8 Design pressure: 1200 kPa (175 psi).

.9 Acceptable material:

.1 Bell & Gossett Model

.2 Armstrong

2.3 SUCTION DIFFUSER

.1 Body: cast iron with flanged connections.

.2 Strainer: with built-in, disposable construction 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection.

.3 Provide permanent 0.125" (3 mm) perforated stainless steel strainer.

.4 Permanent magnet particle trap.

.5 Full length straightening vanes.

.6 Pressure gauge tappings.

.7 Adjustable support leg.

.8 Angle orientation. Line size inlet and pump suction size outlet.

.9 Acceptable Material:

.1 To match pump supplier.

2.4 TRIPLE DUTY VALVES

.1 Body: Cast iron with flanged connections. Straight pattern combination shut off, non slam check and calibrated balance valve.

.2 Brass seat, bronze disk with EPDM seat insert.

.3 Brass stem, stainless steel spring, teflon-graphite packing.

.4 Brass readout valve.

.5 Straight orientation when installed in discharge piping downstream of pump. Line size inlet and outlet.

.6 Angle orientation when installed at pump outlet. Pump discharge size inlet and line size outlet.

.7 Acceptable material:

.1 To match pump supplier.

2.5 Spare Parts

.1 Refer to Section 20 05 11 Mechanical Work Requirements.

Part 3 Execution

3.1 INSTALLATION

.1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible suction discharge in vertical alignment.

.2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.

.3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.4 Pipe drain tapping to floor drain complete with isolating valve.

.5 Install volute venting pet cock in accessible location.

.6 Check rotation prior to start-up.

.7 Install pressure gauge with plug cocks on inlet and outlet on pump.

3.2 SUCTION DIFFUSERS

.1 Install on inlet to pumps.

.2 Remove construction screen from inlet suction guide after system cleaned and before balancing.

3.3 TRIPLE DUTY VALVES

.1 Valves shall be straight pattern.

.2 Provide 4x pipe diameter spool piece between pump discharge and triple duty valve.

.3 Leave valves open for T.A.B to set.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Plumbing Specialties and Accessories.

.2 Hydronic Systems – Steel.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society of Mechanical Engineers (ASME).

.3 ANSI/ASME Boiler and Pressure Vessel Code, Section VI.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements.

.2 Include following:

.1 Log sheets as recommended by manufacturer.

.2 Test reports.

Part 2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals, service by one supplier.

.2 Acceptable manufacturer:

.1 Chem Aqua (226-808-3617)

.1 Vanessa Vautour
Tel: (416) 428-7940
Email: vanessa.vautor@nch.com

.2 Tricia Bloomfield
Tel: (905) 457-5220 ext. 318
Email: tricia.bloomfield@nch.com

2.2 POT FEEDER

.1 Welded steel, pressure rating 1200 kPa (175 psi). Temperature rating: 90°C (194°F).

2.3 CHEMICAL FEED PIPING

.1 Resistant to chemicals employed. Pressure rating: 1200 kPa (175 psi).

2.4 CHEMICAL FEED PUMPS

.1 Top-mounted electronic metering diaphragm type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with pressure relief valve, check valve, foot valve, injection fitting.

.2 Piston type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with stainless steel piston, pressure relief valve, double ball and check valves.

2.5 SHIPPING/ FEEDING CHEMICAL CONTAINERS

.1 High density moulded polyethylene, with liquid level graduations, cover.

.2 Agitators: as required by manufacturer.

2.6 CONDUCTIVITY CONTROLLER

.1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 micro omhs.

.2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

2.7 CONDUCTIVITY PROBES

.1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

2.8 WATER TREATMENT FOR HYDRONIC SYSTEMS

.1 Hot water heating system: Pot feeder, 25 l (6.6 gal).

.2 Micron filter for each pot feeder:

.1 Capacity 2% of pump recirculating rate at operating pressure.

.2 Six (6) sets of filter cartridges for each type, size of micron filter.

.3 Balancing valve set for 2% pump capacity.

2.9 WATER TREATMENT FOR CONDENSER WATER SYSTEMS, SPRAY WATER SIDE OF CLOSED CIRCUIT COOLERS

.1 Chemical feed pump:

.1 To provide proportional chemical feed.

.2 Chemical container:

.1 See specification elsewhere this section.

.3 Bleed-off solenoid and throttling valves.

.4 Panel: EEMAC type 5 12 4 enclosure with enamel finish, pre-wired, following features:

.1 Internal wiring harness, colour-coded, identified, brought to central terminal board.

.2 Grounded AC receptacles for feed pumps and utility.

.3 Main power switch, indicating light, legend nameplate.

.4 Manual-auto selector switches, indicating lights for bleed-off control, chemical feed, with legend plates.

.5 Timers pulsed from water meter with contacting register to operate feed pumps [and bleed-off solenoid valve].

.5 Flow assembly: Consisting of conductivity probe mounted in flow-tee complete with isolating valves.

.6 Automatic flow switch: To shut down and re-start water treatment system on interruption of water flow.

.7 Make-up water meter:

.1 Bronze, capacity to meet requirements, non-reset electric cumulative totalizer, electric contacting register.

.8 Pot feeder:

.1 For addition of biocides.

2.10 CHEMICALS

.1 Provide 1 year's supply.

2.11 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

2.12 CLEANING CHEMICALS

.1 Provide as required to make system clean.

.2 Cleaner chemical: compatible and of the same manufacturer of the water treatment supplier.

2.13 RECORD MANAGEMENT

.1 Provide cards and card holder mounted on wall adjacent to each pot feeder.

Part 3 Execution

3.1 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

.1 Install crosses at all changes in direction. Install plugs in all unused connections.

3.3 WATER TREATMENT SERVICES

.1 After entire new and existing system is cleaned as specified elsewhere, provide monthly water treatment monitoring and consulting services for period of one year after system start-up. Provide written report to consultant after each visit. Service to include:

.1 Initial water analysis and treatment recommendations.

.2 System start-up assistance.

.3 On site system testing and recording of treated hydronic system.

.4 Operating staff training.

.5 Visit plant every 7 days during first month of operation and as required until system stabilizes, and advise consultant in writing on treatment system performance.

.6 Provide monthly visits with reports after system has stabilized to the satisfaction of the owner.

.7 Provide necessary monthly recording charts and log sheets for one year operation.

.8 Provide necessary laboratory and technical assistance.

.9 Instructions and advice to operating staff to be clear, concise and in writing.

3.4 START-UP

.1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 SYSTEM COMMISSIONING AND TRAINING

.1 Commissioning and training shall be provided by installing water treatment sub-contractor and water treatment supplier.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After start-up and before TAB of connected systems.

.3 Pre-commissioning Inspections:

.1 Verify:

.1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.

.2 Suitability of log book.

.3 Currency and accuracy of initial water analysis.

.4 Required quality of treated water.

.4 Commissioning procedures - applicable to all Water Treatment Systems:

.1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.

.2 Monitor performance continuously during commissioning of all connected systems and until acceptance of project.

.3 Establish test intervals, regeneration intervals.

.4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.

.5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.

.6 Visit project at monthly intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).

.7 Advise Engineer in writing on all matters regarding installed water treatment systems.

.5 Commissioning procedures - Water side of closed circuit coolers, Cooling Tower Systems:

.1 Verify operation of bleed-off system.

.2 Establish bleed-off flow rate.

.3 Establish rate of chemical feed - continual and periodic.

.4 Test system water for chlorides, TDS, suspended solids, algae, slime, inhibitor level, pH, alkalinity, hardness, other impurities and microbiological organisms.

.5 Compare with readings of total dissolved and suspended solids meter.

.6 Read make-up water meter, compare with chiller load summation (ton-hours).

.7 Test make-up water for chlorides, hardness.

.8 Compare test results with readings from TDS meter.

.9 Record quantity of make-up water, compare with summation of chiller load (in ton-hours).

.10 Record types, quantities of chemicals applied.

.6 Commissioning procedures - Closed Circuit Hydronic Systems:

.1 Analyse water in system.

.2 Based upon an assumed rate of loss approved by Engineer, establish rate of chemical feed.

.3 Record types, quantities of chemicals applied.

.4 Provide written verification of glycol solution concentration.

.7 Training:

.1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

.2 Train O&M personnel in softener regeneration procedures.

.8 Certificates:

.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

.9 Commissioning Reports:

.1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Consultant.

.10 Commissioning activities during Warranty Period:

.1 Check out water treatment systems on regular basis and submit written report to Consultant.

3.6 CLEANING OF MECHANICAL SYSTEM

.1 Coordinate cleaning of mechanical systems with mechanical contractor.

.2 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.

.3 Procedure:

.1 Flushing and cleaning should only take place after successful piping pressure testing.

.2 Terminal device (reheat coils, heat pumps, perimeter radiation, heat exchangers etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.

.3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.

.4 Timing:

.1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.

.2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.

.3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.

.5 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.

.6 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor.

.7 Flush and clean new piping system in presence of Consultant.

.8 Flush after pressure test for a minimum of 4 hrs.

.9 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.

.10 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.

.11 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.12 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.13 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

.14 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.15 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor and board chemical treatment technician.

.16 Repeat system drain and flush as often as necessary to have a clean system.

.17 Disposal of cleaning solutions to be approved by authority having jurisdiction.

.18 Isolate new piping system from existing system as required for system cleaning

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 SMACNA HVAC Duct Leakage Test Manual.

.4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).

.6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements.

.2 Indicate following:

- .1 Sealants
- .2 Tape
- .3 Proprietary Joints
- .4 Fittings

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 DUCTWORK

.1 Galvanized Steel:

- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	Class A Gauge	Class B Gauge	Class C Gauge
Square and Rectangular			
Up to 600 mm (24")	22	24	24
625 mm to 1000 mm (25" to 40")	20	22	24
1025 mm to 1800 mm (41" to 72")	18	20	22
1825 mm to 2400 mm (73" to 96")	16	18	20
2450 mm and over (97")	16	16	16
Round and Oval			
Up to 300 mm (12")	24	24	24
325 mm to 600 mm (13" to 24")	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37" to 48")	18	20	22
1225 mm (49") and over	18	18	20

.3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

2.2 DUCT CONSTRUCTION

.1 Round and oval:

.1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.

.2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.

.3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexas Duct System.

.2 Square and rectangular:

.1 Ducts: to SMACNA.

.2 Transverse joints, longest side:

up to and including 750 mm (30"): SMACNA proprietary duct joints.

.3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA ”E” or “G” Type connection). Weld all corners.

.1 Acceptable materials:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCI

.4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA “J” Type connection). Weld all corners.

.1 Acceptable materials:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCII.

2.3 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.

.2 Round:

.1 In exposed areas one-piece smooth radius, 1.5 times diameter.

.2 In concealed areas 3-piece adjustable, 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm (16"): with double thickness turning vanes.

.2 Over 400 mm (16"): with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45º entry on branch.

.2 Round main and branch: enter main duct at 45º with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Diffuser connection to main:

.1 90º round spin in collars with balancing damper and locking quadrant.

.6 Transitions:

.1 Diverging: 20º maximum included angle.

.2 Converging: 30º maximum included angle.

.7 Offsets:

.1 Full short radiused elbows.

.8 Obstruction deflectors: maintain full cross-sectional area.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class	Acceptable Leakage Classification (Rectangular)	Acceptable Leakage Classification (Round)
2500 (10")	A	4	2
1500 (6")	A	4	2
1000 (4")	A	4	2
750 (3")	A	8	4
500 (2")	B	16	8
250 (1")	B	16	8
125 (0.5")	C	16	8

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).

.1 Acceptable materials:

.1 Duro Dyne S-2

.2 Foster

2.6 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.

.1 Acceptable material:

.1 Duro Dyne FT-2

2.7 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.8 FIRESTOPPING

.1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

.3 All ductwork passing through partition walls shall be firestopped.

2.9 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 Minimum 3000 mm (120") from duct mounted humidifier in all directions.

.3 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

2.10 HANGERS AND SUPPORTS

.1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 DUCTMATE “Clutcher” cable hanging system may be utilized on round ductwork up to 450mm (18 inch) diameter in areas of exposed ceilings where lateral movement/loads on ductwork is not present (such as those caused by attached linear diffusers).

.3 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.

.4 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

.5 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Acceptable material:

.1 Myatt fig. 485

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Acceptable material:

.1 Grinnell fig. 61 or 60

.3 For steel beams: manufactured beam clamps:

.1 Acceptable material:

.1 Grinnell Fig. 60

Part 3 Execution

3.1 GENERAL

.1 The following systems shall conform to these requirements:

System	Class	Material
HVAC Supply and Return	B	Galvanized steel
General Exhaust	B	Galvanized steel
Ventilation Plenum	B	Galvanized steel
Exhaust Plenum	B	Galvanized steel
Individual Exhaust	C	Galvanized steel

.2 Do work in accordance with ASHRAE and SMACNA.

.3 Do not break continuity of insulation vapour barrier with hangers or rods.

.4 Support risers in accordance with ASHRAE and SMACNA.

.5 Install breakaway joints in ductwork on each side of fire separation.

.6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE, SMACNA and as follows:

Duct Size mm (")	Spacing mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

.4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

3.3 CLUTCHER CABLE HANGER

.1 Do not install in corrosive environments such as pools, aquariums or spas.

.2 Utilize the standard loop hanging style. (limited to 450mm (18”) diameter)

.3 Contractor is responsible to calculate required clutcher and cable weight rating based on manufacturer selection guidelines. Minimum weight rating of system components shall be 250 lbs.

.4 Maximum Hanger Spacing: 3000 mm (120”)

.5 Provide additional rigid supports as required if lateral movement in the ductwork occurs.

3.4 WATERTIGHT DUCT

.1 Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.

.2 Fit base of riser with 150 mm (6") deep drain sump and 25 mm (1") drain connected, with deep seal trap and valve and discharging to open funnel drain.

3.5 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.6 LEAKAGE TESTS

.1 Co-ordinate leakage testing with TAB contractor **and commissioning agent**. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Leakage tests to be done in sections.

.4 Trial leakage tests to be performed as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90º elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.

.7 Complete test before insulation or concealment.

.8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.

.9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

3.7 CLEANING

.1 Keep ducts clear from dust and debris

.2 Keep duct liner clean from dust, debris, and moisture.

.3 At completion of project vacuum ducts if dirt or dust is present.

.4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.

.5 Ensure all systems are clean prior to start up.

3.8 ROOF MOUNTED DUCT SUPPORT

.1 Provide zero penetration duct support on roof where indicated.

.2 Base shall be made of high density polypropylene with UV protection.

.3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.

.4 Provide shop drawings as specified. Install to manufacturers recommendations.

.5 Acceptable materials:

.1 Portable pipe hanger

.2 Bigfoot systems

.3 Trikon Systems

3.9 INSTALLATION REQUIREMENTS

.1 All ductwork is to be protected from the weather and precipitation. The top and sides of all ductwork are to be completely covered with 6mil poly to the satisfaction of the consultant. Maintain protection of the ductwork until the building is made watertight and hollow cores drained. Tape all joints.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.4 ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.5 ASTM E477, Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each piece of attenuation equipment complete with product data.

1.3 PERFORMANCE RATING DATA

.1 Provide performance rating data, certified by an accredited test laboratory and supported by calculations and verified by test results in accordance with referenced standards as follows:

.1 Silencer: insertion loss, pressure drop at design conditions, generated noise level.

.2 Acoustic plenums: transmission loss and acoustical absorption.

Part 2 Products

2.1 ABSORPTION AND INSULATING MEDIA

.1 Acoustical performance measurements to be made in accordance with ASTM E477, ASTM E90 and ASTM C423, except where specified otherwise.

.2 Acoustic quality, glass fibre, free of shot and odor; bacteria and fungus resistant; free of corrosion causing or accelerating agents; packed to density to meet performance requirements; and meet NBC fire requirements or requirements of authority having jurisdiction for duct lining.

2.2 PREFABRICATED PLENUMS

.1 Panels: tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.

.1 Outer sheet: 1.3 mm (18 gauge) thick galvanized steel to ASTM A653/A653M, with coating designation Z90.

.2 Inner sheet: 0.085 mm (22 gauge) thick galvanized steel to ASTM A653/A653M, with coating designation Z90 with 2 mm (79 mil) diameter clean cut perforations on 5 mm (3/16") staggered centres.

.3 Fully framed with 1.3 mm (18 gauge) thick galvanized steel channels.

.4 Horizontal stiffeners: 0.85 mm (22 gauge) minimum galvanized steel on 800 mm (32") centres to control media settlement.

.5 Access panels: sized for equipment removal; two handles per panel; screw at 100 mm (4") maximum centres; perimeter neoprene sponge gasket; materials same as standard panel.

.6 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 2500 Pa (10" w.c.).

.7 Connections: as indicated.

.2 Doors: access doors with minimum 510 mm x 1375 mm (20" x 54") opening.

.1 Construction same as standard panel except interiors to be solid.

.2 Two butt-type nylon bushed hinges, two cam-type latches with inside and outside handles.

.3 Neoprene gasket seal.

.4 Zinc plated hardware.

.5 Open against air pressure.

.3 Windows: inspection windows, 300 mm x 300 mm (12" x 12"), double glazed with 6 mm (1/4") wire reinforced glass mounted in neoprene "U" channels]

.4 Assembly: base sections and flashings 1.3 mm (18 gauge) minimum galvanized steel.

.1 Panel and flashing joints externally sealed with 6 mm (1/4") diameter bead of non sag, non hardening sealant. Floor channel to floor connection sealed with 3 mm x 15 mm (1/8" x 1/2") monolastomeric tape.

.2 Factory cut and frame openings where greatest dimension exceeds 300 mm (12"). Smaller panel openings, to be site located and cut 50 mm (2") larger in diameter, sleeved with 0.7 mm (22 gauge) minimum galvanized steel.

.3 Fill space between pipe or conduit and sleeve with acoustic media, covered and mastic sealed in accordance with manufacturer's instructions.

.4 No sensory leakage at design pressure differential of 1000 KPa (145 psi).

.5 Assembly RSI not less than 1.2 m2°C/W (6.81 ft2°F/Btuh) at 10°C (50°F).

.6 Certified acoustical performance:

.1 Transmission loss to ASTM E90.

.2 Acoustical absorption to ASTM C423.

Octave bands, (Hz)	125	250	500	1000	2000	4000
Transmission loss, dB	[21]	[28]	[39]	[50]	[53]	[56]
Absorption coefficient	[0.7]	[0.9]	[.99]	[.99]	[0.9]	[0.9]

.5 Acceptable materials:
Vibron
BVA Systems
VAW Systems
IAC Acoustics

2.3 ACOUSTIC SOUND PLENUMS

.1 Panels: 50 mm thick tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.

.1 Outer sheet: 1.3 mm (18 gauge) thick galvanized steel to ASTM A526/A526M, with coating designation Z90.

.2 Inner sheet: 0.085 mm (4 mil) thick galvanized steel to ASTM A526/A526M, with coating designation Z90 with 2 mm (79 mil) diameter clean cut perforations on 5 mm (3/16") staggered centres.

.3 Fully framed with 1.3 mm (18 gauge) thick galvanized steel channels.

.4 Horizontal stiffeners: 0.85 mm (22 gauge) minimum galvanized steel on 800 mm (32") centres to control media settlement.

.5 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 2500 Pa (10" w.c.).

.6 Connections: as per manufacturers requirements.

.2 Assembly:

.1 Panel and flashing joints externally sealed with 6 mm (1/4") diameter bead of non sag, non hardening sealant. Floor channel to floor connection sealed with 3 mm x 15 mm (1/8" x 1/2") monolastomeric tape.

.2 Factory cut and frame openings where greatest dimension exceeds 300 mm (12"). Smaller panel openings, to be site located and cut 50 mm (2") larger in diameter, sleeved with 0.7 mm (22 gauge) minimum galvanized steel.

.3 Fill space between pipe or conduit and sleeve with acoustic media, covered and mastic sealed in accordance with manufacturer's instructions.

.4 No sensory leakage at design pressure differential of 1000 KPa (145 psi).

.5 Assembly RSI not less than 1.2 m2°C/W (6.81 ft2°F/Btuh) at 10°C (50°F).

.3 Acceptable materials:
BVA Systems
Vibron
VAW Systems
IAC Acoustics

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Noise flanking: where indicated, install in wall sleeve with uniform clearance all around to ensure no contact of silencer with wall sleeve. Pack with flexible, non hardening caulking on both sides of sleeves.

.3 Instrument test ports: install at inlet and outlet to permit measurement of insertion loss and pressure loss.

.4 Suspension: to manufacturer's instructions.

3.2 SITE VISIT

.1 Supplier of equipment to visit site to ensure installation is in accordance with manufacturer's instructions and submit report to Consultant

.2 Make adjustments and corrections in accordance with written report.

.3 Provide Consultant with notice 48h in advance of visit.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take sound measurement after start up and testing, adjusting and balancing of systems to Testing Adjusting and Balancing (TAB) of Mechanical Systems section.

.2 Sound measurements to extend over specified frequency range of 250 to 2000 and to be taken:

.1 Upstream and downstream of each silencer and plenum.

.2 In areas adjacent to mechanical equipment rooms, duct, and pipe shafts.

.3 At 1800 mm (72") above floor adjacent to first air terminal.

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation, acceptability of noise levels in occupied areas, other conditions affecting acoustics and, where appropriate, recommendation for remedial measures and costs.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.

.3 Gaskets: neoprene

.4 Hardware:

.1 Up to 300 mm (12"): 2 sash locks

.2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.

.3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

.5 Acceptable materials:
Nailor
E. H. Price
Titus

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.

.2 Acceptable materials:
Duro Dyne
Ductmate

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.5 Acceptable material:
Duro Dyne IP1 or IP2
Duct mate

2.6 PREFABRICATED ROOF CURB

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: 1.3 mm (18 gauge) galvanized steel with raised cant and wood nailer.

.3 25 mm (1") insulation 3 lb density.

.4 Acceptable materials:
Greenheck GPR – 600 mm (24") high
Penn

2.7 SPIN-IN COLLAR

.1 Construction: galvanized conical spin-in collar complete with spin-in bead and crimped collar connection.

.2 Provide balancing damper where indicated.

.3 Acceptable materials:

.1 Ecco Manufacturing

.2 Flex Master

Part 3 Execution

3.1 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans. (Unless internally isolated)

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm (4").

.3 Minimum distance between metal parts when system in operation: 75 mm (3").

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 600 mm x 600 mm (24" x 24") for person size entry.

.2 600 mm x 1000 mm (24" x 40") for servicing entry.

.3 300 mm x 300 mm (12" x 12") for viewing.

.4 As indicated.

.2 Location:

.1 At fire and smoke dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At inlet and outlet of reheat coils.

.6 Elsewhere as indicated.

.7 Inlet and outlet of duct mounted coils.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 At ducted inlets to roof and wall exhausters.

.2 At inlets and outlets of other fan systems.

.3 At main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.2 Install on supply ducts only.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following: performance data.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.3 Shaft extension to accommodate insulation thickness and locking quadrant.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height:

.1 50 mm (2") up to 375 mm (15") high duct.

.2 100 mm (4") max 400 mm (16") high duct and over.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Shaft extension to accommodate insulation thickness and locking quadrants.

.8 Acceptable materials:

.1 Duro Dyne

.2 E.H. Price

.3 Nailor

.4 T.A. Morrison

.5 Tamco

.6 Ruskin

.7 Ventex/Alumavent

.8 United Enertech

2.5 LOCKING QUADRANTS

.1 6 mm (1/4") dial regulator with square bearing shaft.

.1 18 gauge oval frame, cadmium plated, clearly shows damper position.

.2 18 gauge formed handle for easy adjustment.

.3 Bolt and wing nut lock damper securely.

.4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.

.2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.

.1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.

.2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.

.3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.

.4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.

.5 Screw holes for mechanically fastening to ductwork.

.3 High pressure system locking quadrant:

.1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.

.2 Handle design for easy recognition of damper position.

.3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.

.4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.

.5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.

.4 Acceptable manufacturers:
Duro Dyne
Ductmate
Pottorff

2.6 VOLUME EXTRACTORS

.1 Fully adjustable gang operated blade volume extractor.

.2 Cold rolled steel construction, 25 mm (1") blade spacing with matte black finish.

.3 Provide Type 1 manual adjusting operating lever.

.4 Acceptable Material
EH Price AE-1
Krueger EX8/EX88
Or equal approved by consultant

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.1 Single blade dampers up to 200 mm (8").

.2 Multi-blade dampers over 200 mm (8").

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Leave all dampers in open position for T.A.B.

.7 Fasten locking quadrants to ductwork and shaft.

.8 Place locking quadrants on standoffs where ductwork insulated.

.9 Lock down quadrant arm in the open position.

3.2 VOLUME EXTRACTOR

.1 Install at branch take off connections where indicated.

.2 Secure lever adjustment rod to inside duct collar after final adjustments.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Fire dampers.

.2 Operators.

.3 Firestop flaps.

.4 Fusible links.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide following:

.1 Six (6) fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FIRE DAMPERS (STATIC)

.1 Fire dampers: arrangement as indicated, listed and bear label of ULC, meet requirements of provincial fire authority and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Acceptable materials:

.1 Ruskin
.2 Nailor
.3 E.H. Price
.4 T.A. Morrison
.5 Tamco
.6 Ventex/Alumavent
.7 United Enertech
.8 Safeair-Dowco (stainless steel)
.9 Greenheck
.10 Pottorff

2.2 FIRE DAMPERS (DYNAMIC)

.1 Multi blade or roll type, fire damper suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.

.4 Stainless closure spring to positively close damper upon fusible link release, for horizontal or vertical orientations.

.5 Linkage concealed in frame.

.6 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.7 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

.8 Acceptable materials:

.1 Ruskin
.2 Nailor
.3 E.H. Price
.4 T.A. Morrison
.5 Tamco
.6 Greenheck
.7 Ventex/Alumavent
.8 Pottorff

2.3 MULTIBLADE DAMPERS (DYNAMIC OR STATIC)

.1 Provide and install multiblade dampers where roll type fire dampers do not have a ULC listing for the size of the penetration through the assembly.

.2 Multi blade type fire dampers shall be suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.

.3 Damper shall be labelled for dynamic or static systems as appropriate for the installed location.

.4 Frame shall be constructed on 16 ga (1.6) steel hat channel with mitered corners reinforced with die-formed corner gussets for strength.

.5 Damper blades shall be 14 ga (2.0) equivalent steel formed double skin, airfoil design.

.6 Damper shall be of opposed blade configuration with an interlocking blade design. Blade seals are not acceptable.

.7 Blade axels shall be double bolted at each end of the blade to provide positive locking connection.

.8 Bearings shall be sintered stainless steel type.

.9 Blade linkage shall be zero-maintenance, concealed in frame and out of the air stream.

.10 Each damper shall be complete with a UL listed fusible link that will cause the damper to close and lock in closed position by means of an over centre/knee lock linkage for assured closure.

.11 Each damper shall be provided with an internal manual locking quadrant(s) for setting and locking of blades in desired position.

.12 Provide a steel sleeve of appropriate gauge and length for the assembly being penetrated.

.13 Provide a 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.14 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

.15 Acceptable materials:

.1 Ruskin
.2 Nailor
.3 E.H. Price
.4 T.A. Morrison
.5 Tamco
.6 Greenheck
.7 Ventex/Alumavent
.8 Pottorff

2.4 FIRE STOP FLAPS

.1 To be ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.1.

.2 Construct of minimum 1.5 mm (16 gauge) thick sheet steel with 1.5 mm (16 gauge) thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°C (165°F).

Part 3 Execution

3.1 INSTALLATION

.1 Provide where indicated and at all fire rated partitions indicated, on architectural drawing.

.2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Coordinate with installer of firestopping.

.7 Static fire dampers: Only on transfer air ducts where ductwork is not connected to a fan/blower.

.8 Dynamic fire dampers: In all duct work where air is moved by a fan/blower.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

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

.7 CAN/ULC-S1001.11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements indicating the following:

.1 Damper type

.2 Operators

.3 Fusible links

.4 Smoke detectors

.5 Power requirements

.6 Size, orientation, construction

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide following:

.1 Six (6) fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sample tube, sleeve, and all other components necessary for a complete and operable system. **The assembly shall be factory assembled as a single unit**. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

.1 Damper shall be ULC listed and labelled.

.2 Both damper and damper actuator to be ULC listed and labelled.

.3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.

.4 Damper shall have Class I leakage rating.

.5 Suitable for horizontal or vertical installations.

.6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator

.1 Actuator shall be ULC listed and labelled.

.2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.

.3 Exterior visualization of damper position.

.4 Damper actuator end switches for monitoring damper position by the BAS.

.4 Factory sleeve.

.1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

.1 ULC approved photoelectric duct smoke detector.

.2 Operates from 300 to 3000 ft/min air velocity (fan system), -4 to 158°F temperature, and 0 to 95% non-condensing humidity.

.3 Operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature and 0 – 95% non-condensing humidity (transfer ducts)

.4 test/reset button with LED display.

.5 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing.

.6 The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.

.9 Size: as indicated on drawings.

.10 Acceptable materials:
E H Price
NCA Ltd.
Nailor Industries Inc.
Ruskin
Alumavent
United Enertech
Safeair-Dowco (stainless steel)
Pottorff

2.2 COMBINATION FIRE AND SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sampling tube, sleeve and all other components necessary for a complete and operable system. **The assembly shall be factory assembled as a single unit.** Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

.1 Damper shall be ULC listed and labelled

.2 Both damper and damper actuator to be ULC listed and labelled.

.3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.

.4 Damper shall have Class I leakage rating.

.5 Suitable for horizontal or vertical installations.

.6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator/Link

.1 Actuator shall be ULC listed and labelled

.2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.

.3 Exterior visualization of damper position.

.4 Damper actuator end switches for monitoring damper position by the BAS.

.5 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

.6 Fusible link, or electric re-settable link (ERL).

.7 Electric fire sensor capable of remote openable control is to be provided in place of fusible link where specifically indicated in project documents.

.8 Where ERL or electric fire sensor is used in place of fusible link, this device shall fail closed upon power failure.

.4 Factory sleeve.

.1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

.1 ULC approved photoelectric duct smoke detector;

.2 Operates from 300 to 3000 ft/min air velocity (fan systems), -4 to 158°F temperature, and 0 to 95% non-condensing humidity;

.3 Operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature and 0 – 95% non-condensing humidity (transfer ducts)

.4 Test/reset button with LED display;

.5 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing

.6 The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer’s installation guidelines.

.9 Fire rating to match wall assembly i.e. 1 hour/1 ½ hour/2 hour/ 3 hour.

.10 Size: as indicated on drawings.

.11 Acceptable materials:
E H Price
NCA Ltd.
Nailor Industries Inc.
Ruskin
Alumavent
United Enertech
Pottorff
Safeair-Dowco (stainless steel)
Pottorff

2.3 NUMBER OF AIR TYPE SMOKE DETECTORS

.1 Where air velocities are greater than 1.5 m/s (300 feet per second), one air duct type detector shall be installed for every 1.5 meters square (16 square feet) of cross-sectional duct area.

.2 Where air velocities are less than 1.5 m/s (300 feet per second), one duct type smoke detector shall be installed for every 0.5 meters square (5.3 square feet) or cross-sectional duct area.

2.4 PRESSURE RELIEF DOORS

.1 Frames shall be Z-shape, 12 gage (2.8) galvanized steel.

.2 Door shall be 12 gage (2.8) galvanized steel, hinged on one side.

.3 Seal shall be around the door perimeter allowing no more than 7 cfm/ft2 at 1.0 inch w.g..

.4 Door shall include stainless steel springs to close door upon pressure relief and system shutdown.

.5 All release mechanisms, springs and parts shall be completely out of airstream.

.6 Pressure relief settings available from 2” (0.5 kPa) to 10” (2.49 kPA) increments of 1” w.g. (0.25 kPa). Supplier shall examine plans to provide appropriate pressure relief based on associated air handling system.

.7 Pressure relief mechanism shall be factory calibrated in an AMCA Registered Laboratory.

.8 Pressure Relief Doors shall be provided as indicated in the execution section.

Part 3 Execution

3.1 INSTALLATION

.1 Provide smoke dampers where indicated and at all duct penetrations through smoke barrier partitions indicated on architectural drawings.

.2 Provide combination fire and smoke dampers where indicated and at all duct penetrations through fire rated smoke barrier partitions indicated on architectural drawings. To provide separated fire dampers and smoke dampers, obtain approval from the consultant for the alternate arrangement.

.3 Provide pressure relief doors (both positive and negative as applicable) as follows:

.1 For all systems with a combination fire smoke or smoke damper in the duct main of the system when:

.1 The system operates at static pressure of 1.0 inches w.g. or higher; and

.2 More than 50% of the system airflow passes through the combination fire/smoke or smoke damper.

.2 Where/as indicated on the plans.

.4 Install in accordance with ANSI/NFPA 90A, in accordance with conditions of ULC listing and manufacturer’s recommendation.

.5 Maintain integrity of smoke separation and fire rating.

.6 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.7 Install access door adjacent to each damper and smoke detector.

.8 Front grille access for through wall dampers that terminate in a grille is acceptable.

.9 Provide proper firestopping and duct seal to fire barrier wall.

.10 Confirm proper operation and test sheets.

.11 Should contractor provide separated devices mount smoke detector downstream of damper and within 1.5 m (5 ft) of damper.

.12 Ensure access doors/panels, fusible links, damper actuators and sensors are easily observed and accessible.

3.2 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.3 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Prior to the building Integrated Life Safety Systems Testing the mechanical contractor shall commission/verify the operation of all installed smoke dampers.

.2 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all operating smoke dampers and associated Life Safety Systems (i.e. fire alarm).

.3 This contractor shall work with the Integrated Life Safety Contractor and reset all systems back into proper operation.

.4 Include all costs associated with participation Integrated Life Safety System Testing in the tender value.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section applies to operating dampers not specified in Controls Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Performance data.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 MOTORIZED DAMPERS

.1 Opposed blade type.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: Refer to BAS Section.

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 250 Pa (1" w.c.) differential across damper.

.2 Pressure drop: at full open position to be less than 10 Pa (0.04" w.c.) differential across damper.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

.3 Use on services to the exterior.

.8 Acceptable materials:
Honeywell
Johnson
T. A. Morrison
E.H. Price
Tamco
Ruskin
Nailor
Henderson Industrial
Ventex/Alumavent
Pottorff

2.2 DISC TYPE DAMPERS

.1 Frame: brake formed, welded, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.2 Disc: spin formed, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 0.001% of rated air flow at 100 kPa (15 psi) pressure differential across damper.

.2 Pressure drop: at full open position to be less than 100 kPa (15 psi) differential across damper.

.7 Acceptable material:
Duro Dyne
Henderson Industrial
Pottorff

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.

.2 Acceptable materials:

T.A. Morrison
Tamco Series 7000
Ruskin
Nailor
E.H. Price
Henderson Industrial
Ventex/Alumavent
Pottorff

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at 100 Pa (0.4" w.c.) static pressure, (adjustable).

.2 Acceptable material:
T. A. Morrison
Henderson Industrial
Ventex/Alumavent
Pottorff

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Duct Accessories Section.

.5 Insulated dampers on all outside air intake and exhaust damper.

.6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.

.3 UL 181, Factory Made Air Ducts and Air Connectors.

.4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC –INSULATED

.1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.

.2 Performance:

.1 Factory tested to 2.5 kPa (10" w.c.) without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Operating pressure: 300 mm (12").

.3 Acceptable materials:

.1 Flexmaster T/L – VT

.2 Ductmate

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

.2 Maximum length of flexible duct: 1.8 m (6' 0").

.3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.

.4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C916 Standard Specification for Adhesive for Duct Thermal Insulation.

.5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

Part 2 Products

2.1 DUCT LINER

.1 General:

.1 Acoustical duct liner to be fibreglass duct liner meeting or exceeding requirements of ASTM C1071, Type I, Flexible or Type II, Rigid, and NFPA 90A/90B.

.2 Bonded with formaldehyde free bio-based binder

.3 Mat faced airstream surface

.4 Factory applied edge coating

.5 Shall not contain formaldehyde, PBDE’s, asbestos, mercury, mercury compounds, lead, contain 50% or greater recycled glass content.

.6 Thermal conductivity, ASTM C177/C518/C1114 .24BTU (sf•hr•°F) @ 75°F mean temp).

.7 Noise Reduction Coefficient (NRC) 1.5 PCF 1" = .70, 1 ½ " = .80, 2" =.95
ASTM C423, Type A mounting.

.8 Noise Reduction Coefficient (NRC) 2.0 PCF 1/2" = .50, 1" = .70, 1 ½ " = .85
ASTM C423, Type A mounting

.9 Corrosiveness/corrosion, ASTM C665/C1617. Does not accelerate/pass.

.10 Mold and mildew growth/fungi resistance, ASTM C1338, ASTM G21/G22, UL2824. Pass/resistant to mold.

.11 Maximum service temperature, ASTM C411, 250°F (121°C).

.12 Maximum rate air velocity, ASTM C1071, 6,000 ft./min. (30.5 m/sec.)

.13 Water vapor sorption, ASTM C1104, less than 3%.

.14 Surface burning characteristics, ASTM E84, UL 273, CAN/ULC S102, 20/50 flame spread/smoke development.

.15 Acceptable material:

.1 Knauf Atmosphere Duct Liner

.2 Manson

.3 Johns Manville

.4 Owen Corning

.2 Rigid:

.1 Use on flat surfaces.

.2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.

.3 Density: 96 kg/m^3 (6 lb/ft^2).

2.2 ADHESIVE

.1 Meet requirements of ASTM C916.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).

.3 Acceptable material:

.1 Duro Dyne 1A-22

.2 Ductmate

2.3 FASTENERS

.1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.

.2 Acceptable material:

.1 Duro Dyne

.2 Ductmate

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.

.2 Acceptable materials:

.1 Duro Dyne FT2

.2 Ductmate

2.5 SEALER

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90F) to 93°C (200°F).

.3 Acceptable materials:

.1 Duro Dyne 1A-94

.2 Ductmate

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with recommendations of MAIMA Fibrous Glass Duct Liner Standards (FGDLS) or SMACNA duct liner standards.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

.4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.

.2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.

.3 Store foam liners away from sunlight.

3.3 JOINTS

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply 2 coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Consultant.

.3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 AMCA 99, Standards Handbook.

.3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.

.5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.

.2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.

.3 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

.5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.

.6 Provide vibration isolation hangers/pads for all fans.

.7 Acceptable materials:

.1 Greenheck
.2 Penn-Barry
.3 Cook
.4 Jenco (S & P)/Jenn
.5 Carnes
.6 Acme
.7 Zonex
.8 Nutone (Range hood)
.9 Broan (Range hood)
.10 Twin-City
.11 Reversomatic
.12 Fantech
.13 Aerovent

.8 Provide factory mounted speed control for all direct drive motors.

2.2 WALL EXHAUSTERS

.1 Centrifugal backward inclined or Axial fan units, V belt or direct driven as indicated.

.1 Spun aluminum [FRP] [PVC] housings, complete with resilient mounted motor and fan.
.2 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum birdscreen.
.3 Automatic gasketted aluminum backdraft dampers.
.4 Disconnect switch within fan housing.
.5 Cadmium plated securing bolts and screws.

.2 Eisenheiss coated wheel for fume service with motor out of air stream.

.3 Housings:

.1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting.
.2 Discharge pattern: away from building.

.4 Size, type, and capacity: as indicated.

2.3 ROOF EXHAUSTERS

.1 Centrifugal V belt or direct driven as indicated.

.1 Housing: spun aluminum complete with resilient mounted motor and fan.

.2 Impeller: aluminum non-overloading.

.3 Adjustable motor sheave

.4 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum birdscreen.

.5 Automatic gasketted aluminum backdraft dampers.

.6 Disconnect switch within fan housing.

.7 Continuous curb gaskets, cadmium plated securing bolts and screw, and sound insulating.

.2 Roof curbs; of same manufacturer as fan and built to suit model specified.

.3 Size, type, and capacity: as indicated

.4 To NFPA 96 requirements where indicated.

2.4 CEILING DISCHARGE FANS

.1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.

.2 Sizes and capacity: as indicated.

.3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.

.4 Side duct outlet with integral backdraft damper, size as indicated.

.5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.

.6 Silver anodized aluminum grille paint finish.

2.5 PROPELLER FANS

.1 Fabricate multibladed propellers of aluminum of airfoil shape within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct or [belt] driven, complete with motor as indicated.

.2 Provide blade guards, bird screen and automatic back draft dampers on discharge or intake, with gasketted edges.

.3 Provide insulated motorized dampers on fan greater than 140 l/s (300 cfm). Damper motors suitable for 120/1/60 with end switch to star/stop fans. Wired into fan motor.

.4 Acceptable materials:

.1 Buffalo

.2 Greenheck

.3 Penn

.4 Bailey

.5 Carnes

.6 Jenn

.7 Penn Barry

2.6 EXISTING EXHAUST AIR FANS

.1 Refurbish existing exhaust air fans as follows:

.1 Vacuum entire unit interior.

.2 Lubricate all bearings.

.3 Replace fan belt(s).

.4 Rebalance to capacity indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 Provide flexible duct connection for all fans.

.3 Provide backdraft damper at building exterior penetration.

.4 Provide and install vibration isolation.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

1.2 MAINTENANCE MATERIALS

.1 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.3 MANUFACTURED ITEMS

.1 Grilles, registers, and diffusers of same generic type to be product of one manufacturer.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by them from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board and as specified.

.3 Concealed fasteners.

.3 Concealed operators.

.4 Colour and Finish: standard as directed by Consultant.

.5 Acceptable materials:

.1 E.H. Price
.2 Nailor
.3 Krueger
.4 Titus
.5 Carnes
.6 Seiho
.7 Metalaire
.8 Tuttle and Bailey

2.2 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.

.2 Type, size, and capacity: as indicated.

2.3 RETURN AND EXHAUST GRILLES

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets **and fire stop flap where indicated.**

.2 Type R1: aluminum, channel border, 15 x 15 mm (1/2" x 1/2") egg crate type face bars, baked off white finish. Model: Kreuger EG5.

.3 Type, size, and capacity: as indicated.

2.4 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets **and fire stop flap and fire blanket where indicated**.

.2 Type D1: 4-cone adjustable, steel, square type, having adjustable pattern, 4-cone, baked off white finish, lay-in and or surface mounted (sliding type adjustment will not be accepted). Complete with fire stop flap and blanket. Model: Krueger 1400A

.3 Type D2: steel, round type, having adjustable pattern, duct and or surface mounted, c/w safety chains and diffuser wire guard. (sliding type adjustment will not be accepted). Finish selected by Consultant. Model: EH Price RCDA.

.4 Type, size, and capacity: as indicated.

2.5 OPEN MESH SCREEN

.1 15 mm x 15 mm (½"x ½") open mesh screen fastened on 25 mm (1") border; screw fasten.

.2 On all open ends of ductwork and where indicated.

.3 Size: To match ductwork size.

2.6 DOOR GRILLES

.1 Heavy duty steel construction, sight proof, complete with flat border both sides, screwed fastening. Finish by Consultant.

.2 Install door grille in door.

.3 Acceptable manufacturer:

.1 EH Price STG-1BF.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place.

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.

.5 Clean grilles upon completion.

.6 Paint ductwork beyond grilles, matte black where visible.

.7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.4 Colour and finish.

1.3 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 TEST REPORTS

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 GOOSENECK HOODS

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA and or proprietary manufactured duct joint.

.1 Acceptable material:
Ductmate Canada
Exanno Nexus

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm (12 gauge) diameter aluminum wire. Use 15 mm (1/2") mesh on exhaust 20 mm (3/4") mesh on intake.

.6 Vertical or Horizontal backdraft dampers as required.

.7 Prefabricated roof curb through roof complete with insulation and counter flashing.

2.2 FIXED LOUVRES – ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").

.4 Frame, head, sill, and jamb: 100 mm (4") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm (60") maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: Kynar 500
Colour: to Consultant's approval.

.9 Acceptable materials:
Greenheck
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Ventex
Nailor

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening.

.4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Clearly indicate following:

.1 Methods of sealing sections.

.2 Methods of expansion.

.3 Details of thimbles.

.4 Bases/Foundations.

.5 Supports.

.6 Guy details.

.7 Velocity Cone.

.3 Venting manufacturer shall provide shop drawings for review based on the capacity, height, offset and termination location. Submit venting calculations certified by the boiler manufacturer.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

Part 2 Products

2.1 POSITIVE PRESSURE VENTING (CATEGORY III AND IV)

.1 The vent shall be of the double wall, factory-built type, designed for use in conjunction with Category III, or IV condensing or non-condensing positive pressure appliances or as specified by the heating equipment manufacturer.

.2 Maximum continuous flue gas temperature shall not exceed 550 degrees F (288 degrees C).

.3 Vent shall be listed for a maximum positive pressure rating of 6.0" w.c. and shall have passed testing at 15.0" w.c.

.4 The vent system shall be continuous from the appliance’s flue outlet to the vent termination outside the building. All systems components shall be ULC listed and supplied by the same manufacturer.

.5 The vent shall be constructed with an inner and outer tube, with an annular space between the tubes of 25 mm (1").

.6 The inner tube (flue gas conduit) shall be constructed from AL29 4C® or UNS S44735 stainless steel, with a min. wall thickness of 0.4 mil (26 ga) for 3" through 7" diameter vents, 0.5 mil (24 ga) for 8" through 12" diameter vents and 0.6 mil (22 ga) for 14" and 16" diameter vents.

.7 The outer tube (jacket) shall be constructed from 304 or 430 stainless steel, with a minimum wall thickness of 0.4 mil (26 ga) for 3" through 6" diameter vents and 0.6 mil (22 ga) for 7" through 16" diameter vents.

.8 All systems components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings required to install the vent system shall be UL listed and provided by the vent manufacturer.

.9 All system components shall include a factory-installed gasket in their female-end to render the vent air and water tight when the male/female ends are pushed together as per manufacturer's instructions. Vent systems requiring field installed sealants or compounds shall not be acceptable.

.10 All systems components shall include a factory installed, internal mechanical locking band for fastening and securing all vent components against each other.

.11 Vent layout shall be designed and installed in compliance with manufacturer's installation instructions boiler manufacturer, and all applicable local codes.

.12 Acceptable Manufacturers:

.1 Pro Tech Systems, Inc. – FasNSeal W2 (Insulated)

.2 Van Packer

.3 Z-Flex Model SVE-IV (Insulated)

.4 Cheminée Lining

.5 Selkirk/Ampco

.6 Security Chimneys International

.7 ICC Chimney VIP

2.2 TYPE A GAS VENT

.1 ULC labelled, 537º C (1000º F) rating maximum, atmospheric gas vent only.

.2 Sectional, prefabricated, double wall with 50 mm (2") insulated cavity. Stainless steel inner wall. Stainless steel outer wall. Mated fittings and couplings.

2.3 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: double acting, 70% of full size of breeching area.

.3 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA)

.4 Velocity cone.

.5 Expansion sleeves with heat resistant caulking, held in place as indicated.

.6 Roof flashing cones.

.7 Guy wire supports and anchors.

Part 3 EXECUTION

3.1 INSTALLATION – GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at 1.5 m (5') centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.5 Install flashings on chimneys penetrating roofs and building structures.

.6 Install velocity cones and cleanouts, as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 Canadian Gas Association (CGA).

.1 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers.

.2 CSA-B149.1, Natural Gas and Propane Installation Code.

.4 American National Standards Institute (ANSI).

.1 ANSI Z21.13, Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.5 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

.6 ASHRAE 90.1 – Energy Standard for Building Except Low-Rise Residential Buildings

1.2 BOILER SYSTEM LAYOUT ON FLOOR

.1 Pre-planning of the boiler room system must be done prior to any new construction in the boiler room beginning. The contractor shall provide a full scale markup of the boiler system on the floor of the boiler room. The markup shall be in various coloured chalk and shall include all the components/equipment of the boiler system.

.1 Housekeeping pad sizes/locations.

.2 Floor/hub drain locations.

.3 Vent/chimney stack locations and locations thru roof.

.4 Boiler positions (including burner & front door swing – depending on type of boiler).

.5 Rough locations and routing for heating supply/return headers and branch piping.

.6 Location of gas train (compared to boiler access/door swing) so gas can be disconnected from one or two unions.

.7 Locations for pumps, air separator, sink, eyewash, expansion tanks, etc.

.8 Locations for chemical treatment pot feeder assembly and makeup water assembly.

.9 Coordinate with the electrician and include markup locations for starters, panels, VFDs, etc.

.10 Location of unistrut supports where needed to route wiring or mount piping or equipment.

.11 Location of BAS controls and panels.

.2 Markup shall be reviewed with the consultant and owner prior to new installations starting. Changes or adjustments of the layout will be made with chalk during the review.

.3 Contractor to provide multiple photos of the final chalk layout.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate the following:

.1 Capacities of selected model

.2 General arrangement showing terminal points, instrumentation test connections.

.3 Clearances for operation, maintenance, servicing, cleaning.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.10 Warranty information

.3 Engineering data to include:

.1 Boiler efficiency at 100% of design capacity.

.2 Radiant heat loss at 100% design capacity.

.3 Water side pressure drop curve.

.4 Certificate of Product Rating: AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input and Gross Output.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION

.1 Manufacturer's Certification: The boiler manufacturer shall certify the following:

.1 The products and systems furnished are in strict compliance with the specifications.

.2 the boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler.

.3 ASME certification.

.4 CSA (AGA/CGA) certification.

.5 The specified factory tests have been satisfactorily performed.

.6 The equipment furnished contains inter-changeable parts with the specified equipment so that all major equipment parts can be obtained from the specified manufacturer.

1.6 WARRANTY

.1 Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within the specified period:

.1 Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to thermal shock, flue gas condensate corrosion, and/or defective material or workmanship for a period of 10 years, non-prorated, from the date of shipment from the factory provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual.

.2 Burner: The boiler manufacturer shall warranty the burner against defective material or workmanship for a period of five (5) years, non-prorated, from the date of shipment from the factory.

.3 All other Components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material within eighteen (18) months of shipment from the factory or twelve (12) months from start-up, whichever comes first.

Part 2 Products

2.1 GENERAL

.1 Furnish the number of factory "packaged" low pressure hot water boilers indicated on the drawings. Each factory "packaged" boiler shall be complete with all components, accessories, and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

.2 Each hot water boiler shall consist of a vertical, stainless steel heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.3 The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

2.2 PERFORMANCE CRITERIA

.1 Refer to schedules for boiler capacities.

.2 Boiler shall be capable of operating with a minimum outlet water temperature of 20°C (68°F).

.3 Boiler shall comply with ASME Section IV for 345 kPa (50 psig) (max 98°C/200ºF).

.4 Boiler relief valve setting shall be 345 kPa (50 psig) max.

.5 Maximum allowable water temperature shall be 210°F

.6 Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5" w.c. to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14" w.c.

.7 Ambient air temperature shall be assumed to range from 10°C (50°F) to 32°C (90°F) with an average of 21°C (70°F).

.8 Power voltage shall be 120/208 vac, 1-phase, 60 hertz. Control voltage shall be 24 vac (transformer to be supplied by boiler manufacturer).

.9 Boiler shall be suitable for use with either water or glycol solutions.

2.3 HEAT EXCHANGER

.1 Each boiler heat exchanger shall be duplex stainless steel, single or multi-pass, down fire, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section

.2 Boiler heat exchanger headers shall be fabricated stainless steel and be completely removable for inspection. Seals shall be EPDM, rated for 400°F service. Push nipples or gaskets between the sections are not permitted.

.3 Heat exchange capability shall be maximized through the use of a corrugation process or fins.

2.4 PRESSURE VESSEL

.1 Shall be constructed of carbon stainless steel with welded heads and tube connections.

.2 Pressure vessel shall be counter-flow design for water flow, with internal water baffling plates if required to meet energy efficiency requirements.

.3 The water volume of the boiler shall not be less than 42 gallons of water volume/1000 MBH.

.4 The pressure vessel shall have sufficient water capacity to be flow tolerant without minimum flow requirements or the use of a flow switch.

The allowable pressure drop across the boiler inlet and outlet connections shall not exceed **2.0 psi/4.6 ft H20** if the system is piped as a primary flow only.

2.5 FRAME AND ENCLOSURE

.1 Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from a minimum 16 gauge carbon steel. The complete outer casing shall be finished, inside and out, with a powder coat finish.

.2 The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 37°C (100°F) when the boiler is operated at full rated load.

.3 An observation port shall be located on the boiler to allow for observation of the burner flame.

.4 Access panels shall be hinged.

.5 Provide appropriate NEMA 250, Type 1 enclosure for controls components.

.6 Provide lifting eyes and fork holes accessible for rigging and movement of the boiler.

.7 Minimum 2 inch thick insulation surrounding the heat exchanger.

2.6 CONNECTIONS

.1 Each boiler shall be provided with all necessary inlet and outlet connections. Boiler connections shall be as follows:

.1 One (1) water supply outlet, Victaulic

.2 One (1) water return inlet, Victaulic

.3 One (1) relief valve outlet.

.4 One (1) flue gas vent outlet.

.5 One (1) fuel gas inlet.

.6 A flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting (stack) as defined in NFPA 54 (ANSI Z221), latest edition. Contractor must provide venting (stack) certified for installation on a Category IV appliance.

2.7 MAIN GAS VALVE TRAIN (MODULATING)

.1 Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

.1 One (1) manual shutoff valve (gas train inlet connection).

.2 Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.

.3 Modulating Air – Gas ratio control (maximum inlet pressure 14” w.c.).

.4 One (1) low gas pressure switch (manual reset).

.5 One (1) high gas pressure switch (manual reset).

.6 Two (2) pressure test ports.

.7 Union connection to permit burner servicing.

2.8 NEUTRALIZING VESSEL

.1 Rotationally molded low density polyethylene vessel with minimum 3" diameter fill/access openings at each end, 3/4" diameter inlet and outlet pipe connections. Provide all necessary mounting hardware. Unit (or units if more than 1 is required) is to be sized to neutralize capacity of condensate from boiler, before being drained to sewer system. Vessel to be sized to suit condensate produced by the boiler.

.2 Provide initial charge of limestone and store one (1) additional charge where directed on site.

.3 Acceptable materials: From boiler manufacturer.

2.9 IGNITION SYSTEM

.1 Each boiler shall be equipped for direct spark ignition.

2.10 COMBUSTION AIR CONTROL SYSTEM (DIGITAL)

.1 Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

.1 The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve, which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.

.2 One (1) low airflow differential pressure switch to insure that combustion air is supplied.

.3 High exhaust back pressure switch.

2.11 VENTING

.1 The boiler shall be capable of operating with a stack effect not exceeding -0.04” W.C. and a combined air intake and exhaust venting pressure drop not exceeding +1.50” W.C.

.2 It shall be acceptable to either direct vent the boiler using sealed combustion by drawing combustion air in from the outdoors, or by drawing air from the mechanical space itself.

.1 Sealed Combustion: Contractor shall supply and install venting to suit manufacturers installation guidelines.

.2 Mechanical Space: Manufacturer shall supply and install filter for combustion air intake if required or recommended by manufacturer.

.3 Flue Gas exhaust stack shall be AL 29-4C, 316L stainless steel or other material as indicated in manufacturer installation manual. Material shall be listed and labelled to UL 1738 / C0UL S636 for use with Category IV appliances. Material shall be guaranteed appropriate for the application by the manufacturer of the boiler.

.4 Condensate drain material must be stainless steel or Schedule 40 CPVC. Copper, carbon steel, or PVC pipe materials are not acceptable.

.5 **Obtain boiler manufacturer approval of venting (route, termination, and material).**

2.12 CONTROL PANEL

.1 The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:

.1 One (1) burner "on-off" switch.

.2 One (1) electronic combination temperature control, flame safeguard and system control.

.3 Control circuit breaker, 5 amp.

.4 All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.

2.13 INTERNAL CONTROL

.1 Boiler control system shall consist of an integral boiler display and micro-processor control system.

.2 LED Display Panel to adjust set points and control operating parameters. LED display to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, sensor values such as inlet, outlet, flue gas and outdoor air.

.3 Control system shall be capable of controlling/staging multiple boiler systems, as well as starting/stopping primary boiler pumps, varying primary pump speed based on boiler firing rate and opening and closing the boiler automatic isolation valve. Boiler shall be able to control minimum two separate heating loops.

.4 In a multiple boiler system, the control shall stage and modulate the boilers utilizing firing rate threshold staging and parallel modulation to optimize condensing potential while minimizing energy wasting short cycling. The control shall monitor the supply water temperature and return water temperature and communicate between the boilers on a local boiler system control network.

.5 Boiler controls shall have provisions for outside air reset and night setback. Boiler manufacturer to provide outdoor air temperature sensor.

.6 All parameters shall be adjustable through the control panel display.

.7 Boiler control panels shall be mounted and located on the boiler to provide ease of servicing and prevent accidental water damage.

.8 The integral controller on each boiler shall provide for the following functions:

.1 Flame safeguard

.2 Burner sequencing, with safe start check, pre-purge, electronic direct spark ignition and post-purge. Combustion shall be proven.

.3 Flame Supervision: Maintain a running history of operating hours, number of cycles, and the most recent lockouts. Display information on display screen in clear English text descriptions without the need to look up error codes.

.4 Safety Shutdown with display of lockout and hold condition.

.5 PID modulating control of the variable speed fan for firing capacity relative to load requirements. i.e. to meet supply water temperature set point.

.6 Gas Pressure supervision (high and low)

.7 Combustion Air Proving supervision

.8 High Air Pressure (Back draft too high) supervision

.9 Control relay for operation of the isolation valve.

.10 Low Water Cut Off (provide for field installation if not integral to boiler)

2.14 BAS HARDWIRE INTEGRATION

.1 Terminal Strip Integration: Boiler shall communicate with the BAS via a terminal strip integration. Provide the following points for integration:

.1 Boiler Enable/Disable

.2 Boiler Status

.3 Boiler Alarm

.4 Hot Water Supply and Return Water Temperature Set Point

.5 Boiler modulation rate

.6 Firing Rate feedback

2.15 BACNET INTEGRATION

.1 The boiler shall also include for the addition of the BACNet integration.

.2 Through digital integration the following minimal information shall be controlled and visible:

.1 Writeable Points

.1 Hot Water Supply Temperature Set Point

.2 Hot Water Return Temperature Set Point

.3 Fire rate

.4 System/Boiler Pump Command

.5 Boiler Enable/Disable

.6 Lead/Lag Control (enable and settings)

.7 Emergency Shut down

.2 Readable Points

.1 Hot Water Supply Temperature

.2 Hot Water Return Temperature

.3 Fire Rate Feedback

.4 Failure/Alarm

.5 Cycle/Run Time totals

.6 Flow verification (if equipped with internal flow switch)

.7 Pump status

.8 Combustion efficiency

.9 Various operating status’ as available in standard BACNet integration offering.

.3 Lock out and error codes shall be transmitted to the BAS and be readable at the Operator Workstation so that error codes can be remotely accessed and reviewed prior to site visit. Manufacturer shall provide correct controller to provide this functionality.

2.16 ELECTRICAL CONNECTION

.1 Provide single point field power connection, factory installed and wired, including all transformers, control/safety devices and other devices as required for a complete and operable system.

.2 Power shall be 120 V, 60 Hz, single phase. Maximum 20 Amp breaker.

2.17 TRIM

.1 Boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

.1 Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to acceptable drain.

.2 Water pressure-temperature gauge.

.3 Primary low water flow fuel cutoff (probe type with manual reset).

.4 High limit water temperature controller to stop burner operation at excess water temperature (shall be manual reset).

.5 Operating temperature control to control the sequential operation of the burner.

.6 Separate inlet and outlet water temperature sensors capable of monitoring flow.

.7 Alarm lights and horn

.8 LCD Display and Diagnostics

2.18 ACCESSORIES

.1 Condensate neutralizing system

.2 Drain Valve

.3 Flow Switch (if required for boiler operation or indicated on plans)

.4 BACNet integration card and any required protocol translators for boiler integration with the Building Management System.

.5 Auto restart (on loss of power).

.6 Internal On/Off/Auto switch.

.1 Auto for BAS control.

.2 On for manual operation of boiler, with internal safeties and temperature setpoint.

2.19 ACCEPTABLE MATERIALS

.1 PK Storm (Basis of Design)

.2 Lochinvar Crest

Part 3 Execution

3.1 INSTALLATION

.1 Contractor shall install boilers in accordance with all manufacturer installation instructions and as indicated on the drawings.

.2 Meet all local and applicable codes of installation.

.3 Maintain manufacturer's recommended service clearances on all sides of the equipment.

.4 Supplying contractor shall install all shipped loose equipment.

.5 Supplying contractor shall be responsible for all interconnecting electrical control and power wiring, including high voltage wiring between boiler and isolation valve actuator.

.6 Install boilers on cast-in-place concrete housekeeping pads.

3.2 QUALITY CONTROL

.1 Boiler shall be provided by a firm regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than ten (10) years.

.2 Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME "H" stamp.

.3 Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

.4 The manufacturer shall have a factory authorized service training program, where boiler technicians can attend a training class and obtain certification to perform start-up, maintenance and basic troubleshooting specific to the product line. There shall be a minimum of 4 trained technicians within 100 km of the job site.

.5 Provided equipment shall be of the type, design and size that the manufacturer currently offers for sale and must appear in the manufacturer's current catalogue.

3.3 FIELD TESTING

.1 The boiler manufacturer shall field test the following:

- .1 Boiler and burner interlocks.
- .2 Valves.
- .3 Controllers.
- .4 Gauges.
- .5 Thermometers.
- .6 Alarms

.7 Stack Pressure

.8 Switches.

.9 LCD Screen Functional Test

.10 Any malfunctioning component shall be replaced.

3.4 COMMISSIONING

.1 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.2 Provide Consultant at least 48h notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.5 DEMONSTRATION AND TRAINING

.1 Provide minimum 2 hours training to owner's representative, including all safety procedures, maintenance procedures, control operations and diagnostic procedures.

.2 Training shall be provided by a factory trained service technician.

.3 Training shall occur at the installed location.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A153, Specification for zinc coating (Hot- Dip) on iron and steel hardware.

.3 CTI ATC-105, acceptance test code.

.4 CTI STD-201-, Standard for the Certification of Water Cooling Towers Thermal Performance.

.5 CSA B52, Mechanical refrigeration code.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Requirements Section.

.2 Indicate:

.1 Connections, piping, fittings valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.3 Wiring as assembled and schematically.

.4 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.5 Vibration control measures.

.6 Manufacturers recommended clearances.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in General Requirements Section.

.2 Include:

.1 Description of equipment giving manufacturers name, type, model year, capacity.

.2 Start-up and commissioning procedures.

.3 Details of operation, servicing, and maintenance.

.4 Recommended spare parts list.

1.4 SPARE PARTS

.1 Furnish following spare parts:

.1 Belts

.2 Spray nozzles.

Part 2 Products

2.1 COOLING TOWER

.1 Factory-assembled, counterflow, blow-through design with single side air entry. Unit shall be of a one-piece design with all moving parts factory mounted and aligned, with no joints which require field sealing. All structural elements and steel panels shall be constructed of Z-700 hot-dip galvanized steel.

2.2 PERFORMANCE

.1 **Cool 142 USGPM of water from 95°F to 85°F with 76°F** entering air wet bulb temperature. Cooling Tower model line shall be certified by the Cooling Tower Institute in accordance with CTI Certification Standard STD-201 or, lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC-105 by the Cooling Tower Institute or other qualified independent agency such as certified agency of the Associated Air Balance Council (AABC). When a field acceptance test is required, the Cooling Tower submittal shall include performance curves in accordance with Section II of ATC-105. A Manufacturer's guarantee performance bond or test by the Manufacturer will not be accepted as an alternative to CTI Certification or an independent field test.

2.3 PAN/FAN SECTION

.1 Heavy gauge Z-700 galvanized steel panels utilizing double brake flanges for maximum strength, rigidity and reliable sealing at watertight joints. Standard pan accessories shall include large circular access doors, large area lift-out strainer of anti-vortexing design and solid brass make-up valve with large diameter, unsinkable, polystyrene-filled plastic float arranged for easy adjustment.

.2 The fan shall be located in the dry entering air stream to provide greater reliability and ease of maintenance. Fan wheels are to be forwardly curved centrifugal squirrel-cage type and shall be statically and dynamically balanced and shall be mounted on a steel fan shaft supported by heavy-duty, self-aligning, relubricatable bearings with cast iron housings. Intermediate sleeve bearings **will not be acceptable**. Fan housings shall have curved inlet rings for efficient air entry. Fan wheels and housings shall be constructed of heavy gauge galvanized steel. The fan housings shall be of split design to facilitate fan wheel and shaft removal. Towers not having split housing design must co-ordinate layout with the architect to allow space for fan shaft removal.

.3 Provide Baltibond Corrosion Protection System coating for the entire cooling tower unit (excluding coil pack).

2.4 FAN MOTOR & DRIVE

.1 One (1) 15 HP., 1800/900 RPM, two speed, single winding, T.E.F.C., ball bearing type with 1.15 service factor and shall be located at the base of the unit. The motor shall be mounted on a heavy-duty motor base, adjustable by means of a single threaded bolt-and-nut arrangement. The motor shall be suitable for outdoor service on 575 volt, 60 hertz, 3 phase electrical service.

.2 V-belt fan drive shall be sized for not less than 150% of motor nameplate horsepower. Drive and all moving parts shall be protected by removable hot-dip galvanized screens or panels.

2.5 SURFACE SECTION

.1 The heat transfer section shall include serpentine, PVC wet deck surface below a spray-type water distribution system, all encased by Z-700 hot-dip galvanized steel panels. The Polyvinyl Chloride (PVC) sheets shall be impervious to rot, decay, fungus or biological attack and have a flame spread rating of 5 per ASTM Standard E84-77a. The surface shall be manufactured and performance tested by the Cooling Tower Manufacturer to ensure single source responsibility and control of the final product.

2.6 WATER DISTRIBUTION

.1 Distributed evenly over the heat transfer section. The system shall consist of Schedule 40 PVC header and spray branches with large diameter, non-clog, plastic spray nozzles. The branches and spray nozzles shall be held in place by snap-in rubber grommets, providing quick removal of individual spray nozzles or complete branches for cleaning or flushing. Screw-in nozzles **will not be acceptable**.

2.7 ELIMINATORS

.1 Constructed of specially formulated PVC and be removable in easily handled sections. They shall have a minimum of three changes in air direction with an air deceleration zone to direct discharge air away from the fans and limit drift loss to less than 0.002% of the total water circulated.

2.8 ELECTRIC IMMERSION PAN HEATER

.1 Electric immersion pan heater to prevent the condenser water from freezing when the unit is inoperative. The heater shall be sized to maintain the pan water temperature at plus 40º F (4.5º C), when the ambient air temperature is minus 20º F (minus 29º C).

.2 One (1), three phase 575 volt heater shall be provided having a total capacity of 7.5 KW. The heater shall be tubular element construction and the contact terminals enclosed in a moisture-proof terminal box. A 110 volt, moisture-resistant temperature controller shall be included. A low water level cutout shall be provided to de-energize the heater in the event element is not fully submerged.

2.9 REMOTE CONTROL PANEL

.1 Provide remote control panel complete with remote VFD for cooling tower fan motor, panel heater, spray pump, and damper control. Mount VFD in existing Mechanical Room as indicated complete with motor and pan heater disconnects. Control panel, VFD, and disconnects to be supplied by cooling tower manufacturer.

2.10 UNIT SIZE

.1 Overall unit dimensions shall not exceed approximately 6'-10” x 3’-11.5” with an overall height not exceeding approximately 8’-8.75”. The operating weight shall not exceed 3,920 lbs.

2.11 EXTENDED WARRANTY

.1 In addition to the one (1) year warranty on the entire Unit the Cooling Tower Manufacturer shall provide a five (5) year Warranty on materials and workmanship on the drive components, including fans, fan shaft, shaft bearings, sheaves and fan motors.

2.12 ACCESSORIES

.1 Vibration rails.

.2 Tapered discharge hood.

.3 Fan and motor enclosure with screened inlet and hinged access door.

.4 Variable speed motor.

2.13 ACCEPTABLE MATERIALS

.1 Baltimore Air Coil VF1-018-32J

.2 Evapco

Part 3 Execution

3.1 GENERAL

.1 Mount on structural supports [and vibration isolators] [as indicated] and to manufacturer’s recommendations.

.2 Ensure clearance for servicing and maintenance as recommended by manufacturer.

.3 Manufacturers field service representative to approve installation, to [supervise] start up and to instruct operators.

3.2 TEST

.1 Test under actual operating conditions in accordance with CTI ATC-105 to verify specified performance.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA-90A, Installation of Air Conditioning and Ventilating Systems.

.3 AMCA 99 – Standard Handbook.

.4 AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

.5 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.

.6 ANSI/AHRI 340/360 – Performance Rating of Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment.

.7 AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

.8 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment.

.9 NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

.10 UL-1995 – Standard for Safety for Heating and Cooling Equipment.

1.2 QUALITY ASSURANCE

.1 Manufacturer shall have a minimum 15 years of experience in designing, manufacturing and servicing large air handling units.

.2 Units shall be factory tested prior to shipment.

1.3 ALTERNATES CO-ORDINATION

.1 The design indicated on the schedules and shown on the drawings is based upon the products of the named manufacturer. Alternate equipment manufacturers named in this specification are acceptable if equipment meets scheduled performance requirements.

.2 If equipment is supplied by a manufacturer other than the one named as the basis of design, coordinate with the General Contractor and affected subcontractors to ensure the specified performance is met. This coordination shall include (but is not limited to) the following:

.1 Structural supports for units.

.2 Size and location of concrete bases/housekeeping pads.

.3 Location of roof curbs, unit supports and roof penetrations.

.4 Ductwork sizes and connection locations.

.5 Piping size and connection/header locations.

.6 Interference with existing or planned ductwork, piping and wiring.

.7 Electrical power requirements and wire/conduit and over current protection sizes.

.3 The Mechanical Contractor shall be responsible for costs incurred by the General Contractor, Subcontractors, and Consulting Engineers to accommodate units furnished by a manufacturer other than manufacturer named as basis of design.

.4 Substitution of products from manufacturers not listed in the list of acceptable manufacturers shall not be accepted.

1.4 RATINGS AND CERTIFICATIONS

.1 Unit shall conform to AMCA 210 for fan performance ratings.

.2 Unit sound ratings shall be reported in accordance with AHRI 260 for inlet and discharge sound power levels.

.3 Unit casing radiated sound ratings shall be reported in accordance with ISO 9614 parts 1&2 and ANSI S12.12.

.4 Unit shall conform to AHRI 410 for capacities, pressure drops, and selection procedures of air coils.

.5 Unit shall conform to ANSI/AHRI 430 for all fabrication procedures of air handling units.

.6 Control Wiring comply with NEC codes and all other requirements of the Authority Having Jurisdiction.

.7 Units shall comply with energy use AHSRAE 90.1 and meet all Government of Canada and Ontario Building Code energy requirements, including SB-10 energy efficiency requirements. Energy Efficiency shall be verified by third party laboratory testing.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements. Ensure the following information is included:

.2 Furnish fan performance ratings and fan curves with specified operating point clearly plotted.

.3 Furnish drawings indicating unit dimensions, required clearances, field connection locations, wiring diagrams, shipping drawings, and curb drawings.

.4 Furnish performance report showing unit level performance data including: fan(s), motor(s), coil(s) and other functional components. Performance report shall also include unit casing performance.

.5 Furnish operation and maintenance data, including instructions for lubrication, filter replacement, motor and drive replacement, and condensate pan cleaning; spare parts lists, and wiring diagrams.

.6 Adjust and report performance ratings for the proper altitude of operation.

.7 Report air-handling unit performance ratings in accordance with ANSI/AHRI-430 (static pressure, airflow, fan speed, and fan brake horsepower).

.8 Report coil ratings in accordance with AHRI-410 (capacities and pressure drops).

.9 Report unweighted octave band AHU sound power for inlets and outlets rated in accordance with AHRI Standard 260. Provide eight data points, the first for the octave centered at 63 Hz, and the eighth centered at 8,000 Hz. Manufacturer shall not use sound estimates based on bare fan data (AMCA ratings), nor use calculations like the substitution method based on AHRI 260 tests of other AHU products. Provide data for inlets and outlets as scheduled. Report unweighted casing radiated sound power over the same 8 octave bands in accordance with ISO 9614 Parts 1&2 and ANSI S12.12.

.10 Report weight loads and distributions by component section.

.11 Report product data for filter media, filter performance data, filter assembly, and filter frames.

.12 Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.13 Report motor electrical characteristics.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

1.8 UNIT ASSEMBLY

.1 Unless stated otherwise, air handling units are to be shipped to the job in one piece, factory assembled. All equipment shall be factory tested prior to shipment.

.2 Units that are shipped in segments must be re-assembled by manufacturer's factory trained service personnel.

1.9 PERFORMANCE RATINGS

.1 Unit certification: Units shall conform to CSA-C746-2006 and ARI 340/360-2007, be listed by NRCan as approved for sale in Canada and be compliant with the SB-10 Supplement of the Ontario Building Code. Manufacturers shall have performance certified by an AHRI-sponsored, independent, third party laboratory and be able to provide a Certificate of Product Ratings.

Part 2 Products

2.1 GENERAL

.1 Field Factory assembled components to form units supplying air at design conditions as indicated and specified.

Acceptable materials:

.1 Daikin Applied

.2 Engineered Air.

2.2 GENERAL DESCRIPTION

.1 The air handling unit (AHU) shall consist of the following components:

.1 Structural frame, including base. Frame must maintain it's integrity when all wall panels are removed.

.2 Wall panels complete with access doors.

.3 Filters, motors, motor controls, dampers and other components as specified.

.4 A supply air fan.

.5 Power exhaust fan.

.6 A modulating gas burner.

.7 Packaged DX cooling.

.8 A mixed air section complete with economizer operation.

.9 Integral energy recovery wheel complete with bypass damper and purge.

.10 Single point power connection.

2.3 UNIT CONSTRUCTION

.1 Base Rail:

.1 Units shall be provided with a structural steel base rail under the full perimeter of the unit, formed from mill galvanized steel, or welded structural steel if determined to be necessary based on unit size by the manufacturer.

.2 Base rail shall allow for clearances for proper trapping of drain pans and condensate.

.3 Base rail shall have a lifting lug system that does not require additional support for rigging on site. Alternatively, lifting lugs or forklift openings on cabinet are acceptable if designed for on site rigging.

.2 Casing:

.1 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include for the prevention of infiltration of rain and snow into the unit, and louvres or hoods on air intakes and exhaust openings with 25 mm (1") galvanized inlet screens. Provide rain gutters over all access doors and caulk all joints with a water resistant sealant.

.2 Casing construction shall not be relied upon to provide structural integrity.

.3 Casing panels shall be 2" double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.

.4 Unit casing shall be of minimum 1.3 mm (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.

.5 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.

.6 Provide casing with minimum thermal resistance (R-value) of 13 hr-ft2-°F/BTU. Exposed insulation is not acceptable.

.7 Casing panel insulation shall be injected polyurethane foam. Rigid foam board panels are acceptable provided the above noted R value is met.

.8 Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.

.9 Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined double-walled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.

.10 Casing panels with perforated interior liners (perforated panels) shall be provided where indicated on the drawings and/or schedule. Perforated panels shall be a hybrid combination of 1" fiberboard and 1" injected polyurethane foam. Rigid foam board panels shall not be used. Minimum perforated panel thermal resistance (R-Value) shall be R11 hr-ft2-°F/BTU.

.11 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage.

.12 Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +5 inches w.g. in positive pressure sections and -5 inches w.g. in negative pressure sections. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

.13 Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

.14 Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft2. 'L' is defined as the panel-span length and 'L/240' is the deflection at the panel midpoint.

.3 Access Doors

.1 Units shall be provided with double wall gasketed access doors that meet the requirements of the AHU casing.

.2 Access doors shall be provided to the following components: fans and motors; filters; dampers and operators; and access plenums. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable.

.3 Provide hinged access doors, fully lined, with hinges, with a minimum of two camlock fasteners for all units over 1200 mm (48") high.

.4 Whenever possible, hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. Where space constrictions require the use of outward opening doors to an area of positive pressure, a clear warning label must be affixed.

.5 Hinged access doors shall be provided with tie back clips.

.6 Doors shall have a drip guard above the door frame, extending 50 mm (2") beyond door surface.

2.4 DX, WATER AND GLYCOL HEATING AND COOLING COILS

.1 General

.1 Coils shall meet or exceed performance scheduled on drawings.

.2 Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.

.3 Cooling coils shall be provided with a maximum face velocity of 500 feet per minute. Face velocity calculations shall be based on the finned area of the coil.

.4 Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of 10" downstream of the face of the coil.

.5 Coil segment casing shall accommodate full-face or reduced-face coils as scheduled. Face and bypass coil shall only be allowed when specifically specified. Where specified segments shall be provided with factory installed bypass damper.

.6 Access shall be provided of at least 24" between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.

.7 Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.

.8 Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.

.9 Individual coils shall be removable from the side of the AHU.

.10 Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.006" or 0.008 or 0.01" thick.

.11 DX Cooling Coils

.1 The coil shall be installed in a blow through configuration, upstream of the supply air fan.

.2 The coil shall be multirow, with a minimum of 3 rows. All coils shall have interlaced coil circuiting that keeps the full coil face active at all load conditions.

.3 Direct expansion (DX) coils shall conform to UL-207, "Standard for Safety: Refrigerant - Containing Components and Accessories, Nonelectrical," when operating with a maximum refrigerant pressure of 325 psig. Factory shall test DX coils with 325 psig compressed air under water. DX coils shall be dehydrated and sealed prior to installation.

.4 Coils shall be provided with a tube OD of 1/2” or 5/8”. Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface.

.5 DX coils shall be provided with brass distributor and solder-type connections. Suction and discharge connections shall be on the same end regardless of coil depth.

2.5 PRIMARY DRAIN PANS

.1 Unit(s) shall be provided with a drain pans under each cooling coil and where applicable, humidifier.

.2 Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width, and extend a minimum of 6” downstream of cooling coil.

.3 Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.

.4 Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.

.5 Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.

.6 Provide a minimum of 1” clearance between the drain pan and any coil casing, coil support or any other obstruction.

.7 Provide drain pan that allows the design rate of condensate drainage regardless of fan status.

.8 Provide drain pan sloped in at least two planes by at least 1/8” per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

.9 Drain pans shall be stainless steel or fibre reinforced plastic.

2.6 FANS

.1 General Description

.1 Units shall be provided with fans as shown on equipment schedule and drawings.

.2 Fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA.

.3 The fan section shall be provided with an access door on the drive side of the fan.

.4 Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame.

.1 Provide vibration isolation, as follows:

.1 ¼ hp thru to 1 ½ hp: Rubber isolation.

.2 Over 1 ½ hp: Internal Spring Isolation

.3 Rubber isolation is acceptable for direct drive plenum fans.

.5 DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.

.6 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance prior to shipment.

.7 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled design airflow. The fan shall not operate in a state of surge at any point within the modulation range.

.2 Belt Drive Fan, Bearings, and Drives

.1 Fans shall be provided with polished steel shafts with first critical shaft speed at least 125% of the maximum operating speed for the fan pressure class. Shaft shall have an anti-corrosion coating.

.2 Fan wheels shall be keyed to the fan shaft to prevent slipping.

.3 Fan shall be provided with an OSHA-approved belt guard to deter incidental contact with rotating sheaves and belts.

.4 Airfoil (AF) Fan

.1 Provide airfoil fans with blades formed of extruded aluminum, as scheduled. Bent sheet metal blades are not acceptable.

.2 Airfoil fans shall comply with AMCA standard 99 2408 69 and 99 2401 82. Provide an AMCA Seal on airfoil fans. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air performance.

.5 Bearings and Drives (Note to writer – applies to Belt Drive Fans only)

.1 Units fans shall be provided with bearings complying with ANSI/AFBMA 9 for fatigue life ratings and with an average life L10 of at least 200,000 hours, as scheduled.

.2 DWDI fans shall be belt driven complete with VFD. SWSI fans shall be belt drive or direct driven complete with VFD.

.3 Forward curved fans smaller than 18” shall be provided with permanently lubricated bearings. For other fans, manufacturer shall provide re-greaseable bearings with hydraulic grease fittings and lube lines extended to the motor side of the fan or to the exterior of the unit primary access side.

.4 Fans shall be provided drives selected with a 1.5 service factor. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer.

.5 Fixed pitch sheaves shall be provided on both the fan and motor. Fans with motors rated at 15 HP or less may be field balanced using variable pitch sheaves. Fixed pitch sheaves shall be provided when final balance is complete. Air balancer shall select and provide final set of sheaves.

.6 For Belt-driven fans with 10 HP motors or greater shall be provided with multiple belt drives. Belts shall be V-type, precision molded, raw edge construction, anti-static, oil- and heat-resistant.

.3 Direct Drive Fans

.1 Plenum (SWSI) Fan

.1 Plenum fan wheel shall be single-width, single-inlet.

.2 Plenum fan blades shall be aluminum backward-inclined airfoil.

.3 Plenum fan shall be direct-driven.

.4 Provide VFD with all direct drive fans.

.4 Fan Motors

.1 Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.

.2 Fan motors shall be provided with the following characteristics:

.1 Voltage, Frequency and Phase, as scheduled.

.2 Motor RPM, maximum 1800 rpm.

.3 Minimum service factor of 1.15.

.4 Premium efficiency, or as required to meet ASHRAE 90.1.

.5 NEMA design ball bearing type.

.6 Rated for continuous duty at full load in a 104°F (40°C) ambient.

.7 Electronically Commutated (EC).

.8 Suitable for use in variable frequency application, per NEMA MG-1 Part 30.

.9 Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2.

.5 Fan Motor Disconnects

.1 Manufacturer shall provide UL or ETL listed fan-motor disconnects and associated components. Disconnects shall comply with applicable provisions of the National Electric Code.

.2 Fused or non-fused fan-motor disconnects shall be provided in NEMA 3R enclosures.

.3 Provide single dead front disconnect.

.4 Disconnect shall be suitable for use as an OSHA lockout/tagout disconnect.

.5 Disconnect handles shall be lockable in the “off” position with up to three padlocks. Switch mechanism shall be directly lockable in the “off” position via padlock when door is open.

.6 Disconnects shall be provided with integral ground lug sized to be industry standard.

2.7 GAS HEAT SECTION

.1 The rooftop unit shall include a natural gas heating section. The assembly shall be an indirect fired type, having 80% minimum thermal efficiency.

.2 The gas furnace shall be factory installed downstream of the supply air fan in the heat section.

.3 The gas furnace shall be tubular in design with in-shot gas burners. It shall be of a floating stress relief design and be provided with a condensate drain connection.

.4 The heat exchanger shall be constructed of stainless steel.

.5 The heating section shall have modulating control with minimum 8:1 turn down.

.6 The heating section shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

.7 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber. The burner controller shall control pre-purge and post-purge fan operation.

.8 The ignition system, consisting of an electronic ignitor and pilot light will operate continuously with the furnace. The pilot light must extinguish when heating is not required.

.9 The factory-installed DDC unit control system shall control the gas heat module. The manufacturer’s unit certification shall cover the complete unit including the gas heating modules.

.10 All operating controls and functions shall be factory tested prior to shipment.

.11 Operating natural gas pressure shall be 7" (1750 Pa) W.C. The burner shall be capable of operating on propane systems with field conversion of orifices and other components as necessary.

2.8 PACKAGED MECHANICAL COOLING

.1 General

.1 Provide an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

.2 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

.2 Condensing Section

.1 Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

.2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0-120°F. Mechanical cooling shall be provided to 0º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

.3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material

.4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.

.5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

.6 Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

.7 Compressors shall be set on neoprene pads.

.8 Compressors shall be located on the side of the unit in a service enclosure complete with hinged access doors c/w lever lock handles for ease of service.

.9 Compressors shall have inbuilt overload and temperature protection.

.3 Hot Gas Reheat

.1 Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.

.2 Hot gas reheat coil shall be a copper tube/aluminum fin design. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

.3 The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

.4 Each coil shall be factory leak tested with high- pressure air under water.

2.9 HEAT PUMP HEATING

.1 The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

.2 The refrigerant system shall have a pump-down cycle.

.3 The unit shall have a natural gas furnace for hybrid heating. When the heat pump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.

2.10 ENERGY RECOVERY WHEEL SECTION

.1 The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.

.2 The wheel capacity, air pressure drop and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.

.3 The unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.

.4 The unit shall have 2” Merv 13 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door.

.5 The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

.6 The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

.7 Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Where segments are provided, segments shall be removable without the use of tools to facilitate maintenance and cleaning.

.8 Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.

.9 Wheel seals shall be contact brush seal on both the periphery of the wheel and the face. Seals shall be easily adjustable.

.10 The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface if a BACNet interface has been specified.

.11 The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall (stop, slow down) the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

.12 A mechanical purge shall be available and be field adjustable. Purge shall be capable of limiting Exhaust Air Transfer Ration (EATR) values to 0.4% through proper fan and purge adjustment.

.13 The energy recovery wheels shall have bypass dampers that allow for 100% outdoor air economizer operation of the unit.

2.11 FILTERS

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 Provide 2" filter rack on outdoor air intake for all units with energy recovery. (MERV 13)

.3 Provide 2" filter rack on return air (MERV 13)

.4 Two sets of filters, as well as a construction set of filters shall be provided.

.5 For units with filter banks 1825 mm (72") high or less, the filter modules shall be designed to slide out of the unit. Side removal filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

2.12 ECONOMIZER SECTION

.1 Unit shall be provided with an outdoor air economizer section.

.2 The economizer section shall include outdoor, return, and exhaust air dampers.

.1 Dampers provided shall be tested in accordance with AMCA 500.

.2 Dampers shall be formed damper blades or airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.

.3 Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g., and shall comply with ASHRAE 90.1.

.4 Damper frames shall be u-shaped galvanized metal sections securely screwed or welded to the air handling unit chassis. Pivot rods of 15 mm (1/2") aluminium, shall turn in bronze bushings, fabricated from self- oiling bronze. Rods shall be secured to the blade by means of straps and set screws.

.5 Blades shall be 1.3 mm (18 gauge) galvanized metal with two breaks on each edge and three breaks on centreline for rigidity. The pivot rod shall "nest" in the centreline break. Damper edges shall interlock. Maximum length of damper between supports shall be 1067 mm (42"). Damper linkage brackets shall be constructed of galvanized metal.

.6 Two position inlet dampers shall be parallel blade type complete with actuator.

.7 The outside and return air dampers shall be sized to handle 100% of the supply air volume.

.3 The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature.

.4 An outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The hood shall also include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

.5 A barometric exhaust damper shall be provided to exhaust air out of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

.6 Damper Control

.1 Outdoor Air Damper Control shall be controlled by the Building Automation System.

2.13 POWER EXHAUST

.1 Units without a return fan shall be equipped with a power exhaust fan.

.2 Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

.3 The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.4 Fan Control:

.1 The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field installer shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.14 FAN MOTOR VARIABLE FREQUENCY DRIVES (VFDS)

.1 Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.

.2 VFDs shall be mounted in a dedicated NEMA 3R compartment located on the primary access side of its associated fan section and wire VFD to motor, unless otherwise indicated on drawings.

.3 After unit installation, VFD shall be started and programmed by a factory trained and employed service technician.

.4 Unit(s) shall be provided with VFD disconnect and bypass.

.5 Unit(s) shall be provided with harmonic distortion feedback protection:

.1 Equivalent 5% impedance input line reactor.

.2 Integral RFI/EMI filtering to meet EMC EN61800-3 for First Environment.

.6 Unit(s) shall be provided with a user interface consisting of following features:

.1 30 Character multi-lingual alphanumeric display.

.2 Parameter set-up and operating data.

.3 Display data shall include:

.1 output frequency (Hz).

.2 speed (RPM)

.3 motor current

.4 calculated % motor torque

.5 calculated motor power (kW)

.6 DC bus voltage

.7 output voltage

.8 heat sink temperature

.9 elapsed time meter (re-settable)

.10 kWh (re-settable)

.11 input / output terminal monitor

.12 PID actual value (feedback) & error

.13 fault text

.14 warning text

.15 scalable process variable display

.7 VFD shall be provided with the following protection circuits:

.1 over current
.2 ground fault
.3 over voltage
.4 under voltage
.5 over temperature
.6 input power loss of phase
.7 loss of reference/feedback
.8 adjustable current limit regulator

.8 VFD shall be UL 508C approved for electronic motor overload.

.9 VFD shall be provided with features for high input transient protection and surge suppression, such as

.1 4 MOVs ahead of diode bridge.
.2 120 Joule rated 1600V diode module.
.3 Compliant with UL 1449 / ANSI 61.4.

.10 VFD shall be provided with the following communication features:

.1 Two programmable analog inputs.
.2 Six programmable digital inputs.
.3 Two programmable analog output.
.4 Three programmable digital relay outputs.
.5 BACNET Communications protocol.
.6 Adjustable filters on analog inputs and outputs.
.7 Input speed signals, including 4-20 mA and 0-10 VDC.
.8 Accel/Decel contacts [floating point control].
.9 Auto restart [customer selectable and adjustable].
.10 Integrated control interface for Siemens FLN, Johnson N2, Modbus RTU, BACnet MS/TP or LONWorks over RS-485.

.11 VFD shall consist of the following functions:

.1 Pre-magnetization on start.
.2 DC braking/hold at stop.
.3 Ramp or coast to stop.
.4 Seven preset speeds.
.5 Three critical frequency lockout bands.
.6 Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start.

2.15 ELECTRICAL WIRING

.1 Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with CSA standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be CSA recognized.

.2 A terminal block shall be provided for the main single point power connection. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit.

.3 Each compressor and condenser fan motor shall be furnished with contactors and internal thermal overload protection. Supply fan motors shall be supplied with external overload protection.

2.16 UNIT CONTROLS

.1 The unit shall be equipped with a microprocessor based control system. The unit's control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interfaces required for the operation of the unit.

.2 The unit control system shall be able to perform all unit control functions, including scheduling, unit diagnostics and safeties with and without connection to a building automation system.

.3 The controller shall have a 4 line x 20 character display with all information and instructions shown in plain English. A keypad shall allow information and controls to be accessed. The microprocessor shall have a programmable time clock, store current and past alarm conditions.

.4 All factory wiring shall be internal to the unit to maintain product standards for less than 1% air leakage.

.5 All wiring at unit splits shall be connected with quick-connects - no field splicing of wiring is allowed.

.6 Control panels shall be factory mounted and all end devices shall be terminated either directly to the controller or to a terminal block.

.7 Control panels shall include integral 24VAC transformers with circuit breaker overloads.

.8 No low voltage controls or communication wiring shall be running in the same tray, conduit or proximity as any high voltage wiring.

.9 Averaging temperature sensors shall be mounted to cover as much cross-sectional area of the interior unit as possible. End and support brackets shall be provided to support sensing element and eliminate strain.

.10 For mounting probe temperature sensing elements at discharge and air inlet openings, support brackets shall be provided a solid mounting location to minimize vibration effects.

.11 All actuators for control dampers shall be mounted within the frame of the damper. Actuators shall be mounted on the access side of the damper to facilitate commissioning and servicing.

.12 Low temperature cut out sensors shall be mounted on downstream face of first water coil within the coil housing frame.

.13 High temperature cut out sensors shall be mounted, so that the manual reset switch is accessible from the fan section access door. The temperature sensor shall be mounted in the discharge air stream.

.14 High and low pressure cutout devices shall be mounted so that the manual reset switch is accessible from the fan section access door without putting operator at risk.

.15 Factory mounted control panels shall be mounted to the exterior wall of the supply fan section. Internal unit wiring is brought into the panel through a single rear knockout. The penetration shall be sealed to prevent air and leakage moisture leakage. Power shall be provided from the single point power connection on the unit.

.16 Factory packaged controls shall be factory tested using a functional test method. All inputs [AI, BI, DI] and outputs [AO, BO, DO] shall be tested. All sensors and switches shall be cycled through a change of state. All actuators shall be stroked to verify correct operation and rotation through the full operating range. The factory test data results shall be fully documented including all operational conditions. A factory test report document shall be available for each unit. The factory test report shall be provided to the commissioning agent.

2.17 BAS INTEGRATION

.1 Provide BACNet integration card.

.2 Provide internal wiring to terminal strip in NEMA 1 enclosure, with space for future DDC controller by BAS contractor. Provide the following points.

.1 Supply Fan Start/Stop/Status.

.2 Return Fan Start/Stop/Status.

.3 Mixed Air Damper Modulation.

.4 ERW Bypass Damper Modulation.

.5 Mixed Air Temperature.

.6 Supply Air Temperature Reset.

.7 Heating Enable/Disable/Status.

.8 Cooling Enable/Disable/Status.

.9 HeatPump Enable/Disable/Status.

.10 Energy Recovery Wheel Enable/Disable/Status

.11 Alarm Status.

2.18 ACCESSORIES

.1 Roof Curb

.1 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of **600 mm (24") high** and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 25 mm (1") upturn on inner perimeter, to provide a complete seal against the elements. Provide on the interior of the roof curb 100 mm (4") thick rigid foil faced insulation over entire surface. Foil tape all joints including joints at curb. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

.2 Roof curb shall be matched to the roof slope, and be level in both axes.

2.19 CAPACITY

.1 Provide unit capacity indicated on schedules.

Part 3 Execution

3.1 INSTALLATION

.1 Fabricate to provide smooth air flow through all components. Limit air leakage to 1% of rated air flow at 2.5 kPa (10" w.c.) suction pressure.

.2 Apply sealer into all seams prior to assembly. Secure toe angles continuous along entire length of assembly.

.3 Install to manufacturers requirements.

3.2 FANS

.1 Install flexible connections at fan outlets. Ensure metal bands of connectors are parallel and not touching when fan is running and when fan is stopped. Ensure that fan outlet and duct are aligned when fan is running.

3.3 START-UP/COMMISSIONING

.1 Unit manufacturer shall perform start-up and commissioning.

3.4 SPARE PARTS

.1 Two (2) complete sets of filters.

.2 One (1) set of spare belts.

3.5 WARRANTY

.1 One (1) year on parts on all components.

.2 Five (5) years on Energy Recovery Wheel media.

.3 Ten (10) years on heat exchanger.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ARI 210/240, Standard for Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.3 ANSI/ARI 320, Standard for Water-Source Heat Pumps.

.4 ARI 325, Standard for Ground Water - Source Heat Pumps.

.5 CAN/CSA-C656, Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.6 CAN/CSA-C13256-1, Water Source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps.

.7 CAN/CSA-C13256-2, Water-source Heat Pumps – Testing and Rating for Performance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps.

.8 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.9 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Capacities.

.2 ARI Ratings.

.3 Sound Power levels.

.4 Installation instructions.

.5 Start-up Instructions.

.6 O&M Instructions.

1.3 WARRANTY

.1 Contractor hereby warrants heat pumps in accordance with general requirements, but for 5 years.

Part 2 Products

2.1 GENERAL

.1 Heat pumps to be EPS 1/RA/2, CSA approved and carry ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Refrigerants: use only refrigerants approved by Environment Canada and conforming to intent of Montreal Protocol and all amendments.

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 INCREMENTAL WATER SOURCE HEAT PUMP

.1 General:

.1 Horizontal type, as indicated, consisting of factory-assembled package containing fan, air-to-refrigerant coil, compressor, 4-way reversing valve, water-to-refrigerant heat exchanger, controls for use with -R for 1 ton units and R410A for units 1.5 tons and over. Unit complete with 2-way & 3-way control valves. Control of 2-way & 3-way valves by BAS System. Refer to plans for locations of 2 & 3-way control valves.

.2 Performance:

.1 Certified in accordance with CAN/CSA-C655.

.2 As indicated on the drawings.

.3 Ratings in accordance with CAN/CSA-C655.

.3 Basic unit:

.1 Compressor: welded hermetic type with internal vibration isolation. Controls to prevent compressor short cycling.

.2 Air-to-refrigerant coil: aluminum plate fins mechanically bonded to copper tubing with all joints brazed and with all controls factory installed.

.3 Water-to-refrigerant heat exchanger: copper integral finned inner tube tested for maximum working pressure of 2 MPa (290 psi).

.4 Refrigerant piping: factory assembled, tested charged with refrigerant sealed, with thermal expansion valve, pilot operated refrigerant reversing valve, high pressure and low temperature safety cut-outs.

.5 Water piping within unit: factory assembled and tested to 1.4 MPa (203 psi).

.6 NPT connections: ball valve tested to 1.4 MPa (203 psi) WOG (on supply line) and ball valve tested to 2.8 MPa (406 psi) WOG (on return line), flexible hose with threaded swivel connections on supply and return lines to heat exchanger.

.7 Piping connections: arranged so that only one supply and return connections to hydronic system is required on site.

.8 Fan: centrifugal forward curved with double inlet, statically and dynamically balanced direct from multi-speed, factory **ECM** lubricated motor. Provide fan speed controller.

.9 Filters: 25 mm (1") thick MERV 8 filters

.10 Unit cabinet: constructed of heavy gauge die-formed galvanized steel with welded corner bracing, complete with provision for connection to return ductwork, hanger brackets and vibration isolators.

.1 Console cabinet to be acoustically insulated.

.2 Finish: oven baked enamel.

.11 Provide for field connection of water and electrical services.

.12 Condensate drain: pan and piping designed to ensure complete removal of all water. Drain connections: minimum NPS 20 mm (3/4").

.13 Provide the following minimum hose kit, isolating valves, **MANUAL** circuit balancing valves and strainers:

.1 up to and including 2½ ton unit: 20 mm (3/4").

.2 3 ton unit: 25 mm (1").

.3 3½ ton unit and over: 32 mm (1¼").

.4 Controls:

.1 Units shall consist of a factory installed microprocessor-based control system, wired and piped, which shall optimize operation, and run self-diagnostics.

.2 Manufacturer to provide any special tools like a hand held terminal for any configuration **2 of such tool** with all associate wiring and licensing to be provided as part of the project. (The tool to be new and not to be used for commissioning purpose). Software tool is not preferred. If only software tool is available. Ensure that all upgrade and licensing provision for next 5 years is factored in and all associate interface cables are provided. (2such tool)

Factory certified vendor training and documentation to be provided

.3 O.E.M. furnished controller must use the following inputs for control:

.1 Binary input from Building Automation System to command / enable / disable Mechanical Cooling

.2 Binary input from Building Automation System to command / enable / disable Heating.

.3 Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)

.4 O.E.M. furnished controller must provide a binary output or dry contact set for indication of unit fault.

.5 Unit shall be equipped to accept signal from end switch on 2-way control valve provided by others. Upon activation, the unit shall turn off the compressor.

.6 Unit shall be equipped with a condensate overflow switch. Upon activation, the unit shall turn off the compressor.

.7 Unit Control will be by the Building Automation contractor in accordance with Section 25 20 11.

.5 Noise and vibration requirements:

.1 Sound ratings: measured from unit casing at unit inlet while in cooling mode.

.2 Maximum permissible outlet Sound Power Levels (DB re 10 to -12 Watts).

.3 Where manufacturer cannot meet specified Sound Power Levels, provide downstream or upstream silencer. Where radiated noise level exceeds specified PWL, provide special enclosure around entire unit, designed to fit in allotted space and still allow full access to unit for O&M.

.6 Acceptable materials:

.1 Daikin

.2 Johnson/Water Furnace

.3 Carrier

.4 Trane

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated and in accordance with manufacturers instructions.

.2 Secure with hold-down bolts.

.3 Make all duct connections through flexible connections.

.4 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.5 Make all piping connections.

.6 Nothing to obstruct ready access to all components or to prevent removal of components for servicing.

3.2 DRAIN PANS

.1 Install so that no water can accumulate and arrange so as to be easily accessible for cleaning.

3.3 START-UP AND COMMISSIONING

.1 Manufacturer to certify installation.

.2 Manufacturer to be present during start-up, and test and start up units, and certify.

.3 Manufacturer to provide verbal and written instructions to operating personnel.

.4 Submit written report to Consultant.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, capacity, piping, and connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

.3 Special enclosures.

.3 Primer coat to be off white.

.4 All hydronic heating shall be by a single manufacturer.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 DAMPERS

.1 Factory built, internal damper, complete with operator, at enclosure air outlet grille for each convection type heating unit not thermostatically controlled. Refer to schedules on drawings.

2.2 CAPACITY

.1 As indicated.

2.3 EXISTING WALL FIN AND CABINET RADIATION (H-EX)

.1 Remove existing cover, vacuum existing fin and components.

.2 Replace damaged components including but not limited to hangers, wall mounting brackets.

.3 Replace existing control valve where installed and ensure operation.

.4 Replace isolating valves as indicated.

.5 Replace existing cabinet. Provide new filler pieces etc., to match existing cabinet.

2.4 HORIZONTAL UNIT HEATERS (H-1)

.1 Casing: 1.6 mm (16 gauge) thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 1 MPa (145 psi).

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

.4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.

.5 Air outlet: two-way adjustable louvres.

.6 Capacity: as indicated.

.7 Control: room thermostat: electric, line voltage, locking cover, set point locking device, concealed adjustment, plastic cover. (By Building Automation Contractor).

.8 Acceptable materials:

.1 Engineered Air H-Series

.2 Slant Fin

.3 Sigma

.4 Dunham-Bush

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and reviewed shop drawings.

.3 Provide for pipe movement during normal operation.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

.6 Valves

.1 Install valves with stems upright or horizontal unless approved otherwise.

.2 Install isolating gate valves on inlet and balancing valves on outlet of each unit.

.7 Venting:

.1 Install screwdriver vent on cabinet convector, terminating flush with surface of cabinet.

.2 Install standard air vent with cock on continuous finned tube radiation.

.8 Clean finned tubes and comb straight.

.9 Install flexible expansion compensators as indicated.

.10 Mount wall mounted convectors at 200 mm (8") above finish floor.

.11 Mount wall mounted radiation at 200 mm (8") above finish floor unless otherwise indicated.

.12 Thermostats on outside walls: mount on insulated backplates.

.13 On units fed from below floor provide factory manufactured piping shrouds on the exposed piping between base of the radiation cabinet and finished floor. Shroud shall be manufactured by the radiation manufacturer. Shroud shall match finish of the radiation cabinet.

.14 On fan forced units set discharge patterns and fan speeds to suit requirements prior to acceptance.

.15 Provide new filter media.

END OF SECTION

Part 1 General

1.1 GENERAL NOTE

.1 This Section is to be read in conjunction with Division 1, the General Conditions and Section 15010, the General Requirements of the Mechanical Trades, and the documents required by the BIDDING REQUIREMENTS and CONDITIONS OF THE CONTRACT sections.

.2 All pricing shall be in accordance with Catholic School Board Services Association (CSBSA) Agreement.

.3 All pricing submissions shall include the following supporting documents; Detailed List Summary, Poteau Analysis, Project schedule and summary letter.

.4 The controls (BAS) contractor will work for the Owner.

.5 GENERAL

.1 The work shall include design, supply, installation, and commissioning a complete microprocessor based automatic control system to achieve the performance specified in the following clauses.

.2 The control system shall be installed by the control subcontractor but as an integral part of the mechanical sub-contract. The system shall be installed by trade certified electricians regularly employed by the control sub-contractor.

.3 The controls contractor will specifically read all mechanical and electrical drawings, specifications, and addenda and determine the controls work provided by the mechanical contractor, his subcontractors, and the electrical contractor. The controls contractor is expected to have the expertise to coordinate the work of other contractors and to make a completely coordinated Building Automation Control System (BAS) for the mechanical systems. The controls specifications are specifically written to coordinate the mechanical and electrical systems. Where others are specifically specified to allow for controls work, then the BAS contractor will not allow for that work. This clause is not intended to make the controls contractor responsible for work not specified, but to make the BAS contractor responsible for examining the specifications for contradictions and overlap.

.4 All work indicated in the plumbing drawings and associated with the fire protection or plumbing systems will be the responsibility of the mechanical contractor unless specifically indicated in the controls sequence of operation or points list.

.5 The BAS contractor shall provide the necessary engineering, installation, supervision, commissioning and programming for a complete and fully operational system. The contractor will provide as many trips to the job site for installation, supervision, and commissioning as are necessary to complete the project to the satisfaction of the consultant and/or school board project supervisor.

.6 The system shall consist of all operator interfaces, microprocessor-based controllers, sensors, wells, automatic control valves, control dampers, transducers, and relays, automatic control valves, and damper actuators.

.6 SCOPE

.1 This project scope shall include, but not be limited to, the following work:

.1 Preparation of control shop drawings for review and approval. See Submittals.

.2 Supply and install a network of Building Automation Control System (BAS) panels and field devices. See Hardware, Software and Field Devices.

.3 Supply and install customized graphics software to the school board standards, system software, and third party software as specified. See Software.

.4 Install, wire and label all BAS control system components. See Installation.

.5 Calibrate and commission the installed control system. See Commissioning.

.6 Provide maintenance manuals and as-built drawings. See As-Built Documentation.

.7 Provide customized training for school board operations, maintenance and technical staff. See Training.

.7 APPROVED SYSTEMS

.1 Bids for the BAS contract will be tendered separately by the school board.

.8 SUBMITTALS

.1 Submit the six (6) copies of following information to the consultant and/or the school board project supervisor for review and approval:

.2 Control Schematics

.3 Detailed sequence of operation for each control schematic or controlled system.

.4 System Architecture indicating the proposed interconnection and location of all BAS panels, network connections and key peripheral devices (workstations, modems, printers, repeaters, etc.)

.5 BAS Points List indicating the panel ID, panel location, hardware address, point acronym, point description, field device type, point type (i.e., AO/DO/AI/DI), end device fail position, end device manufacture and model number, and wire tag ID).

.6 Wiring diagrams including complete power system, interlocks, control and data communications.

.7 Manufacturers' data / specification sheets for all material supplied.

.9 RELATED WORK

.1 Unless otherwise specified, the following work shall be furnished by others:

.1 The mechanical sub-contractor shall provide:

.1 Water treatment system mechanical wiring.

.2 The BAS contractor shall provide:

.1 Boiler mechanical wiring

.2 DX-cooling solenoid interlock

.3 AHU freeze stats and high limit

.4 Remote VFDs alarm interlock

.3 The mechanical sub-contractor under the supervision of the controls subcontractor shall provide:

.1 Installation of control dampers including duct transitions, assembly and inter-connection of multiple section dampers.

.2 Supply and installation of sheet metal baffles as required to eliminate air stratification.

.3 Supply and installation of access panels for service and installation of control equipment.

.4 Installation of automatic valves, wells, flow switches, and other pipe related control devices.

.10 SYSTEM HARDWARE

.1 The system architecture will be comprised of an Operator Workstation, PCUs (Primary Control Units), PACs (Programmable Application Controllers) and ASCs (Application Specific Controllers) networked together to provide a system of connected controllers that operate as a single BAS for the entire project.

.2 Supply PCU's, PAC's and ASC's as required to interface to all specified equipment.

.3 Allow minimum 25% spare program and trend memory capacity in each PCU and PAC.

.4 Primary Control Units (PCU)

.1 Use only Primary Control Units namely Reliable Mach-Global, Mach 2 or Mach 1 to directly control any major mechanical equipment. Major mechanical equipment includes air handling units, boiler plants, chiller plants, cooling towers and other critical equipment.

.2 Every installation shall have a minimum of one (1) Reliable Mach-Global Panel.

.3 Each PCU shall provide an RS-232 port for direct connection to a PC.

.4 Each PCU shall contain a real time clock and sufficient memory to store its own application database, operating parameters, user programs and trend data storage.

.5 Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours to eliminate operating data reload in case of power failure.

.6 Each PCU output shall include a Hand/Off/Auto (HOA) selector switch for all analogue and digital outputs used to control major equipment as described above.

.7 Each PCU shall have a minimum of 10% spare input channels and 10% spare output channels installed onboard the panel and ready for connection at the completion of the project.

.8 The PCU shall have a minimum of eight (8) inputs and eight (8) outputs.

.5 Programmable Application Controllers (PAC)

.1 PACs are fully programmable controllers namely Mach 1 panels, used for controlling distributed equipment such as radiation, reheat coils, exhaust fans and other distributed equipment. PACs interface to the Primary Control Units via on a sub-network.

.2 PACs shall not be used for controlling major mechanical equipment as described above.

.3 Each PAC shall contain a real time clock and sufficient RAM to store its own application database, operating parameters, user programs and trend data storage.

.4 Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours to eliminate operating data reload in case of power failure.

.5 Each PAC output shall include a Hand/Off/Auto (HOA) selector switch for all analogue and digital outputs used to control major equipment as described above.

.6 The PAC shall have a minimum of eight (8) inputs and eight (8) outputs.

.6 Application Specific Controllers (ASC)

.1 Application Specific Controllers are pre-programmed controllers namely Reliable Mach-Air panels, used to control typical equipment such as rooftop units.

.2 ASCs shall not be used to control major mechanical equipment or non-typical equipment.

.7 Operator's Work Station

.1 Supply and install all operating software and dynamic system graphics on the Operator's Workstation. Workstation to be supplied by the school board.

.2 Supply licenses for all supplied software directly to the School Board Project Supervisor.

.8 System Remote Access

.1 WAN Access

.1 Provide necessary interface and cabling to connect the BAS to the school board WAN. Obtain the particular WAN system details from the Engineer or School Board Project Supervisor.

.2 WAN IP address to be supplied by the school board.

.2 Alarms

.1 Provide and wire a dedicated input to monitor alarming and disarming of the building security system.

.3 Local PC Ports (RS-232)

.1 Where BAS points (4 or more) are located in a mechanical room that does not have a local BAS panel installed, a remote serial port connector (9-pin female) shall be provided to allow for local interface to the BAS via the portable maintenance interface.

.2 Mount the serial connector in a hinged metal enclosure with key-lock set and lamicoid ID label.

.11 SYSTEM SOFTWARE

.1 Operators Workstation Software and Graphical Interface

.1 The Operators Workstation software shall be the latest version of the manufacturers product (RC-Studio) and original software disks / CD's shall be provided to the school board.

.2 The software shall provide access to all controllers, points programs and systems.

.3 The Graphical User Interface shall be installed and dynamically updated.

.4 The Graphics shall be installed as per the school board standards specified in section 15900-16 of this document.

.2 Trend Data

.1 Provide trend logs for every hardware input and output.

.2 All trends should be accessible via the graphical interface.

.3 Trends should contain all related variables of a control loop (i.e. setpoint, measured variable and control output) and have the ability to be plotted simultaneously on the same graph. Field Devices Individual trends should provide an appropriate "snapshot" of the variable. Slow reacting variables such as space temperatures should be sampled every 30 - 60 minutes while other variables such as mixed air or boiler water temperatures should be sampled every 5 to 10 minutes. Trends should contain a minimum of 72 hours worth of trend data.

.4 The primary input sensor for all control loops must connect to the same panel containing the control loop output.

.5 Trend data storage must be in the same panel as the hardware or logical points being trended.

.3 User Access

.1 The remote connection to the BAS will be configured to allow for the same user commands and functionality as the local front-end connection. The modem connection will allow a remote user to perform panel database uploads/downloads on all BAS panels in the system.

.2 The system will be configured so that a remote user (dial-in or LAN) and local user can be logged onto the BAS simultaneously, and be able to access all controllers, points and programs in the system.

.4 Alarms

.1 The BAS will be configured to provide for remote alarm capabilities. The BAS shall be capable of dialling out to a minimum of three separate telephone numbers. Designated alarms will be capable of being sent to one or more telephone numbers.

.2 Alarms will be sent in ASCII text format.

.3 The controls vendor will verify that the designated remote workstation successfully receives a series of test alarms

.4 Provide and wire a dedicated output to interface to a designated building security/surveillance. This output will be programmed to initiate

.12 FIELD DEVICES

.1 Automatic Control Valves

.1 Submit a valve schedule for all valves supplied under this contract. The valve schedule will contain the following information for each valve:

.2 Valve type, size, manufacturer, model number, flow coefficient, design flow, pressure drop across valve, max. close-off pressure, actuator manufacturer and model number and maximum torque.

.3 Zone valves shall have a design pressure drop of approximately 1.0 psi. HVAC control valves shall have a design pressure drop between 3 and 5 psi. The minimum allowable CV shall be 0.8 regardless of pressure drop.

.4 Valves used for throttling applications shall have a linear percentage-to-flow characteristic.

.5 Ball valves are the preferred valve type for zone and HVAC control valves. Globe and butterfly valves shall be used where required to provide the desired pressure drop and CV.

.6 Automatic Control valves shall be manufactured by Belimo.

.2 Control Valve Actuators

.1 Size control valve actuators to provide a tight close off against system head pressures and pressure differentials.

.2 Valve actuators shall accept a 0-10VDC control voltage for all proportional applications.

.3 Floating-point control of valves are not acceptable under any circumstances.

.4 Heating valves shall spring-return fail open and cooling valves shall spring-return fail closed. Non-spring-return control valves may be used for terminal reheat coils and large HVAC control valves requiring a higher close off pressure.

.3 Damper Actuators

.1 Actuators shall be direct coupled for either modulating or two-position control. Actuators shall be powered by an overload-proof synchronous motor. Provide 0-10 VDC control voltage for all proportional applications and either line or low voltage actuators for all two-position applications.

.2 Damper actuators are to be manufactured by Belimo.

.3 Duct temperature sensors shall be installed in the airflow down stream of every duct mounted reheat coil.

.4 Duct temperature sensors shall be installed downstream of all variable air volume boxes with reheat coils installed.

.4 Automatic Control Dampers

.1 All automatic control dampers not furnished with packaged equipment shall be supplied by the controls subcontractor and installed by the sheet metal subcontractor. All dampers in a mixing application shall be opposed blade. Parallel blade shall be permitted in other applications. Dampers shall be a tight closing, low leakage type with replaceable extruded vinyl seals on all outdoor and exhaust applications.

.5 Room Sensors/Thermostats

.1 Mount sensors at a height of 5’-6’’ unless otherwise indicated.

.2 10 k ohm type-3 thermistors only shall be used and shall have end-to-end accuracy +/- 0.3 deg C over the entire operating range.

.3 Provide stainless steel plate sensors for public areas such as stairways, vestibules, lobbies and gymnasiums.

.4 Room sensors will not normally have setpoint adjustment. Provide an external setpoint adjustment only when specified for specific offices or meeting rooms.

.5 Mount thermostats and space sensors as noted on the drawing. Do not mount on outside walls without permission of consultant.

.6 Supply and install heavy-duty thermostats for unit heaters, electric radiation or fan coil units where specified.

.6 Current Switches (Digital)

.1 Provide BAS status for fan and pump motors using a mosfet type digital switch. Acceptable manufactures are ACI, Enercorp, Greystone and Veris, and Elkor.

.7 Pressure Transmitters

.1 Technical Performance - Solid State design, operating on capacitance principle, with non-interactive fine resolution, zero and span adjustments. End-to-end accuracy +/- 2% of full-scale pressure range, including temperature compensation. 4-20mA or 0-5 VDC output.

.2 Standard of Acceptance – ACI, Enercorp, Greystone, Modus

.8 Duct Temperature Sensor

.1 Probe - Technical Performance – 10 k ohm thermistor sensor encapsulated in a 200mm long, 6mm OD copper or stainless steel probe. Operating range 0-60 degrees C. End-to-end accuracy +/- 0.3 deg C. Assembly complete with wiring housing and mounting flange.

.2 Averaging - Technical Performance - 10 k ohm thermistor constructed of FT6 plenum rated cable or soft copper tubing, incorporating numerous temperature sensors encapsulated at equal distances along the length of the element. The assembly acts as a single sensor reporting the average temperature form all individual sensors. End-to-end accuracy +/- 0.3 deg C. Assembly complete with wiring housing and mounting flange. Mount in a zigzag manner to provide continuous coverage of the entire duct cross-sectional area.

.9 Outdoor Air Temperature Sensor

.1 Two outdoor air temperature sensors shall be installed and shall be programmed to check each other for accuracy. In the event of sensor failure the sensor deemed to be accurate should be used to control the systems. The outdoor air sensors shall be located on a north wall if possible and a minimum of three (3) feet from any opening in the building envelope, which could affect the sensor readings. The back face of the sensor enclosure shall be insulated to prevent temperature pick up from the building wall.

.2 Technical Performance, 10 k ohm thermistor -50C to 50C in a weatherproof enclosure mounted on north exposure. End accuracy of +/- 0.3 deg C over the entire operating range.

.10 Pipe Temperature Sensor

.1 Well - Technical Performance - 10k ohm thermistor sensor encapsulated in a 6mm OD, 50mm long probe, with screw fitting for insertion into a standard thermowell. Operating range -10 - +100 degrees C. End-to-end accuracy +/- 0.3 deg C over the entire operating range. Comes complete with brass thermowell. Use conductive gel when mounting the sensor in thermowell. Use heat transfer paste when mounting the sensor in thermowell. No surface mount strap on temperature sensors shall be used to monitor fluid temperature unless approved by the engineer.

.11 C02 Detector

.1 Technical Performance – Infrared CO2 monitor c/w 4-20mA or 0-5 VDC output, accuracy of +/- 40 ppm +3% reading.

.2 Standard of Acceptance – Vulcain 90DM4DT-C-2000 duct mount, Vulcain 90DM4ASM wall mount.

.12 Electrical Phase Monitor

.1 Every installation shall include an electrical phase monitor installed on the incoming power supply to the building.

.2 In the event of an electrical phase loss the phase loss monitor shall immediately shut down all electrical motors controlled by the BAS.

.3 If a phase loss is detected the BAS system shall generate an alarm, and the alarm shall be sent to the boards central monitoring station.

.13 Airflow measuring stations required to accomplish the specified control sequence shall be furnished under this section but installed under the sheet metal section. Airflow measuring stations shall be of heavy gauge metal construction, and shall be furnished with an air straightening section with an open face area of not less than 97%.

.1 Each airflow measuring station shall measure airflow by means of a network of static and total pressure sensors factory positioned and connected in parallel to produce an averaged velocity pressure. The measured velocity pressure converted to airflow (CFM) shall have an accuracy within 2% of the full scale throughout the velocity range from 700 to 4,000 fpm when measured under ideal laboratory conditions. The location of stations shall meet manufacturer's guidelines.

.2 The maximum resistance to airflow shall not exceed 0.6 times the velocity head. The unit shall be suitable to withstand temperatures up to 121°C (250°F).

.13 INSTALLATION STANDARDS

.1 Power Sources and Wiring Methods

.1 All wiring line and low voltage shall be installed in EMT conduit unless specifically specified otherwise.

.2 In accessible ceilings wiring from BAS controllers to sensors and actuators, control system network and low voltage wiring only may be installed with yellow jacket LVT cable. Where the ceiling is used as a return air plenum install plenum rated yellow jacket cable instead of LVT.

.3 BX or flex conduit may only be used for the final (approximately one meter) run to controls devices, where the controls equipment is mounted on vibrating machinery.

.4 Install EMT and cable at right angles to building lines, securely fastened, and in accordance with the standards set out in Division 16.

.5 No wire smaller than 18 gauge wire is to be used on the project except for: wiring between terminal computer devices, wire in standard communication cables, such as printers and short haul modems, wire used in communication networks, i.e. any cable transferring digital data, using twisted shielded pairs.

.6 All wiring from panels to devices shall be without splicing.

.7 Provide wells for all specified temperature sensors in hydronic piping system. Strap-on sensors may be only be used where a well installation is not possible. Obtain approval of Engineer for the use of strap-on sensors.

.8 Power for control system shall not be obtained by tapping into miscellaneous circuits that could be inadvertently be switched off.

.9 Mount transformers and other peripheral equipment in panels located in serviceable areas. Provide line side breakers/fuses for all transformers.

.10 All 120 VAC power for any controls equipment shall be from dedicated circuits. Provide a breaker lock for each breaker used to supply the control system. Update the panel circuit directory.

.11 The controller may be powered from the equipment that it is directly controlling (i.e. heat pump, roof-top unit) only if the controller controls no other equipment and the power supply to the controller remains energized independently of unit operation or status.

.12 All BAS control panels shall be provided with UPS in the power supply except for Application Specific Controllers (ASC).

.13 All BAS control wiring shall be yellow jacket for identification purpose.

.14 The breaker or power isolation location shall be clearly marked on the inside door of each BAS panel enclosure.

.2 Equipment Location

.1 All distributed equipment such as VAV boxes, Roof top units, unit ventilators, fan coil units, etc. that utilize dedicated BAS controllers, shall have locally mounted controllers, in accessible locations within the building envelope. All locally mounted controllers shall be installed in enclosures suitable for that location. BAS controllers for mechanical equipment other than those listed above shall be mounted in mechanical rooms as noted below, unless specifically approved by the Engineer for this project.

.2 All other BAS controllers, and interface devices that require regular inspection or that serve multiple HVAC systems shall be located in mechanical rooms, or in pre-approved storage rooms, or janitor closets.

.3 All BAS panels shall be located within the building envelope, and shall be enclosed in a metal locking enclosure, as specified elsewhere herein.

.4 All equipment located in mechanical rooms, storage rooms or janitor closets shall be installed in metal cabinets with hinged, lockable covers. Provide an school board-standard #549 key/lock set for each cabinet.

.5 Transformers or power supplies shall not be located in ceiling spaces unless approved by the engineer for terminal control valves, actuators or zone controllers. When transformers are installed above ceilings, transformers shall be installed in metal enclosures, and the location shall be clearly labelled on the t-bar ceiling to indicate power transformer location.

.6 A 120 VAC duplex receptacle for laptop power shall be provided if the cabinet is located further than 1500 mm (5’) laterally from the nearest outlet.

.14 IDENTIFICATION AND LABELLING OF EQUIPMENT

.1 All panels must have a lamicoid tag (min. 3”x1”) affixed to the front face indicating panel designation and function (i.e. “BAS Panel 1” or “Relay Panel 3”).

.2 All field sensors or devices must have a lamicoid tag (min. 3”x1”) attached with tie-wrap or adhesive indicating the point software name and hardware address (i.e. AHU1_MAT, 2.IP4).

.3 Room sensors and other sensors in finished areas do not require a device tag.

.4 All devices within a field enclosure will be identified via a label or tag.

.5 All BAS panel power sources must be identified by an adhesive label indicating the source power panel designation and circuit number on the outside of the enclosure door (i.e. “120vac fed from LP-2A cct #1).

.6 All field equipment panels fed from more than one power source must have a warning label on the front cover.

.7 All wires will be identified with self-adhesive wire labels or clip-on plastic wire markers at both ends.

.8 All rotating equipment controlled by the BAS will have a tag or label affixed indicating that the equipment may start without warning.

.9 If a phone line manager is supplied, its location should be indicated via a label affixed to the inside cover of the modem enclosure or BAS panel.

.10 All BAS panels will have a points list sheet (within a plastic sleeve) attached to the inside door. The points list will identify the following for each point: Panel number, panel location, hardware address, software name, point description, field device type, point type (i.e. AI or DO), device fail position, device manufacturer and model number or reference and wire tag reference.

.11 Where required, field panels will have wiring diagrams attached to the inside door.

.12 Provide new or modify existing equipment wiring diagrams (i.e. boilers, chillers, etc.) wherever the BAS interfaces to other equipment.

.15 COMMISSIONING

.1 Confirm and demonstrate to the Engineer Mechanical Contractor, and the Owner’s agent that that all systems are programmed and operating correctly.

.2 Submit four (4) copies of the system commissioning report to the Engineer for review and approval.

.3 Each analogue inputs (i.e. temperatures, pressure, etc.) shall be verified with an approved calibration device. All actual temperature readings should be with +/- 1C of the readings observed at the workstation.

.4 Each analogue output shall be verified by manually commanding the output channel from the operator workstation to two or more positions within the 0-100% range and verifying the actual position of the actuator or device. All devices shall operate over their entire 0-100% range from a minimum control range of 10-90%.

.5 Digital outputs shall be verified by witnessing the actual start/stop operation of the equipment under control.

.6 Digital inputs shall be verified by observing the status of the input point as the equipment is manually cycled on and off.

.7 Record all out-of-season or unverified points in the commissioning report as “uncommissioned”.

.8 The BAS field panel power source shall be toggled on and off to ensure reboot functionality and power down memory retention of all parameters. During the power down test, all connected system components should go to their fail-safe state.

.9 All trends should be reviewed to ensure that setpoints are being maintained and excessive cycling of equipment is not occurring.

.10 Control loop-tuning parameters can be verified by applying a change to the current setpoint and observing the resulting trend log. Setpoint should be reached in a “reasonable” period of time without excessive cycling or hunting of the controlled device.

.16 TRAINING

.1 The school board staff shall provide training for the building operations staff.

.2 At the completion of the installation and immediately following commissioning provide a ½ day training session on site for the Owner's designated maintenance personnel.

.17 WARRANTY

.1 Warranty all components supplied under this contract for a period of one year from substantial completion. Replace all controls equipment that fails during this period without cost to the owner.

.18 AS-BUILT DOCUMENTATION

.1 Within two weeks following substantial completion of the project, update the original submittal documents to reflect the "As Built" conditions of the project and submit as many copies as are required by the consultant and/or the School Board Project Supervisor.

.2 Provide a separate laminated copy of the control drawings for mounting in the mechanical room or in the controls panels as directed by the consultant or the School Board Project Supervisor.

.3 Submit diskettes/CD’s (including back-up diskettes/CD’s) containing up to date copies of the programs in each controller. Provide original program disks and documentation proving registration for all software programs provided as a part of this contract including: the BAS operator interface software, and the BAS graphics (Illustrator files & bitmap files). Provide one set of original disks for every computer supplied under this contract or that the software has been loaded onto.

.4 Submit (4) printed copies of the final programs that include all point definitions, weekly and annual schedule setting, controller setpoints and tuning parameters, and documented programmed sequences of operation.

.19 GRAPHIC DISPLAY SCREENS

.1 All Graphic Display Screens shall have the following common elements and functions regardless of system manufacturer. Every site shall have a graphic display screen for Site Graphic, System Architecture, each air handler, boilers, emergency generator, lighting, exhaust fans, heat reclaim, and for each room controlled by the BAS system.

The Graphic Display Screens shall follow the format to be consistent with the established School Board BAS Systems as displayed in Appendix “A”. All operator accessible points shall be yellow text and all information points shall be blue. The specific screens shall include the following:

.2 Graphic Screens General All Screens

.1 Navigation buttons to each major system in the building which indicate current screen display by a change in button colour

.2 Background colour shall be black

.3 Outdoor air temperature shall be displayed on every graphic screen

.3 Site Graphic

.1 the School Board Logo on the site or opening graphic screen

.2 artist concept or scanned in picture of the front of the school

.3 access links to all global schedules or specific screens affecting entire building operation

.4 access buttons links to Set Time, Holiday Schedule, PD Day Schedule, Alarms, Points on Manual, Conversion °C - °F, 24 Hour Clock, Operations Manual, AutoCAD Drawings, Reliable BAS Manual, and Work Orders.

.4 System Architecture

.1 control panel layout and network architecture

.2 indicating BAS panels and panel type (model)

.3 panel locations

.4 systems controlled by each panel

.5 links to points list accessible from each panel

.5 Floor Plans graphics

.1 Room numbers accurate as per room signage

.2 Mechanical rooms locations & signage tags

.3 space temperatures for every temperature on each floor in appropriate room

.4 space focus pick area for individual room control where applicable shall be yellow text.

.5 Air Handler symbols indicating areas of the floor plan serviced by each air handler by a corresponding colour, as shown in Appendix “A”

.6 Status of Air Handler by colour change Red for off status, or text indication

.7 Supply air temperature for each air handler

.6 Air Handler (AHU) graphic

.1 accurate representation of the AHU design

.2 all associated control points to be displayed

.3 all points to be monitored for automatic mode and shall be displayed when in Manual mode

.4 a calculated percentage of fresh air shall be indicated on the AHU graphic

.5 operator offset adjustment of the supply air setpoint, adjustable directly form the graphic

.6 AHU physical location shall be indicated on the graphic

.7 weekly occupied time of day schedule for the associated AHU shall be accessible directly from the graphic by selecting an icon

.8 weekly student time of day schedule for the associated AHU shall be accessible directly from the graphic by selecting an icon

.9 trend logs shall be accessible directly form the graphic by selecting an icon

.7 Glycol Heating

.1 graphic piping layout shall be accurate as per piping layout

.2 all associated control points for the glycol heating system to be displayed

.3 operator offset adjustment of the scheduled water setpoint, adjustable directly form the graphic.

.4 lead pump shall be indicated

.5 pump status shall be indicated graphically

.6 calculated scheduled water setpoints to be displayed

.7 operator offset editable directly from the graphic screen

.8 weekly time of day schedule for the building occupied schedule shall be accessible directly form the graphic by selecting an icon

.9 trend logs shall be accessible directly form the graphic by selecting an icon

.8 Exhaust fans graphic

.1 exhaust fans control shall be editable directly from the graphic

.2 exhaust fan status shall be indicated in text and a change in the exhaust fan icon

.3 exhaust fan physical location shall be indicated on the graphic

.4 area of the building being exhausted shall be indicated on the graphic

.20 BAS DATABASE NAMING CONVENTIONS AND PROGRAMS

.1 Miscellaneous Equipment Naming Conventions

.2 Network Status Panel Naming Conventions should indicate the school, panel location and panel number. The school name can be abbreviated as necessary to fit in the space.

INPUTS		***OUTPUTS***	
Equipment	***Point Name***	***Equipment***	***Point Name***
Exhaust Fan Status	*EF # Status*	*Exhaust Fan Control*	*EF # Control*

1.2 RELATED WORK

.1 Supply all necessary efforts to provide the project DDC system as specified.

1.3 DESCRIPTION OF SYSTEM

.1 This is an upgrade and/or modification of an existing DDC control system. Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control and monitor HVAC equipment, HVAC systems, and other equipment as specified in this section.

.2 Refer to demolition drawings for removal of all existing control devices. All existing exposed pneumatic tubing and equipment which is not reused shall be removed complete. All concealed existing pneumatic tubing shall be abandoned.

.3 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control and monitor HVAC equipment, HVAC systems, and other electrical loads as specified in this section.

.4 The work shall include but is not limited to the following:

.1 A programmable building automation control (BAS) system

.2 Local/remote system control/monitoring via BACnet/IP TCP/IP Ethernet LAN/WAN connections

.3 Extension of the existing programmable building automation (BAS) control system

.4 Heat Pump Loop Control

.5 MUA Unit Control

.6 Individual Heat Pump Control

.7 Lighting control

.8 Building low temperature

.9 Domestic water solenoid valve control

.10 Connection to fire alarm system

.11 Unit Heater Control

.12 Mechanical Room Control

.13 Hot Water Boiler System

.14 Existing Systems Control

.15 Cooling Tower

.16 Injection Pump Control

.5 All the necessary controls, valves, motors, control wiring, conduit, control panels, instrumentation, computer software, and network access units, for the specified system shall be provided under this section. The installed system shall incorporate electronic and digital control devices to perform the control sequences and programs outlined herein. Specific control sequence requirements are as detailed in subsequent sections of this specification and on the drawings.

.6 All electrical wiring, mechanical installations, and control sequences shall comply with local and provincial electrical and mechanical codes.

.7 Testing, debugging, confirmation of total system operation and owner training on the complete operation of the system and the computer software shall also be provided in this section.

1.4 ASSOCIATED WORK SPECIFIED IN OTHER SECTIONS

.1 The contractor shall coordinate the installation of devices furnished in this section with the installing contractor by trade jurisdiction.

.2 Heating Contractor

Install all valves, valves, wells etc. as shown on drawings

.3 Sheet Metal/Ventilating Contractor

Install all single and multiple section dampers, interconnecting linkages, blank-off plates, duct transitions, access doors, louvers and similar items as required for the system and/or as indicated on the drawings.

.4 Electrical Contractor

Install and connect electrical power to all motors, transformers and starters. A power supply will be available from the panel in the mechanical room for DDC system control panels.

1.5 SYSTEM ACCEPTANCE

.1 System commissioning and interface to facilities management network shall be performed by the Building Automation contractor.

.2 On project completion, the contractor shall issue a report to the consultant stating that the system is complete, that all hardware and software functions have been verified and that the system is operating in accordance with the specifications. A demonstration of complete system operation shall then be made to the owner's authorised representative.

.3 Upon successful completion of the system demonstration, the owner's representative shall be requested to approve, in writing, the satisfactory operation of the DDC System, interface devices and accessories.

.4 The consultant shall verify through the owner’s representatives that the entire system is complete and operating to the satisfaction of the owner before final acceptance is approved.

1.6 MAINTENANCE DATA AND SERVICE

.1 Provide maintenance data for controls and instrumentation for incorporation into maintenance manual.

.2 After acceptance, seasonally check and readjust control systems for change over. Make 2 site trips. Notify Engineer of scheduled dates. Carry out any preventive maintenance required including parts and labour. Report to Engineer, in writing, results or resetting made.

.3 Provide as-built information in accordance with Section 15010, requirement.

1.7 TESTING AND BALANCING

.1 During the system testing and balancing by an independent agency fully demonstrate the operation of all sensors, dampers, actuators, controls, valves, etc. This contractor shall be present during the testing and balancing and make adjustments as often as necessary to satisfy the testing and balancing agency.

Part 2 Products

2.1 ELECTRIC AND MECHANICAL DEVICES

.1 All electric switch devices shall be selected for the applied load and UL listed and labeled for the application and environment to which they are applied. Miscellaneous, electric, and mechanical devices shall include:

.2 Provide any automatic control dampers not specified to be integral with other equipment. Frames shall not be less than 2.5 mm (13 gauge) galvanized steel. Blades shall not be over 200 mm (8") wide nor less than 1.6 mm (16 gauge) galvanized steel roll formed. Bearings shall be oilite, ball bearing or nylon with steel shafts. Side seals shall be stainless steel of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of –40°C to 93°C (-40°F to 200°F).

.1 All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.

.2 Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 150 mm (6").

.3 Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all control dampers with the temperature control submittal. Maximum leakage for dampers in excess of sixteen inches square shall be 152 l/s/m^2 (30 cfm/ft^2) at static pressure of 25 mm (1") of w.c.

.4 Where ultra-low leakage dampers are specified the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 2.8 l/s/m^2 (6 cfm/ft^2) for dampers in excess of sixteen inches square at 25 mm (1") of w.c.

.3 Automatic control valves 65 mm (2½") and smaller shall be screwed type, and valves 80 mm (3") and larger shall be flanged. Valves shall be ANSI-rated to withstand the pressures and temperatures encountered. Valves shall have stainless-steel stems and spring loaded Teflon packaging with replaceable discs.

.1 All modulating straight-through water valves shall be provided with equal-percentage contoured throttling plugs. All three-way valves shall be provided with linear throttling plugs such that the total flow through the valve shall remain constant regardless of the valve's position. Valves shall be sized for a pressure drop equal to the coil they serve but not to exceed 34 kPa (5 psi).

.2 Unitary valves shall provide precision flow control of hot or chilled water in various heating or cooling applications. The unitary valves shall consist of a valve body and replaceable characterized cartridge assembly and shall be compatible with a valve actuator that meets the requirements of UL94-5V fire

retardancy for mounting in return air plenums. The actuators shall have conformally coated printed circuit boards for humidity resistance.

.3 The actuators shall de-energize when the valve is not in motion to extend service life. The unitary valves shall provide proportional flow in modulating, diverting or mixing applications. They shall operate silently and resist water hammer.

.4 The unitary valve and actuator assembly shall be equipped with a manual opener and position indicator.

.4 All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off. All actuators (valves, dampers etc.) shall be by this contractor.

.5 Acceptable material:

Belimo

Part 3 Execution

3.1 GENERAL

.1 The DDC controls project shall be performed in accordance with the general conditions of the contract. The contractor shall conduct all on-site work in conjunction with building operating staff to streamline the new system startup.

.2 The summary of input/output channels describe the DDC system points. It is the responsibility of the Contractor to ensure compatibility of the mechanical systems, devices, and actuators with the DDC system.

.3 All digital output control points located in unconditioned spaces shall be relocated to an accessible ventilated indoor location. All control devices, DDC panels; other shall be located inside the conditioned space of the building envelope.

.4 All DDC system equipment will become the property of the Owner.

3.2 ON SITE TESTING

.1 Provide Engineer-approved operation and acceptance testing of the complete system. The Consultant/Owner will witness all tests.

.2 Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The installer shall complete all testing, calibrating, adjusting and final field tests. Provide a detailed cross-check of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards.

Provide a cross-check of each control point within the system by making a comparison between the control command and the field-controlled device. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance.

.3 Compliance Inspection Checklist: Submit in the form requested, the following items of information to the Owner's Representative and Consultant for verification of compliance to the project specifications. Failure to comply with the specified information shall constitute non-performance of the contract. The contractor shall submit written justification for each item in the checklist that he is unable to comply with. The Owner's Representative and the Consultant will initial and date the checklist to signify contractor's compliance before acceptance of system.

.1 Verify to the Owner's Representative and Consultant in letterform that supplier has in-place support facility. Letter shall show location of support facility, name and titles of technical staff, engineers, supervisors, fitters, electricians, managers and all other personnel responsible for the completion of the work on this project.

User Date Consultant Date

.2 Manually generate an alarm at a remote DDC Controller as selected by the Consultant to demonstrate the capability of the workstation and alarm printer to receive alarms within 5 seconds.

User Date Consultant Date

.3 Disconnect an operator workstation in the central control room and manually generate an alarm at a remote DDC Controller to demonstrate the capability of the system printer to receive alarms when the workstation is disconnected from the system.

User Date Consultant Date

.4 Disconnect one DDC Controller from the network to demonstrate that a single device failure shall not disrupt or halt peer-to-peer communication. Panel to be disconnected shall be selected by the Consultant.

User Date Consultant Date

.5 At a DDC Controller of the Consultant’s choice, display on the portable operator's terminal:

.1 At least one temperature set point and at least one status condition, i.e., on or off for a system or piece of equipment attached to that panel as well as for points at another DDC Controller on the network.

.2 The diagnostic results as specified for a system or piece of equipment attached to that panel as well as for a system or piece of equipment attached to another DDC Controller.

.3 The ability to add a new point to the DDC Controller with the POT and have it automatically uploaded to the workstation to modify that panel's stored database.

User Date Consultant Date

3.3 INSTALLATION

.1 Install systems and related controls in accordance with approved shop drawings and manufacturer's recommendations using factory-trained journeymen certified by the Province of Ontario.

.2 Locate room sensors, etc., at height and as required per Ontario Building Code.

.3 Secure approval for damper motor locations and supports. Submit detail of damper motor location and support for approval.

.4 Provide dampers, for installation by the sheet metal contractor.

.5 Provide valves for installation by the piping contractor.

3.4 POINT DESCRIPTORS

.1 Adopt and utilize a consistent naming convention in order to identify points and facilitate wild-card calling of all points, systems, and programs to the standards of the school board.

3.5 SYSTEM OPERATION

.1 General

Where Optimum Start Stop (OSS) is specified, equipment shall start-up based on global outdoor temperature, space temperature, and system response to assure that comfort conditions are reached at scheduled occupancy time (occupancy schedules are defined under time programs), and operate in both heating and cooling cycles. In all cases, the optimum start program shall operate fully stand-alone in the local GPC.

OSS shall include a Night Cycle program applying to (heating cycle only) (both heating and cooling cycle) with the outdoor air dampers closed. The space temperature shall be used to determine the “fan on” and/or “supply heat” command to maintain a low limit of *50-55* degrees for the heating cycle and the “fan on” and “supply cooling” command to maintain 82 degrees for the cooling cycle.

Where an Economizer Cycle (EC) is specified, it shall automatically enable the economizer mode based upon an enthalpy comparison of outdoor air and return air of each AHU.

.2 Data Control (D/C) and Graphics Summary

All hardware, custom software, application software, graphics, etc., necessary to accomplish the control sequences and display the graphics specified shall be provided as part of this contract. Provide all controllers, inputs, outputs, valves, dampers, actuators and flow meters required to provide the control and graphic data described. Provide software setpoints required for display in logical groups and graphics.

Each digital output shall have a software-associated monitored input. Any time the monitored input does not track its associated command output within a programmable time interval, a “command failed” alarm shall be reported.

Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups.

Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single remote panel containing the DDC algorithm, and shall function independent of any primary or UC communication links. Secondary (reset type) analog inputs may be received from the primary network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

In addition to the Unitary DDC Controller data points specified to be presented on colourgraphic displays, technical data for each zone mechanical apparatus shall be presented to operators on the OWS in full English menu text displays including the apparatus name; heating and cooling PID loop P, I and D gains; primary CFM airflow (if measured); damper position (% open); reheat status/value; cooling setpoint; heating dead-band; minimum and maximum CFM setpoints; reheat CFM setpoint; unoccupied temperature setpoint; temperature sensor calibration offset; bypass push button time, in minutes; smoke purge mode damper position; smoke pressurization mode damper position; smoke depressurization mode damper position; and morning warm-up mode damper position. All such points shall be presented in complete and direct read-write (command) format, unless they are provided in commandable colourgraphic displays.

In addition to Graphics of building systems with dynamic data points as noted in the following Data and Control and Graphic Summary, the following additional graphics shall be provided:

.1 Facility layout (showing buildings, streets, etc.)

.2 Individual area layouts or isometrics

.3 Any other graphics necessary for logical penetration

.4 Individual HVAC systems graphics

.5 Sequences of operation

.6 Flowcharts for critical DDC loops

.7 Supervisor graphics

.8 System configuration

.3 Application Requirements

.1 Software

The microprocessor-based control system shall rely on software for non-critical interlocks and time delays. Where required by the specifications, these functions shall be provided by separate thermostats, relays, and delay timers.

.2 Interlocks

Safety and other interlocks may require relays depending on the specific devices being used. Some devices may require a special power supply as shown in the wiring details. Safeties shall be hardwired into the control circuit and shall also be monitored by the BMCS.

.3 Sensors

Select duct insertion sensors to suit the application. For large ducts, use sensors with longer probe lengths. For heating and cooling coil freeze protection, use a long capillary type sensor. For mixed air and coil discharge temperature sensing, use averaging capillary type sensors.

.4 Valves

Ensure that actuators meet all the job requirements (i.e., control signal, close off, action, etc.). Control valves shall be selected to suit both the medium and the specified configuration (i.e., Straight-thru, 3-way, screwed, flanged, etc.).

.5 Damper Actuators

The total number of actuators may vary depending on the damper size. Consult the actuator's application literature to determine sizing requirements and use no less than 30% of the minimum number of actuators recommended.

.6 Graphics

The system graphics shall include operator control panels to facilitate working with the AHU:

.1 The Warm-up Panel shall permit the operator to monitor the status of the warm-up mode (on or off), and to change the setpoint of the warm-up temperature.

.2 The Unoccupied Cycle control panel shall permit the operator to monitor the status of the mode (occupied or unoccupied), and to change the unoccupied periods setpoints.

.3 The Mixed Air Dampers control panel shall permit the operator to monitor the economizer mode (on or off), monitor the damper position, and to change the minimum position setpoint.

.4 The Optimum Start/Stop control panel shall permit the operator to monitor and change optimum start/stop program parameters.

.5 The Reset Schedule control panel shall permit the operator to monitor and change reset schedule program parameters.

It is not acceptable to monitor and change these modes of control in a manner other than that specified. Having to edit, compile and reload application programs to achieve monitoring and control of these modes is not acceptable.

.6 Provide the text of the control sequence so that it may be displayed on the operator screen by clicking on the Sequence control button on the system graphic. The sequence will incorporate all parameter values and setpoints and will update them dynamically as they change or are changed.

.7 Graphic Display Screens

.1 All Graphic Display Screens shall have the following common elements and functions regardless of system manufacturer. Every site shall have a graphic display screen for Site Graphic, System Architecture, each air handler, boilers, emergency generator, lighting, exhaust fans, heat reclaim, and for each room controlled by the BAS system. The Graphic Display Screens shall follow the format to be consistent with the established School Board Reliable BAS Systems as displayed in Appendix "A". All operator accessible points shall be yellow text and all

information points shall be blue. The specific screens shall include the following:

.1 Graphic Screens General All Screens

.1 Navigation buttons to each major system in the building which indicate current screen display by a change in button colour.

.2 Background colour shall be black.

.3 Outdoor air temperature shall be displayed on every graphic screen.

.4 Site Graphic.

.5 the School Board Logo on the site or opening graphic screen.

.6 artist concept or scanned in picture of the front of the school.

.7 access links to all global schedules or specific screens affecting entire building operation.

.8 access buttons links to Set Time, Holiday Schedule, PD Day Schedule, Alarms, Points on Manual, Conversion °C - °F, 24 Hour Clock, Operations Manual, Autocad Drawings, Reliable BAS Manual, and Work Orders s shown in Appendix “A”.

.2 System Architecture

.1 control panel layout and network architecture.

.2 indicating BAS panels and panel type (model).

.3 panel locations room number text on screen.

.4 systems controlled by each panel.

.5 links to points list accessible from each panel.

.3 Architecture Panel Layout (Locations on Floor Plans)

.1 Locations of each panel on each floor plan level.

.2 Panel types indicated by different icon.

.3 Controls transformers locations.

.4 Main network wiring and sub-network wiring layout.

.4 Floor Plans Graphics

.1 Room numbers accurate as per room signage.

.2 Mechanical rooms locations and signage tags.

.3 space temperatures for every temperature on each floor in appropriate room.

.4 space focus pick area for individual room control where applicable shall be yellow text.

.5 Air Handler symbols indicating areas of the floor plan serviced by each air handler by a corresponding colour, as shown in Appendix “A”.

.6 Status of Air Handler by colour change Red for off status, or text indication.

.7 Supply air temperature for each air handler.

.5 HVAC Unit Graphic

.1 accurate representation of the HVAC design.

.2 all associated control points to be displayed.

.3 all points to be monitored for automatic mode and shall be displayed when in Manual mode.

.4 a calculated percentage of fresh air shall be indicated on the HVAC graphic.

.5 operator offset adjustment of the supply air setpoint, adjustable directly from the graphic.

.6 HVAC physical location shall be indicated on the graphic.

.7 weekly occupied time of day schedule for the associated HVAC shall be accessible directly from the graphic by selecting an icon.

.8 weekly student time of day schedule for the associated HVAC shall be accessible directly from the graphic by selecting an icon.

.9 trend logs shall be accessible directly from the graphic by selecting an icon.

.6 Boiler Graphic (glycol Loop Similar)

.1 boiler graphic piping layout shall be accurate as per piping layout

.2 all associated control points for the boiler system to be displayed

.3 operator offset adjustment of the scheduled water setpoint, adjustable directly form the graphic

.4 lead boiler and boiler stages shall be indicated

.5 lead pump shall be indicated

.6 boiler status shall be indicated graphically

.7 pump status shall be indicated graphically

.8 calculated scheduled water setpoints to be displayed

.9 operator offset editable directly from the graphic screen

.10 weekly time of day schedule for the building occupied schedule shall be accessible directly from the graphic by selecting an icon

.11 trend logs shall be accessible directly from the graphic by selecting an icon

.7 Exhaust Fans Graphic

.1 exhaust fans control shall be editable directly from the graphic.

.2 exhaust fan status shall be indicated in text and a change in the exhaust fan icon.

.3 exhaust fan physical location shall be indicated on the graphic.

.4 area of the building being exhausted shall be indicated on the graphic.

.4 Design Requirements

.1 Safeties: Smoke detector or high temperature interlocks will be hard-wired to the supply fan starter. These points will be assigned addresses in the DDC controller for alarm annunciation purposes only. AHU's with flows greater than 15,000 CFM will require a smoke detector or high temperature detector in the supply and return air ducts.

.2 Schedules: Time schedules will default to 6AM to 6PM, Monday through Friday.

.3 Actuators: Actuator output points will display as follows:

.1 0% = 2-way valve, closed.

.2 0% = 3-way valve, closed to the coil.

.3 0% = Mixed air dampers, full return air position.

.4 100% = 2-way valve, open.

.5 100% = 3-way valve, open to the coil.

.6 100% = Mixed air dampers, full fresh air.

.7 These requirements shall be the case no matter how the actuator is sequenced or whether it is a reverse or direct acting valve.

.4 Valves: Heating coil valves shall fail open to the coil. Mixed air dampers shall fail to the full return air position.

.5 Outdoor Sensors: Outdoor air temperatures and humidity (where applicable) are assumed to be Global points transferred to DDC controllers. If the BMCS system lacks global point capability, global points shall be replaced by hardware points connected to specific controllers; the I/O capacity of the controller being used must be checked to make sure the added points will fit in the controller and upgraded in point capacity if necessary.

3.6 SEQUENCE OF OPERATION

.1 SEQUENCE OF CONTROL

.1 General

.1 The control programs shall be modular and structured in order to provide specific control operation of all HVAC components indicated.

.2 All control programs shall provide a minimum of 20% spare memory for expansion.

.3 Each control program shall contain "REM" statements which explain the program operation.

.4 Each control program shall open with a list of the I/O points used and controlled in the program.

.2 DDC Sensors and Devices - are listed in the Points Summary that is part of this specification. Provide 5% spare I/O capacity.

Implement the following control program concepts in full, or partial as required, to provide complete HVAC equipment control. The programs shall perform all control strategies on the basis of protecting equipment operation, saving operational energy costs, and indicating alarm conditions.

Programs, which increase the system energy consumption or cause equipment failures, will be refused and resolved by the contractor accordingly at not additional cost to Owner.

.3 Where Optimum Start Stop (OSS) is specified, equipment shall start-up based on global outdoor temperature, space temperature, and system response to assure that comfort conditions are reached at scheduled occupancy time (occupancy schedules are defined under time programs), and operate in both heating and cooling cycles. In all cases, the optimum start program shall operate fully stand-alone in the local GPC.

OSS shall include a Night Cycle program applying to (heating cycle only) (both heating and cooling cycle) with the outdoor air dampers closed. The space temperature shall be used to determine the "fan on" and/or "supply heat" command to maintain a low limit of 50-55 degrees for the heating cycle and the "fan on" and "supply cooling" command to maintain 82 degrees for the cooling cycle.

.4 Where an Economizer Cycle (EC) is specified, it shall automatically enable the economizer mode based upon an enthalpy comparison of outdoor air and return air of each AHU.

.5 System Architecture: The control sequences will be performed by DDC controllers arranged as indicated in the following architecture diagram:

.6 Boiler Graphic (glycol Loop Similar)

.1 boiler graphic piping layout shall be accurate as per piping layout

.2 all associated control points for the boiler system to be displayed

.3 operator offset adjustment of the scheduled water setpoint, adjustable directly form the graphic

.4 lead boiler and boiler stages shall be indicated

.5 lead pump shall be indicated

.6 boiler status shall be indicated graphically

.7 pump status shall be indicated graphically

.8 calculated scheduled water setpoints to be displayed

.9 operator offset editable directly from the graphic screen

.10 weekly time of day schedule for the building occupied schedule shall be accessible directly from the graphic by selecting an icon

.11 trend logs shall be accessible directly from the graphic by selecting an icon

.2 HEAT PUMP LOOP

.1 System Operation

The heat pump loop system shall be enabled based on a time of day schedule (adjustable) and if the heat pump loop system enable calendar is enabled. The system will also look at any temporary calendars and schedules (adjustable) to determine if the system should be enabled or not.

The new duty heat pump loop pump (C-5 or C-6) will be enabled. When status of the pump is received, the control sequence will be enabled. The duty pump will be switched on a weekly basis.

The new VFD, for the duty pump will modulate to maintain the differential pressure at the differential pressure setpoint (adjustable, initially set at 70 kPa, the actual value is to be determined by the balancing contractor). The differential pressure sensor shall be installed 2/3 of the way out in each system (this is a new sensor, location to be approved by consultants). The new differential pressure sensor is to be hardwired back to the local controller; sharing the sensor values over the BAS network is not allowed.

The circulation pumps (C-5, C-6) shall run in a lead/standy basis. A run time counter will determine lead pump. When heat pump system is enabled each of them shall be enabled automatically if the other fails. When there is no demand signal the pumps shall be OFF. When there is no demand signal the pumps shall be off and shall be enabled for 2 hours Pump Cycle per week. Pumps shall have a minimum off time of 5 minutes. Failure of either lead/lag pump starts standby pump.

On sensing a decrease in the heat pump loop supply temperature below the heat injection setpoint (10°C, adjustable), the injection pump (C-7 or C-8) will run and the hot water injection valve will be modulated open to satisfy the setpoint. The circulation pumps (C-7, C-8) shall run in a lead/standy basis. A run time counter will determine lead pump. When heating is enabled each of them shall be enabled automatically if the other fails. When there is no heating demand signal the pumps shall be OFF. When there is no heating demand signal the pumps shall be off and shall be enabled for 2 hours Pump Cycle per week. Pumps shall have a minimum off time of 5 minutes. Failure of either lead/lag pump starts standby pump.

On sensing an increase in the heat pump loop supply temperature above the heat rejection setpoint (38°C, adjustable), the cooling tower dampers will be commanded open, then the cooling tower spray pump will be enabled, then the cooling tower fan will be enabled and modulated through the VFD in order to satisfy the setpoint.

.2 Safeties/Alarms

If the heat pump loop system is enabled, and the heat pump loop supply temperature falls below the “no heat” security alarm output setpoint (8 deg C, adjustable), the “no heat” security alarm output shall be enabled, to notify the security system of the issue. The BAS will wait for 30 minutes upon the initial enabling of the system before sending out the “no heat” security alarm.

If any of the associated pumps' statuses does not match its associated pump enable command, an alarm will be sent to the BAS, and the other pump will be enabled.

If the cooling tower damper, spray pump, fan status does not match its associated command, an alarm will be sent to the BAS.

.3 TERMINAL UNIT – HEAT PUMP CONTROL

.1 Occupied Mode

The unit will be started based on a time of day schedule (adjustable). The unit will also look at any temporary calendars and schedules (adjustable) to determine if the unit should be started or not.

When the unit is in occupied mode, the supply fan will be commanded on and run continuously.

If the zone temperature drops 1 deg C below the occupied zone temperature setpoint (22 deg C, adjustable), the compressor will be enabled (the two-position isolation valve will be opened via the heat pump's local controls whenever the compressor is enabled from the BAS) and the reversing valve will be commanded to "heat" mode. The perimeter radiant heating valve will also be modulated open (if applicable). When the setpoint has been satisfied, the compressor will be disabled and the two-position isolation valve will be closed.

If the zone temperature rises 1 deg C above the occupied zone temperature setpoint (22 deg C, adjustable), the compressor will be enabled, the two-position isolation valve will be opened and the reversing valve will be commanded to "cool" mode. When the setpoint has been satisfied, the compressor will be disabled and the two-position isolation valve will be closed.

.2 Unoccupied Mode

During unoccupied mode, the unit will normally be off. The fresh air damper will be closed. The lighting output enable point will be disabled.

If the zone temperature drops below the unoccupied zone heating setpoint (18 deg C, adjustable), the supply fan will be started, the compressor will be enabled (the two-position isolation valve will be opened via the heat pump's local controls whenever the compressor is enabled from the BAS) and the reversing valve will be commanded to "heat" mode. The perimeter radiant panel valve will also be modulated open (if applicable).

If the zone temperature rises above the unoccupied zone cooling setpoint (26 deg C, adjustable), the supply fan will be started, the compressor will be enabled, the two-position isolation valve will be opened and the reversing valve will be commanded to "cool" mode.

Once the zone is satisfied (when the zone temp equals the occupied zone temperature setpoint), the unit will be turned off (supply fan disabled, compressor disabled, two-position isolation valve closed).

.3 Safeties/Alarms

If the zone temperature is above or below the alarm levels (adjustable), an alarm will be sent to the BAS.

If the supply fan status does not match the supply fan command, an alarm will be sent to the BAS.

If an alarm condition is sensed from the fire alarm system, the unit will be shutdown. The unit will be restarted once the alarm condition has been cleared. The restarting of the heat pumps shall be staggered to limit the electrical demand.

A filter alarm from the unit will be monitored, and will send an alarm to the BAS if the point is in alarm.

A heat pump alarm from the unit will be monitored, and will send an alarm to the BAS if the point is in alarm. The unit will require a reset to resume normal operation.

.4 MUA DEDICATED MAKE-UP AIR UNIT CONTROL WITH VARIABLE FREQUENCY DRIVES

.1 The MUA unit consists of outdoor air dampers, exhaust connection, OA connection, filter sections, energy recover wheel system, gas heating section, exhaust fan and supply fan.

.2 In the event of power loss, a disable command, or failure of integral heating system the outdoor air dampers and exhaust air dampers are to close, and fans, heating, cooling and mechanical heat / energy recovery system are to shut-down.

.3 Scheduled Occupancy

Pre-Occupancy: The BAS shall enable the supply and return air fans 30 minutes prior to the start of the occupied period. Integral heating, DX cooling and air-source heat pump function is to be enabled and commanded such that a supply discharge air temperature of 18°C is maintained. Modulate bypass damper open. Concluding a run-time of not less than 15 minutes, the return air CO2 value shall be measured. Exhaust fan and/or dampers, when equipped, are to be enabled simultaneously with the supply and return air fans.

Occupied: The BAS shall enable / command on the unit to an occupied state which is defined by school occupancy times. If the measured exhaust CO_2 level value is equal to or greater than 800 ppm (adj) an alarm is generated. Integral heating DX cooling and air-source heat pump function and energy recovery is to be sequenced to maintain a supply discharge air temperature of 18°C. The exhaust fan and dampers are to be enabled simultaneously with the supply air fan. Supply and exhaust fan run continuously. The supply and exhaust fan is wired through their respective integral VFD's interlocked through the BAS control. The unit heat wheel function is controlled from the factory mounted controller.

Un-Occupied: The BAS shall disable /command off the unit to an un-occupied state which is defined by school occupancy times. During the un-occupied state all fans are to be shut-down, the outdoor air dampers, and exhaust air dampers are to be released and close by way of mechanical spring return (0% position).

.4 Discharge Air High/Low Temperature: While in the heating mode with heat stages on, an alarm will be generated whenever the discharge air temperature rises above or drops below the Discharge Air Temperature Heating High or Low limits for a duration of 1 min (adj.).

.5 Fan System Failure Alarm: An alarm is generated whenever the supply and/or exhaust fan fails to respond to start-stop commands. The supply and exhaust air fans are to be controlled by VFD. Status of the fans shall be monitored using a feedback from the drive or an analogue signal from a current transformer.

.6 Freeze Alarm: A freezestat located immediately downstream of the remote heating coil will shut down the HVAC unit and open the three way valve to full flow when it detects a temperature below its setpoint. It will be necessary to reset the freezestat manually.

.7 Discharge smoke detectors in the supply air streams de-energize the supply and exhaust fans upon activation. When the OAT is less than 50 degrees F (10 degrees C), the gas heating valve and dampers modulates to maintain the mixed air temperature at 50 degrees F (10 degrees C).

.5 CABINET UNIT HEATER CONTROL

.1 Provide space sensor to control heater.

.2 On drop in space temperature the fan in the heater is energized.

.6 RADIATION HEATING CONTROL

.1 A space temperature sensor operating through a DDC ASC shall modulate the incremental heating valve to maintain the space temperature setpoint.

.7 LIGHTING CONTROL

.1 Provide programmable control of four (4) lighting control circuits through the OWS. Connect to nearest electrical lighting control panel where indicated:

.1 Interior lighting, 3 points

.2 Security/fire alarm signal, 1 point

.2 Provide a photo cell to inhibit the operation of the exterior lighting circuits a light levels above the photocell setpoint.

.8 BUILDING LOW TEMPERATURE

.1 All space sensors shall be capable of indicating building low temperature. Alarm building low temperatures at OWS.

.9 SECURITY SYSTEM MONITORING TO BAS

.1 All critical alarms as determined by the school board to be sent to security via a digital output.

.10 BOILER ROOM CONTROL

.1 Provide space sensor to control exhaust fan, motorized damper & heater.

.2 On rise in space temperature the exhaust fan & motorized damper is energized.

.3 On drop in space temperature the TCV in the Radiation is modulated.

.11 DOMESTIC HOT WATER

.1 Provide programmable stop/start control of the recirc pump.

.2 Provide supply temperature indication).

.12 TRAP PRIMER SOLENOID VALVE CONTROL

.1 Energize solenoid valve for five minutes (adj) each 24 hour period (adj) during unoccupied times.

.2 Sequence valves so that no more than two (2) valves operate at the same time.

.13 PHASE LOSS DETECTION

.1 Provide current sensing relays on the BUSS in the MCC at the dedicated section.

.2 Turn off all connected equipment.

.3 Sequence equipment on when power is restored.

.4 Provide alarm at OWS on loss of power.

.14 EXHAUST FANS

.1 Provide programmable start/stop control in three groups at the OWS.

.2 Provide dual voltage relays for exhaust fans rated for 120V/1/60. Install dual voltage relays in accessible ceiling space adjacent to exhaust fan.

.3 Wire through dual voltage relay or magnetic starters as indicated. Magnetic starters will be provided by electrical contractor.

.4 Provide override stop/start/status for fans with local control.

.15 HOT WATER BOILER SYSTEM

The hot water boiler system shall be enabled to run whenever the boiler system manual enable point is enabled, the boiler system calendar enable point is enabled, and the outdoor air temperature is less than the OA-T enable setpoint (adjustable, initially set at 15 deg C). The system shall be disabled when the outdoor air temperature is greater than the OA-T enable setpoint, plus a differential of 2 deg C, or if the manual enable point or calendar enable point have been disabled. The system will also look at any temporary calendars and schedules (adjustable) to determine if the system should be enabled or not. When the system has been disabled, all pumps which are running at that time will continue to run for 10 minutes before turning off.

To prevent short cycling, each boiler shall run for and be off for minimum adjustable times (10 minutes, adjustable), unless shutdown on safeties or outside air conditions.

The calculated primary hot water supply temperature setpoint shall be determined based on the following reset schedule:

Outdoor Air Temperature	Primary Hot Water Supply Temperature Setpoint
-15 deg C	82 deg C
15 deg C	60 deg C

Each of the two boilers shall run subject to its own internal safeties and controls. The lead boiler will be switched automatically based on equal runtime. On a call for heating, the lead boiler's circulating pump shall be enabled. Once the circulating pump status has been received by the BAS, that boiler's demand signal will be modulated to satisfy the calculated primary hot water supply temperature.

The demand signal for any boiler will be throttled back if the boiler's individual hot water supply temperature rises above its supply temperature high limit setpoint

(adjustable, initially set at 88 deg C). If any boilers' general alarm point is in alarm, that boiler will be disabled, and the next boiler will be enabled.

If the lead boiler's demand signal reaches 100%, and the calculated setpoint has still not been satisfied, the second boiler's (based on next lowest runtime) circulating pump will be enabled. Once the second boiler's circulating pump status has been received by the BAS, the lead boiler's demand signal will be modulated back to minimum demand, and both boilers' demand signals will be modulated together to satisfy the calculated primary hot water supply temperature.

After a boiler has shutdown, its associated circulating pump shall remain on for a short amount of time (5 minutes, adjustable).

Manual switches shall be provided to select between "Local/BAS" control of the individual boilers to provide back-up in the event of a BAS failure.

When the boiler system is enabled, the primary loop pump (C-3, C-4) will be enabled. When the pump status is received by the BAS, the primary heating loop control scheme will be enabled. The Primary Circulation pumps (C-3, C-4) shall run in a lead/standy basis. A run time counter will determine lead pump. When heating is enabled each of them shall be enabled automatically if the other fails. When there is no heating demand signal the pumps shall be OFF. When there is no heating demand signal the pumps shall be off and shall be enabled for 2 hours Pump Cycle per week. Pumps shall have a minimum off time of 5 minutes. Failure of either lead/lag pump starts standby pump.

The boiler control shall be through hardwired points (0-10 VDC) signal for setpoint control and enable/disable). Boiler run status and boiler alarm points shall be hardwired points to the BAS system.

Safeties/Alarms

If the boiler system is enabled, and the primary hot water return temperature falls below the "no heat" security alarm output setpoint (45 deg C, adjustable), the "no heat" security alarm output shall be enabled, to notify the security system of the issue. The BAS will wait for 30 minutes upon the initial enabling of the system before sending out the "no heat" security alarm.

If either of the two boilers' statuses does not match its associated boiler enable command, an alarm will be sent to the BAS, and that boiler will be taken out of the lead/lag sequencing.

If either of the two boilers' general alarm point is in alarm, an alarm will be sent to the BAS, and that boiler will be taken out of the lead/lag sequencing.

If either of the two boilers' circulating pump statuses does not match its associated boiler circulating pump enable command, an alarm will be sent to the BAS, and that boiler will be taken out of the lead/lag sequencing.

If the perimeter heating loop pump status does not match its associated perimeter heating loop pump enable command, an alarm will be sent to the BAS.

The boiler makeup water meter will be monitored through the BAS, and the consumption will be totalized. An alarm will be generated by the BAS if an abnormally large consumption of water is occurring.

.16 FIRE ALARM

.1 Provide connection to fire alarm panel.

.17 SECURITY SYSTEM MONITORING TO BAS

.1 All critical alarms as determined by the school board to be sent to security via a digital output.

.18 EXISTING SYSTEMS CONTROL

.1 Provide new DDC control and components for the existing systems indicated

3.7 ELECTRICAL

.1 Rules and Regulations: The entire installation shall conform to Division 26 and shall comply with the Canadian Electrical Code and all local and Provincial codes. The contractor shall obtain an ESA certificate for his work.

.2 Refer to equipment wiring schedule or electrical drawings for wiring responsibilities.

.3 Arrange for all the necessary inspections and approvals of built-up and modified control systems and relay panels by governing authorities. All electrical equipment, material , and its installation shall conform to the current requirements of the following authorities:

.1 C.S.A

.2 Ontario Hydro Safety Authority

.3 O.B.C. Building Codes / Fire Codes.

.4 All wiring shall conform to governing codes and shall be inspected by request of the contractor for approval. The contractor shall obtain and purchase all necessary permits as required.

.5 Wiring: All electric wiring in connection with this project shall be furnished and installed under this section.

.1 The Contractor shall be aware that cables carrying high currents run through ceiling and wall cavities. Signal interference or sensor inaccuracy or failure caused by existing cable runs shall be the responsibility of the Contractor and shall be covered under the warranty. The Contractor shall select sensors and use shielded cable or transmitters as necessary to prevent electrical interference with the control system operation.

.2 The Contractor shall coordinate fully the interconnection of factory assembled portions of system controls, field installed control systems and the electrical power system to provide a complete working installation.

.3 Power for control equipment shall not be taken from equipment motor leads. Power shall be from circuits dedicated for controls only.

.4 Transformers shall be sized for 150% of engineered capacity.

.5 All wires are to be numbered using wire labels at each end. These labels shall correspond to wire identification on the shop drawings and "as-built" drawings.

.6 All wiring concealed in walls and chases and all exposed wiring shall be run in conduit.

.6 Electrical Isolation of I/O Points: To prevent serious damage to the field panels from surges, or RFI electrically induced spikes, protection in the following form shall be provided, as a minimum:

.1 Digital outputs singularly or collectively shall be galvanically isolated from the main panel processor.

.2 Analog outputs shall be galvanically isolated from each other and the main panel processor.

.3 Digital inputs shall be galvanically isolated from the main panel processor.

.7 Panel Documentation: Mount an input/output layout sheet within each controller field panel. This sheet shall include the name of the points connected to each controller channel.

.8 Conduits: All wiring in finished areas shall be concealed. All exposed wiring, whether for power, sensors, actuators, or data communications, shall be in metallic conduit. This includes all wiring runs in and around rooftop HVAC units. All conduits shall have a minimum inside diameter of 13mm.

.1 All conduits shall be installed out of the way in traffic areas, and parallel to the lines of the building. Flexible conduit may be used only in areas of vibration or expansion joints. All conduits shall be supported at least every 4 feet.

Supports shall be located at each connector end of each conduit. High and low voltage wire shall not be run in the same conduit.

Only wires of similar purpose shall be run in the same conduit; i.e. sensor or control, power, and communication wire shall be in separate conduit.

.9 Pull Boxes and Junction Boxes: Pull boxes shall be located at a minimum spacing of 30m. The contractor is responsible for getting approvals from the Owner for locating pull boxes. Pull boxes shall comply with the Canadian Electrical Code. All boxes shall be clearly marked as part of the automated control system.

.10 Enclosures: All enclosures shall be mounted such that the doors can open fully without interference with new or existing equipment. Except where expressly permitted in writing by the Owner or Engineer, enclosures shall be mounted in easily accessible locations where a technician can clearly see and easily access all components inside without a stool or ladder.

.11 Power Protection: During the warranty period, the Contractor shall be responsible for parts and labour to repair or replace any system equipment damaged by power quality problems (spikes, sags, waveform anomalies, etc.). with that in mind, the Contractor shall provide appropriate power protection.

.12 All wiring shall conform to governing codes and shall be inspected by request of the contractor for approval. The contractor shall obtain and purchase all necessary permits as required.

.13 It is the responsibility of this contractor to provide dedicated 120 V, power from the spare breaker for the automation system from the nearest electrical panel. Provide typewritten information on panel directory.

3.8 BAS DATABASE NAMING CONVENTIONS AND PROGRAMS

.1 Programs Architecture

.1 All BAS programs shall be created in each panel in logical order as determined by the equipment being controlled by each panel on the network. The Outdoor Air Temperature Program shall be in its own program named OAT PG.

.2 The programs shall be created in the following order:

.1 Air Handlers Example: Common for all air handlers and rooftop air handlers.

.1 AH # Start PG – contains all start stop parameters for the air handler.

.2 AH # Setpoint PG – contains all setpoint calculations for the specific air handler.

.3 AH # Control PG – contains all control points for the air handler for both occupied and unoccupied modes.

.4 AH # Zone Setpoint PG – contains all setpoint calculations and limitations for zones serviced by the air handler.

.5 AH # Zone Feedback PG – contains calculation of zone temperature averages, coldest and warmest spaces.

.6 All Rooftop air handlers shall start with the letters RT in the naming conventions.

.2 Boilers, Pumps, and Hydronic Heating Systems Examples:

.1 Heating Enable PG – contains all enable/disable calculations for the entire heating system.

.2 Heating Setpoint PG – contains all setpoint calculations for scheduled water temperatures for both occupied and unoccupied periods.

.3 Heating Control PG – contains control strategies for all heating equipment controlled from the panel.

.4 Pump Control PG – contains control strategies for circulation pumps including pump cycle when heating system is not enabled.

.3 Specialty and Miscellaneous Equipment Programs – specialty equipment with more than three (3) control points, shall be controlled in a separate program and shall be named according to the devices the program controls. The programs for specialty equipment shall be named the following the examples for air handlers and Heating equipment. Miscellaneous equipment with less than three (3) control points may be placed in a program called Misc. PG, and should contain all control parameters in the programs.

.4 Alarm Programs – Each Panel shall have an alarm program for General Warning alarms named P# Alarm PG, and an alarm program for Critical Alarms, named P# Critical PG. The alarms being sent to central monitoring shall be in the panel where the output is connected to the security panel and the programming to activate the Remote Alarm shall be in its own program named Remote Alarm PG.

.5 Point Naming Inputs & Outputs – The listings indicated below are the most common inputs and outputs used in system. Equipment not listed should always indicate clearly the equipment system, function and location in the name if possible. Point naming conventions shall be in upper and lower case for easier readability.

.1 Air Handler Systems Naming Conventions

INPUTS		**OUTPUTS**	
Equipment	Point Name	Equipment	Point Name
Supply Fan Status	AH# SF Status	Supply Fan Control	AH# SF Control
Return Fan Status	AH# RF Status	Return Fan Control	AH# RF Control
Supply Fan Speed Status	AH# SF Spd St	Supply Fan Speed Control	AH# SF Spd Ctrl
Return Fan Speed Status	AH# RF Spd St	Return Fan Speed Control	AH# RF Spd Ctrl
Supply Air Temperature	AH# Supply Temp	Damper Control	AH# Mixed Air Dmpr
Return Air Temperature	AH# Return Temp	Coil Heating Valve Control	AH# Heating Valve
Mixed Air Temperature	AH# Mixed Temp	Cooling Coil Valve Control	AH# Cooling Valve
Return Air C02	AH# Return C02	DX Cooling Stage Control	AH# DX# Control
Air Handler Coil Pump Status	AH# P# Status	Air Handler Coil Pump Control	AH# P# Control
Air Handler Filter Status	AH# Filter	Reclaim Damper Control	AH# Reclaim Dmpr
Air Handler Freezestat Status	AH# Freeze	Reclaim Valve Control	AH# Reclaim Vlv
Reclaim Pump Status	AH# RclP# Stat	Reclaim Pump Control	AH# RclP# Ctrl
Reclaim Temperature Air Entering	AH# Rcl In Temp		
Reclaim Temperature Air Leaving	AH# Rcl Out Temp		
Reclaim Supply Fluid Temperature	AH# Rcl SW Temp		
Reclaim Return Fluid Temperature	AH# Rcl RW Temp		
Duct Pressure	AH# Duct Press		
Building Pressure	Bldg Pressure		

.2 Heating Systems Naming Conventions

INPUTS		**OUTPUTS**	
Equipment	**Point Name**	**Equipment**	**Point Name**
Boiler Status	Blr# Status	Boiler Control	Blr# Control
Outdoor Air Temperature 1	OAT1	Boiler Stage Control	Blr# Stg# Ctrl
Outdoor Air Temperature 2	OAT2	Boiler Modulation	Blr# Modulation
Boiler Pump Status	Blr P# Status	Boiler Pump Control	Blr# P# Control
Heating Pump Status	Heating P# Status	Heating Pump Control	Heating P# Control
Glycol Pump Status	Glycol P# Status	Glycol Pump Control	Glycol P# Control
Heating System Pressure	Htg Pressure	Heating Valve Control	Htg Valve Ctrl
Glycol System Pressure	Gly Pressure		
Heating Supply Water Temperature	Htg Supply Temp		
Heating Return Water Temperature	Htg Return Temp	Heating Differential Pressure Valve	Heating DP Valve
Glycol Supply Water Temperature	Gly Supply Temp	Heat Exchanger Control Valve	HX Vlv ControlGlycol Return
Water Temperature	Gly Return Temp		

.3 Lighting Equipment Naming Conventions

INPUTS		OUTPUTS	
Equipment	**Point Name**	**Equipment**	**Point Name**
Outdoor Photocel	Outdoor Light Levels	Outdoor Light Control	Outdoor Ltg Ctrl
Outdoor Light Override	O/S Lgt Override		
Room Motion Sensor	Rm# Motion	Room Lighting Control	Rm# Ltg Ctrl
Corridor Motion Sensor	Corr# Motion	Corridor Lighting Control	Corr# Ltg Ctrl

.4 Miscellaneous Equipment Naming Conventions

INPUTS		OUTPUTS	
Equipment	**Point Name**	**Equipment**	**Point Name**
Exhaust Fan Status	EF# Status	Exhaust Fan Control	EF# Control
Domestic Hot Water Recirc Pump Status	DHW P# Status	Dom Hot Water Pump Control	DHW P# Control
Urinal Motion Detector	Ur Rm# Motion	Urinal Flush Control	Ur Rm# Control
Electrical Meter	Elect Meter		
Water Meter	Water Meter	Main Water Valve Control	Main Water Vlv
Gas Meter	Gas Meter		
Sump Level Alarm	Sump Alarm		
Area Water Flush Flow	East DWater Flow	Area Domestic Water Flush Control	East DW Flush Ctrl
		Area Flush Flow Alarm Light	East Flush Alarm
Building Security Status	Bldg Security	Building Remote Alarm	Bldg Remote Alarm
Building Override	Bldg Override		

.6 Network Status Panel Naming Conventions should indicate the school, panel location, and panel number. The school name can be abbreviated

3.9 POINTS LIST

.1 The points list appended here to shall be read in conjunction with the drawings and specification. Should the control functions be indicated in the specification and not indicated on the points list or indicated in the points list and not in the specification, it does not relieve in the contractor in provide a complete system. It is the contractor's responsibility to ensure the BAS system is installed and operates as specified.

END OF SECTION

REFER TO ATTACHED POINTS LIST

Holy Family Catholic Elementary School - Points List							
CONTROL POINTS	**DEVICE**	**DO**	**DI**	**AO**	**AI**	**Override Switch**	**Location**
Individual Heat Pumps							
Room Temperature	Space Sensor				24		Refer to Plan
Room Temperature Setpoint	Space Sensor				24		Refer to Plan
Control Valve	2-10 VDC Control	24					Refer to Plan
Compressor (if applicable)	Contacts	24					Refer to Plan
Reversing Valve	Contacts	24					Refer to Plan
Common Alarm	Contacts	24					Refer to Plan
Heat Pump Alarm Lockout Reset	2-10 VDC Control			24			Refer to Plan
Heat pump vendor to provide dry contacts on terminal strips for the common function. 24 VAC signal not an acceptable method.							
DHW Disable	On/Off	1					Mechanical Penthouse
DHW Temperature	Strap on Sensor				1		Mechanical Penthouse
DHW Recirc Pump Control	On/Off	1					Mechanical Penthouse
DHW Recirc Pump Status	Amperage				1		Mechanical Penthouse
Circulating Pump C-5 Control (Heat Pump System)	On/Off	1					Mechanical Penthouse
Circulating Pump C-5 Status	Amperage				1		Mechanical Penthouse
Circulating Pump C-5 Variable Frequency Drive	2-10 VDC Control			1			Mechanical Penthouse
Circulating Pump C-6 Control (Heat Pump System)	On/Off	1					Mechanical Penthouse
Circulating Pump C-6 Status	Amperage				1		Mechanical Penthouse
Circulating Pump C-6 Variable Frequency Drive	2-10 VDC Control			1			Mechanical Penthouse
Heat Pump Loop Diff Pressure SP (C-5/ C-6)	Diff Pressure Sensor				1		Refer to Plan

Circulating Pump C-7 Control (Injection Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-7 Status	Amperage				1		Existing Boiler Room

Holy Family Catholic Elementary School - Points List							
CONTROL POINTS	**DEVICE**	**DO**	**DI**	**AO**	**AI**	**Override Switch**	**Location**
Circulating Pump C-8 Control (Injection Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-8 Status	Amperage				1		Existing Boiler Room
3-Way Heating Valve	2-10 VDC Control			1			Existing Boiler Room
Lighting Control	On/Off	5				5	Connect to Nearest Lighting Panel
Cooling Tower Enable/Disable	On/Off	1					Mechanical Penthouse
Cooling Tower Supply Water Temperature	Thermal Well Sensor				1		Mechanical Penthouse
Cooling Tower Return Water Temperature	Thermal Well Sensor				1		Mechanical Penthouse
Sump Temperature	Thermal Well Sensor				1		Mechanical Penthouse
Damper Open Status	Amperage		1				Mechanical Penthouse
Damper Close Status	Amperage		1				Mechanical Penthouse
Damper Open	2-10 VDC Control	1					Mechanical Penthouse
Damper Closed	2-10 VDC Control	1					Mechanical Penthouse
Spray Pump Enable/Disable	On/Off	1					Mechanical Penthouse
Spray Pump Status	Amperage				1		
Cooling Tower Fan Enable	On/Off	1					Mechanical Penthouse
Cooling Tower Fan Variable Speed	2-10 VDC Control			1			Mechanical Penthouse
Cooling Tower Fan Status	Amperage				1		Mechanical Penthouse

Hydronic Force Flow Control	On/Off	6					refer to plan
Hydronic Force Flow Status	Amperage				6		refer to plan
Hydronic Force Flow Space Sensor	Space Sensor				6		refer to plan
MUA-101 Supply Fan Control	On/Off	1					Roof

Holy Family Catholic Elementary School - Points List							
CONTROL POINTS	**DEVICE**	**DO**	**DI**	**AO**	**AI**	**Override Switch**	**Location**
MUA-101 Supply Fan Status	Amperage				1		Roof
MUA-101 Exhaust Fan Control	On/Off	1					Roof
MUA-101 Exhaust Fan Status	Amperage				1		Roof
MUA-101 Supply Fan Variable Frequency Drive	2-10 VDC Control			1			Roof
MUA-101 Exhaust Fan Variable Frequency Drive	2-10 VDC Control			1			Roof
MUA-101 Exhaust Air Temperature	Duct Temp Sensor				1		Roof
MUA-101 Supply Air Temperature	Duct Temp Sensor				1		Roof
MUA-101 Supply Air Sensor	Duct Temp Sensor				1		Roof
MUA-101 Freeze Stat Status	Duct Temp Sensor		1				Roof
MUA-101 Exhaust Air Damper	2-10 VDC Control			1			Roof
MUA-101 Intake Air Damper	2-10 VDC Control			1			Roof
MUA-101 Heat Recovery Wheel Status	Amperage				1		Roof
MUA-101 Bypass Dampers	2-10 VDC Control			1			Roof
MUA-101 Gas Valve	2-10 VDC Control			1			Roof
MUA-101 Carbon Dioxide Sensor	2-10 VDC Control			1			Refer to Plan
MUA-101 DX Cooling (provide staged cooling)	2-10 VDC Control			3			Roof
MUA-101 Heat Pump	2-10 VDC Control			1			Roof
MUA-102 Supply Fan Control	On/Off	1					Roof
MUA-102 Supply Fan Status	Amperage				1		Roof
MUA-102 Exhaust Fan Control	On/Off	1					Roof
MUA-102 Exhaust Fan Status	Amperage				1		Roof
MUA-102 Supply Fan Variable Frequency Drive	2-10 VDC Control			1			Roof
MUA-102 Exhaust Fan Variable Frequency Drive	2-10 VDC Control			1			Roof
MUA-102 Exhaust Air Temperature	Duct Temp Sensor				1		Roof
MUA-102 Supply Air Temperature	Duct Temp Sensor				1		Roof
MUA-102 Supply Air Sensor	Duct Temp Sensor				1		Roof

Holy Family Catholic Elementary School - Points List							
CONTROL POINTS	**DEVICE**	**DO**	**DI**	**AO**	**AI**	**Override Switch**	**Location**
MUA-102 Freeze Stat Status	Duct Temp Sensor		1				Roof
MUA-102 Exhaust Air Damper	2-10 VDC Control			1			Roof
MUA-102 Intake Air Damper	2-10 VDC Control			1			Roof
MUA-102 Heat Recovery Wheel Status	Amperage				1		Roof
MUA-102 Bypass Dampers	2-10 VDC Control			1			Roof
MUA-102 Gas Valve	2-10 VDC Control			1			Roof
MUA-102 Carbon Dioxide Sensor	2-10 VDC Control			1			Refer to Plan
MUA-102 DX Cooling (provide staged cooling)	2-10 VDC Control			3			Roof
MUA-102 Heat Pump	2-10 VDC Control			1			Roof
Exhaust Fan Control	On/Off	2					Refer To Plan - Wire thru Starter
Exhaust Fan Status	Amperage				2		Refer to Plan- Wire thru Starter
Space Sensor	Space Sensor				1		Refer to Plan
Boiler #1 Control	On/Off	1					Existing Boiler Room
Boiler #1 Gas Valve Status	Status		1				Existing Boiler Room
Boiler #1 Alarm Circuit Status	Status		1				Existing Boiler Room
Boiler #1 Supply Sensor	Thermal Well Sensor				1		Existing Boiler Room
Circulating Pump C-1 Control (Boiler #1 Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-1 Status	Amperage				1		Existing Boiler Room
Boiler #2 Control	On/Off	1					Existing Boiler Room
Boiler #2 Gas Valve Status	Status		1				Existing Boiler Room
Boiler #2 Alarm Circuit Status	Status		1				Existing Boiler Room
Boiler #2 Supply Sensor	Thermal Well Sensor				1		Existing Boiler Room
Circulating Pump C-2 Control (Boiler #2 Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-2 Status	Amperage				1		Existing Boiler Room

Holy Family Catholic Elementary School - Points List							
CONTROL POINTS	**DEVICE**	**DO**	**DI**	**AO**	**AI**	**Override Switch**	**Location**
Circulating Pump C-3 Control (Heating System Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-3 Status	Amperage				1		Existing Boiler Room
Circulating Pump C-3 Variable Frequency Drive	2-10 VDC Control			1			Existing Boiler Room
Circulating Pump C-4 Control (Heating System Pump)	On/Off	1					Existing Boiler Room
Circulating Pump C-4 Status	Amperage				1		Existing Boiler Room
Circulating Pump C-4 Variable Frequency Drive	2-10 VDC Control			1			Existing Boiler Room
Loop Diff Pressure SP (C-3/ C-4)	Diff Pressure Sensor				1		Refer to Plan
Solenoid Trap Primer	On/Off	2					Refer to Plan
Boiler Room Supply Fan Control (SF-101)	On/Off	1					Existing Boiler Room
Boiler Room Exhaust Fan Control (EF-101)	On/Off	1					Existing Boiler Room
Hydronic Force Flow Control	On/Off	1					Existing Boiler Room
Hydronic Force Flow Status	Amperage				1		Existing Boiler Room
Hydronic Force Flow Space Sensor	Space Sensor				1		Existing Boiler Room
Radiation Heating Valve(s)	2-10 VDC Control			8			Final Count to be Determined on Site
Space Temperature	Space Temp Sensor				8		Final Count to be Determined on Site