SPECIFICATIONS  
FOR:  
EXTERIOR UPGRADES & ROOF REPLACEMENT  
at: 
UPTERGROVE PUBLIC SCHOOL  
4833 Muley Point Road, Ramara, Ontario  

TENDER 12186T  
2019-05-13  
RYA Project 18-171  

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1. INTRODUCTION

1.1 INVITATION

1.1.1 Simcoe County District School Board (the “Owner”) is soliciting Bids from prequalified general contractors to perform the work described in the Bid Documents (the “Work”) at Uptergrove Public School located at 4833 Muley Point Road R.R. #7, Orillia, Ontario L3V 6H7 (the “Place of the Work”).

1.2 KEY INFORMATION

1.2.1 This Section provides a summary of some key information contained in the Bid Documents and is provided solely as a convenience. Bidders are urged to read all of the Bid Documents carefully and thoroughly to ensure they fully understand all of the terms and conditions, including all Contract requirements.

(a) The Owner has scheduled a mandatory site meeting at Uptergrove Public School on May 21, 2019, commencing at 4:00 PM.

(b) The Owner requires that all Bidders and prequalified Roofing Subcontractors attend the mandatory site meeting. Mechanical Subcontractors are strongly recommended to attend but are not required.

(c) The deadline for submitting questions (the “Question Deadline”) is 10 days before the Submission Deadline.

(d) Questions must be submitted through the online portal www.bidsandtenders.ca.

(e) Bids must be submitted online through the Portal BEFORE 1:30:00PM Local Time on June 4, 2019 (the “Submission Deadline”).

(f) Bids must be irrevocable for a period of ninety (90) days starting from the day after the Submission Deadline (the “Irrevocability Period”).

(g) The form of bid security to be delivered as part of the Bid is a digital bond, no other form of bond is acceptable. Bids submitted without digital bond will be considered noncompliant.

(h) The successful Bidder is permitted to commence work on site as of July 2, 2019.

(i) The successful Bidder will be required to achieve Substantial Performance of the Work by August 23, 2019.

(j) The Bid Coordinator is Justin Apokremiotis, Purchasing Supervisor, at “japokremiotis@scdsb.on.ca”.

1.3 PREQUALIFICATION

1.3.1 The following general contractors are prequalified to submit a Bid (each a “Prequalified Contractor”):

(a) Anacond Contracting Inc.

(b) Aquicon Construction

(c) Bertram Construction (Ontario) Ltd.

(d) Brown Daniels Associates Inc.
INSTRUCTIONS TO BIDDERS

Uptergrove Public School
Building Exterior Upgrades and Roof Replacement

1.3.2 The following Roofing Subcontractors are prequalified for the Work:

(a) Atlas - Apex Roofing Inc
(b) Cordeiro Roofing Ltd.
(c) Crawford Roofing Corporation
(d) D.J. Peat Roofing & Sheet Metal Ltd.
(e) Dean-Chandler Roofing Limited
(f) Flynn Canada Ltd.
(g) Lefleche Roofing
(h) Midhurst Roofing Limited
(i) Nortex Roofing LTD.
(j) Provincial Industrial Roofing and Sheet Metal
1.3.3 The following Mechanical Subcontractors are prequalified for the Work:

(a) Anvi Services Ltd.
(b) CEC Mechanical Ltd.
(c) Division 15 Plumbing & Mechanical In.
(d) H.S. St. Amant & Sons Inc.
(e) JMR Mechanical & Electrical Contractors
(f) Litek Mechanical Services Inc.
(g) Marnoch Electrical Services Inc. (MFM)
(h) Pipe All Plumbing & Heating Ltd.
(i) Sexton's Mechanical Limited.
(j) Soan Mechanical Ltd.
(k) Stellar Mechanical Inc.
(l) SWIFT Mechanical Services Inc.
(m) Western Mechanical Electrical Millwright Services Limited

1.3.4 The following Electrical Subcontractors are prequalified for the Work:

(a) Abercrombie Electric Company Ltd.
(b) B.C. North Electrical
(c) Brian's Little Electric Ltd.
(d) C. Georges Electrical Inc. **
(e) CEC Services Limited
(f) Horse Power Electrical Maintenance & Contracting Corp.
(g) J.M.R. Electric Ltd.
(h) KB Electrical
(i) Marnoch Electrical Services Inc.
(j) Minnings Electric Service Ltd.
(k) N.S.E. 2000 INC.
(l) Pentor Electric
(m) Star Electrical Services Inc.
(n) Walker's Electric 2000
1.3.5 The Owner reserves the right to issue one or more addenda naming additional Prequalified Contractors and/or additional prequalified Subcontractors.

1.3.6 Only Prequalified Contractors are eligible to participate in this Bid Process and to submit a Bid. Submissions received from those who are not a Prequalified Contractor will not be considered.

1.4 THE BID CONTRACT

1.4.1 The Bidders and the Owner acknowledge it is their intention to create a process contract, sometimes referred to as “Contract A” (the “Bid Contract”), between the Owner and each Bidder whose Bid meets all Mandatory Requirements. The Bidders and the Owner further acknowledge that if a Bid Contract is created between the Owner and one or more Bidders, the terms of the Bid Contract are represented by the Bid Documents and include an obligation on the successful Bidder, if any, to sign the Contract.

1.5 BIDDERS’ EXPENSES

1.5.1 Bidders shall bear all costs and expenses incurred by them in any way related to any aspect of their participation or intended participation in this Bid Process including, without limitation, all costs and expenses related to a Bidder’s involvement in:

(a) due diligence, investigations, and information gathering processes;
(b) attendances and/or participation at any and all site visits and/or meetings;
(c) the preparation and submission of a Bid and responding to Requests for Additional Information.

2. DEFINITIONS

Capitalized terms used in the Instructions to Bidders and not otherwise defined in this Article or elsewhere in these Instructions to Bidders shall have the meanings ascribed to them in the Definitions to the Contract. All references in the Instructions to Bidders to “Article”, “Section” or “paragraph” shall, unless specifically indicated otherwise, refer to an Article, Section or paragraph of these Instructions to Bidders.

2.1.1 “Adjusted Bid Price” has the meaning set out in the table in paragraph 10.4.1.

2.1.2 “Bid” means all documents and information submitted through and/or uploaded to the Portal by a Bidder in response to and in accordance with these Instructions to Bidders, together with the documents and information specified in Section 9.4 and Section 10.2, where applicable.

2.1.3 “Bidder” means a Prequalified Contractor that participates in this Bid Process, whether or not it submits a Bid. The term “Bidder” also includes a Prequalified Contractor prior to the submission of its Bid.

2.1.4 “Bid Contract” means the contract described in paragraph 1.4.1 for the evaluation of Bids and the execution of the Contract, if any.

2.1.5 “Bid Coordinator” is the person identified as such in paragraph 1.2.1(j).

2.1.6 “Bid Documents” means the documents listed in paragraph 3.2.1.
2.1.7 “Bid Price” has the meaning set out in paragraph 9.2.1.
2.1.8 “Bid Process” means the procurement process described in the Bid Documents which commences with the issuance of these Instructions to Proponents and ends on the earliest of the following:
(a) the date on which the Contract is signed;
(b) the date on which the Bid Process is cancelled;
(c) the day after the expiry of the Irrevocability Period.
2.1.9 “Board” means the Board of Trustees of the Owner.
2.1.10 “Conflict of Interest” has the meaning set out in paragraph 13.2.1.
2.1.11 “Contract” means the written agreement to be signed between the Owner and the successful Bidder, in the form of CCDC 2 – 2008 stipulated price contract, as amended by Supplementary Conditions.
2.1.12 “Evaluation Score” has the meaning set out in paragraph 10.4.1.
2.1.13 “Irrevocability Period” has the meaning set out in paragraph 1.2.1(f).
2.1.14 “Local Time” means the time measured and recorded on the Portal.
2.1.15 “Mandatory Requirements” means the mandatory requirements listed in paragraph 10.3.1.
2.1.16 “MFIPPA” means the Municipal Freedom of Information and Protection of Privacy Act (Ontario).
2.1.17 “Owner” means Simcoe County District School Board and includes its employees, agents, trustees, officers and directors, whether involved with the Bid Process or not, and includes the Board.
2.1.18 “Place of the Work” has the meaning set out in paragraph 1.1.1.
2.1.19 “Portal” has the meaning set out in paragraph 3.1.1.
2.1.20 “Prequalified Contractor” has the meaning set out in paragraph 1.3.1.
2.1.21 “Question Deadline” is the date identified as such in paragraph 1.2.1(c).
2.1.22 “Reports” has the meaning set out in paragraph 4.1.1.
2.1.23 “Request for Additional Information” has the meaning set out in paragraph 10.2.1.
2.1.24 “Security Documents” has the meaning set out in paragraph 9.3.1.
2.1.25 “Submission Deadline” is the date and time identified as such in paragraph 1.2.1(e).
2.1.26 “Supplementary Conditions” means the Supplementary Conditions for the CCDC 2 – 2008 stipulated price contract included on the Portal.
2.1.27 “Work” means the total construction and related services described in the Bid Documents.

3. **BID DOCUMENTS**

3.1 **ACCESS TO THE BID DOCUMENTS**

3.1.1 The Bid Documents will be made available to Bidders through the online digital bidding system established for this Bid Process on the website hosted by eSolutions Group Limited at
“www.bidsandtenders.ca” (the “Portal”). The Portal will include all Bid Documents as well as Reports and other relevant notices, information and communications.

3.1.2 Each Bidder is solely responsible to ensure that it:
   (a) registers with and obtains access to the Portal; and
   (b) has the appropriate software to access, input, download and upload contents from and to the Portal; and
   (c) visits and reviews the Portal as frequently as is necessary to ensure that it has the most current information, documents and addenda.

Bidders are solely responsible for visiting and checking the Portal for new content and the Owner accepts no responsibility for any Bidder lacking any documents or information posted to the Portal.

3.1.3 If there is a conflict or inconsistency between an electronic version of any document included or posted to the Portal and any other version of the same document, whether in electronic or paper form, the electronic version on the Portal shall govern.

3.2 The Bid Documents

3.2.1 Bidders should ensure they have and/or have access to all of the documents listed below (collectively the “Bid Documents”). A Bid will be deemed to have been prepared on the basis of all Bid Documents issued and posted to the Portal prior to the Submission Deadline, and the Owner accepts no responsibility for any Bidder lacking or not being able to access any part of the Bid Documents.
   (a) Instructions to Bidders (this document).
   (b) Supplementary Conditions.
   (c) Specifications.
   (d) Drawings.
   (e) Addenda, if any.

3.2.2 Bidders should inform the Bid Coordinator immediately if any documents are missing or incomplete and/or upon finding any discrepancies or omissions in the Bid Documents.

3.2.3 The Bid Documents are made available only for the purpose of submitting Bids for the Work. Availability and/or use of the Bid Documents does not confer a license or grant for any other purpose.

4. Bidders’ Due Diligence

4.1.1 In addition to the Bid Documents, the Portal may include the Owner’s information, data and environmental, geotechnical or other reports prepared or obtained with respect to the Place of the Work (collectively the “Reports”). The Reports should not be considered a representation of the conditions of the entire Place of the Work and are provided for general information and guidance purposes only. The Owner does not guarantee the accuracy or completeness of the Reports nor assumes any responsibility for any interpretations or conclusions that Bidders may make or draw from the Reports.
4.1.2 Nothing in this Bid Process or in the Bid Documents or in the Reports is intended to relieve Bidders from undertaking their own research, investigations or other due diligence, or forming their own opinions and conclusions with respect to the Work, the Place of the Work, the Bid Documents, the Contract, and all other matters related to this Bid Process. The Owner (a) does not accept or assume any responsibility for any interpretations or conclusions that Bidders may make or draw from the Bid Documents or the Reports, (b) does not represent, warrant or guarantee that the Bid Documents or the Reports are complete, accurate or comprehensive or exhaustive, and (c) assumes no responsibility for the completeness or accuracy of the Bid Documents or the Reports, or anything else provided or made available by the Owner during this Bid Process.

4.1.3 No allowances will be made for additional costs and no claims will be entertained in connection with:

   (a) conditions which could reasonably have been ascertained by the Bidders through investigation or other due diligence undertaken prior to the Submission Deadline; and/or

   (b) Work which is required and which is reasonably inferable from the Bid Documents and/or the Reports as being necessary.

5. COMMUNICATIONS, QUESTIONS AND ADDENDA

5.1 COMMUNICATIONS

5.1.1 Except as may be permitted in the Bid Documents, Bidders are not to communicate with or otherwise contact the Owner regarding this Bid Process at any time before execution of the Contract, if any. A Bidder's failure to comply with this paragraph may result in the disqualification of the Bidder and the rejection of its Bid.

5.1.2 Except where provided otherwise in these Instructions to Bidders, all communications (including questions) with the Owner permitted by this Bid Process are to be in writing and are to be submitted online through the Portal.

5.2 BIDDERS’ QUESTIONS

5.2.1 Bidders are encouraged to ask questions or request clarification with respect to any part of this Bid Process or any Bid Documents which do not appear to be clear. Questions received by the Question Deadline will be reviewed and if the Owner believes that a response is warranted, it will include the question and its answer in an addendum. Questions received after the Question Deadline may not be considered and may not be answered, although the Owner reserves the discretion, but has no obligation, to consider and respond to questions received after the Question Deadline. In responding to questions the Owner may answer similar questions from different Bidders only once, may edit or rephrase the questions, and may ignore questions which, in the Owner's opinion, do not require a response. All questions must be submitted through the Portal.

5.3 ADDENDA

5.3.1 This Bid Process and the Bid Documents may be amended only by written addendum posted to the Portal. Answers, responses, clarifications, instructions or any other information provided by any other means, by any person, in whatever context or setting, will not in any way bind the Owner or amend this Bid Process or any Bid Documents, and are not to be relied upon by any Bidder, unless and until they are posted to the Portal in the form of an addendum.
5.3.2 Addenda will be posted on the Portal only and will not be sent or otherwise distributed to the Bidders. Bidders are solely responsible:
(a) to visit and review the Portal for addenda, and the Owner shall not be responsible if any addenda are not obtained by a Bidder;
(b) to ensure they have received and that their Bid incorporates all addenda issued and posted to the Portal before the Submission Deadline and takes into account all resulting costs.

Bidders will be required to confirm their Bid incorporates all addenda by so indicating in their Bid.

6. **MANDATORY SITE MEETING**

6.1 **MANDATORY ATTENDANCE**

6.1.1 The Owner has scheduled a mandatory site meeting at the location, date and time specified in paragraph 1.2.1(a). The purpose of the meeting is to review the Bid Process and to provide those in attendance an opportunity to ask questions and tour the Place of the Work.

6.1.2 Attendance at the site meeting is mandatory:
(a) for Bidders;
(b) for prequalified Roofing Subcontractors.

All persons attending the site meeting will be required to sign an attendance log to confirm their attendance.

6.2 **CONSEQUENCES OF FAILING TO ATTEND THE MANDATORY SITE MEETING**

6.2.1 Bids received from Bidders who fail to attend the mandatory site meeting, as determined from the attendance log, will not be considered.

6.2.2 Where the Owner has required that prequalified Subcontractors attend the mandatory site meeting, as indicated in paragraph 6.1.2(b), then, Bids that fail to carry a prequalified Subcontractor that attended the mandatory site meeting, as determined from the attendance log, will not be considered.

6.3 **INFORMATION OBTAINED AT THE MANDATORY SITE MEETING**

6.3.1 Each Bidder acknowledges and agrees that:
(a) notwithstanding the Owner may give answers and may provide information during the site meeting, such answers and information, whether in verbal or in written form, will not in any way bind the Owner or amend this Bid Process or any Bid Documents, and are not to be relied upon in any way by a Bidder, except and only to the extent expressly confirmed in an addendum;
(b) anything said, written or done by the Owner or any other person, and any views or comments expressed in response to anything said or done during the site meeting, will not in any way bind the Owner or amend this Bid Process or any Bid Documents, and are not to be relied upon in any way by a Bidder except and only to the extent expressly confirmed in an addendum.
7. SITE INVESTIGATION BY BIDDERS

7.1.1 Each Bidder is solely responsible, at its own cost and expense, to carry out its own independent research and due diligence and to perform any investigations considered necessary by the Bidder to satisfy itself as to the existence and/or locations of utilities and underground services and all other existing conditions, circumstances and limitations affecting the Place of the Work, the Work, the Bid Documents, the Contract, and all other matters related to this Bid Process. The Bidders’ obligations set out in this paragraph apply irrespective of the information contained in the Bid Documents or the Reports or that is made available to the Bidders during this Bid Process.

7.1.2 Bidders shall not undertake any investigation activities at the Place of the Work except as provided in this Article 7.

7.1.3 Bidders who would like an opportunity to undertake an investigation of the Place of the Work must submit an e-mail request to the Bid Coordinator. Such request must be received at least 2 business days before the Bidder's proposed date for the proposed investigation, provided that all investigations must be completed by the Question Deadline. The request must include:

(a) the proposed date and time and alternate date and time for the proposed investigation;
(b) the anticipated duration of the proposed investigation;
(c) names, titles and contact information of who will be attending;
(d) details of the proposed investigation, including who is proposed to carry out the investigation;
(e) area(s) of the Place of the Work for which access is requested;
(f) such other information as the Owner may reasonably require.

A Bidder's request will not be complete and an appointment for the investigation will not be scheduled until all of the required information has been provided.

7.1.4 If the Owner approves a Bidder’s request to investigate the Place of the Work, the Owner will issue a written notification of the date and time on which the Bidder may attend at the Place of the Work, as well as the investigation activity(ies) which the Bidder is authorized to undertake, and the duration of such activity(ies). A representative of the Owner may attend to monitor the Bidder’s activities.

7.1.5 Bidders acknowledge that unforeseen circumstances may arise and the Owner may, in its sole discretion, cancel, reschedule and/or modify the Bidder’s visit and/or investigation activities on short notice or no notice to the Bidder.

7.1.6 Each Bidder acknowledges and agrees:

(a) that anything said, written or done by the Owner or its representatives, and any views or comments expressed in response to anything said or done during the investigation of the Place of the Work will not in any way bind the Owner or amend this Bid Process or any Bid Documents, and are not to be relied upon by any Bidder;

(b) to waive any and all right to contest, claim, complain, protest and/or dispute this Bid Process based on the fact that findings, information, results or data may have been
obtained by another Bidder as a result of that Bidder’s investigation of the Place of the Work, that were not obtained by, shared with, or provided to other Bidders.

7.1.7 Bidders shall, for their own forces and for their agents, consultants, contractors, subcontractors and all others attending at the Place of the Work with them or on their behalf:

(a) assume overall responsibility for compliance with all aspects of the applicable workers’ compensation and health and construction safety legislation and all related rules, regulations and practices, and shall ensure that appropriate occupational health and safety instruction and training are provided to all those attending the Place of the Work;

(b) perform only investigations authorized by the Owner;

(c) avoid disturbing and take all reasonable steps necessary to promote and maintain the safety of the occupants of the Place of the Work and any adjacent properties and the public in general;

(d) respect and comply with local regulations and the Owner’s requirements regarding permitted work hours and noise levels;

(e) indemnify and save the Owner harmless from, and be responsible for, all claims, demands, losses, costs or damages related to or arising from any activities performed by the Bidder or anyone attending with or on behalf of the Bidder at the Place of the Work, whether or not authorized by the Bidder or the Owner.

8. DESIGNATED SUBSTANCES

8.1 Without limiting the obligations of the bidders set out in Article 5, where the Place of the Work is within or part of an existing building, bidders should note they may encounter designated substances such as lead, mercury, silica, asbestos-containing material (“ACM”), benzene, arsenic, etc. If applicable, a list of designated substances present at the Place of the Work has been provided to all bidders and, if ACM is included in the list of designated substances, a report has also been provided indicating the condition and location of any ACM that may be present at the Place of the Work (collectively the “OHSA Reports”).

8.2 In carrying out the Work under the Contract, bidders shall ensure they do not handle, deal with, disturb or remove any designated substance whether identified in the OHSA Reports or not, unless included in the Work required by the Bid Documents. Should a bidder determine, prior to the Closing Date, that the Work cannot be completed without handling, dealing with, disturbing or removing any designated substance identified in the OHSA Reports (and the Work does not otherwise require the bidder to handle, deal with, disturb and/or remove such substance), it shall immediately notify the Owner and the Consultant in writing so that, if necessary, instructions and/or clarifications may be issued in the form of an addendum.

8.3 All information provided to or obtained by bidders in connection with this bid process, including all Reports, Data and the OHSA Reports, are and shall remain the property of the Owner and must be treated as confidential whether or not a contract is awarded, and which confidentiality obligations shall survive termination of the bid process. Such information is not to be used for any purpose other than submitting a Bid.
9. INSTRUCTIONS FOR BID COMPLETION

9.1 BID COMPLETION

9.1.1 Bids which are completed and/or submitted by any means other than as set out in this Article 9 will not be considered.

9.1.2 Bidders shall:

(a) provide, input, post and/or upload all requested information and shall fill in all spaces and blanks on the Portal, as provided in Section 9.2; and

(b) submit the Security Documents described in Section 9.3 in accordance with and as provided in Section 9.4.

9.1.3 Bidders shall ensure all required information and documents are submitted through and uploaded / posted to the Portal BEFORE the Submission Deadline. Bidders who fail to do so before the Submission Deadline will be unable to submit their Bid.

9.2 INSTRUCTIONS

9.2.1 Bid Price. Bidders shall input in the space provided on the Portal the fixed, all-inclusive lump sum price for the Work (the "Bid Price"). The Bid Price shall exclude the Harmonized Sales Tax (HST) but shall include all other applicable taxes and duties.

9.2.2 Listing Subcontractors.

(a) If required, Bidders shall input a list of the Subcontractors proposed to perform or supply an item of the Work identified on the Portal. Failure to do so may result in the Bid being declared non-compliant.

(b) Where the Owner has prequalified one or more Subcontractors to perform or supply an identified item of the Work, Bidders shall select only a prequalified Subcontractor to perform or supply that item of Work. Failure to do so may result in the Bid being declared non-compliant.

(c) Where the Owner has required that prequalified Subcontractors attend the mandatory site meeting, as indicated in paragraph 6.1.2(b), Bidders shall select and carry only a prequalified Subcontractor that attended the mandatory site meeting, as determined from the attendance log. Failure to do so will result in the Bid being declared non-compliant.

(d) Where a Bidder lists “own forces” in place of a Subcontractor, the Bidder shall perform such item of the Work with its own forces. In such case the Owner reserves the right to obtain information from the Bidder and from third parties respecting the qualifications and experience of the Bidder’s own forces for such item of the Work. If the Owner determines, acting reasonably, that the Bidder’s own forces are not qualified or experienced to perform such item of the Work, the Owner may declare the Bid non-compliant.

9.2.3 Unit, Separate, Itemized and Alternative Prices. If required, Bidders shall submit the following prices, all of which shall exclude the Harmonized Sales Tax (HST) but shall include all other applicable taxes and duties:

(a) unit prices;
(b) separate prices for work, if any, which is not included in the Bid Price and which the Owner may add for the amount(s) indicated;

(c) itemized prices for Work, if any, which is included in the Bid Price and which the Owner may delete for the amount(s) indicated;

(d) alternative prices for work, if any, which is not included in the Bid Price and which the Owner may substitute for Work which is included in the Bid Price for the amount(s) indicated.

The Owner reserves the right to accept or reject any or all unit, separate, itemized and alternative prices submitted, and such prices shall remain in effect for the duration of the Contract.

9.3 SECURITY DOCUMENTS

9.3.1 Each Bidder shall submit the form of bid security specified or permitted in paragraph 1.2.1(f), as further described in paragraph 9.3.2. Where applicable, Bidders shall also submit the agreement to bond / surety’s consent specified in paragraph 9.3.3 (the bid security and, where applicable, the agreement to bond / surety’s consent are collectively referred to as the “Security Documents”).

9.3.2 Bid Security.

The bid security specified in paragraph 1.2.1(f) is a digital bid bond. The digital bid bond shall be in the amount of 10% of the Bid Price in the form CCDC 220 – 2002 naming “Simcoe County District School Board” as obligee and issued by a surety licensed to conduct surety and insurance business in Canada. The bid bond shall remain valid for at least the duration of the Irrevocability Period. No other form of bid bond is acceptable.

The bid security of the successful Bidder will be retained by the Owner as compensation towards the damages the Owner will suffer should the successful Bidder fail to sign the Contract and/or fail to provide the specified performance security and/or otherwise breach the Bid Contract.

9.3.3 Agreement to Bond / Surety’s Consent. Each Bidder that submits bid security in the form of a digital bid bond shall also submit an agreement to bond or surety’s consent issued by the same surety that provides the digital bid bond, undertaking to provide a performance bond and a labour and material payment bond, each in the amount of fifty percent (50%) of the Bid Price. The agreement to bond / surety’s consent shall remain valid for at least the duration of the Irrevocability Period.

9.3.4 Bidders shall include the costs of all Security Documents in their Bid Price.

9.4 DELIVERY OF THE SECURITY DOCUMENTS

9.4.1 Each Bidder that intends to submit bid security in the form of a digital bid bond shall:

(a) upload or post the digital bond described in paragraph 9.3.2. to the Portal; and

(b) upload or post to the Portal a scanned copy (in “pdf” format) of the agreement to bond or surety’s consent described in paragraph 9.3.3.

9.4.2 Reserved.

9.4.3 Bids that do not comply with this Section 9.4 will be declared non-compliant.
9.5 **BID IRREVOCABILITY**

9.5.1 Each Bid shall be irrevocable and shall remain open for consideration by the Owner for the duration of the Irrevocability Period.

10. **EVALUATING BIDS**

10.1 **GENERAL**

10.1.1 Bids will be reviewed and evaluated by the Owner in private.

10.1.2 Notwithstanding anything else contained in the Bid Documents, the award of the Contract, if any, shall be subject to the approval of the Board, in its sole and unfettered discretion. Bidders shall have no claims whatsoever against the Owner or the Board arising out of the exercise of authority by the Board, and/or in the event the Owner, in its sole and unfettered discretion, and for any or no reason, decides not to award the Contract.

10.2 **REQUESTS FOR ADDITIONAL INFORMATION**

10.2.1 The Bid Coordinator, on behalf of the Owner, may contact any one or more Bidders to request clarification of any information or documents submitted as part of a Bid, or to request supplementary information (collectively, "Request for Additional Information"), without any obligation to make the same or any Request for Additional Information of any other Bidder. Notwithstanding the preceding sentence, the Owner has no obligation to make any Request for Additional Information.

10.2.2 Bidders shall respond to all Requests for Additional Information within the time and in the manner stipulated in each Request for Additional Information, and any response received will form an integral part of a Bidder’s Bid. If a Bidder fails to respond to a Request for Additional Information, its Bid will be considered and evaluated based solely on the original Bid contents submitted.

10.2.3 A Bidder’s response to a Request for Additional Information shall not be an opportunity for the Bidder to either correct errors or to change its Bid in any substantive manner. Subject to that, information, prices, rates and documents submitted in response to a Request for Additional Information shall form part of a Bidder’s Bid.

10.3 **MANDATORY REQUIREMENTS**

10.3.1 Subject to paragraph 10.3.2, only Bids which are submitted through the Portal before the Submission Deadline and which meet all of the mandatory requirements listed below (collectively, the “Mandatory Requirements”) on a "pass/fail" basis will be eligible for evaluation and award of the Contract:

(a) the Bidder is a Prequalified Contractor; and

(b) the Bidder attended the mandatory site meeting, as determined from the attendance log; and

(c) where the Owner has required that prequalified Subcontractors attend the mandatory site meeting, as indicated in paragraph 6.1.2(b), the Bid includes prequalified Subcontractor(s) that attended the mandatory site meeting, as determined from the attendance log.
(d) the Bid includes the specified Security Documents and complies with Section 9.4; and

(e) the Bid substantially complies with the requirements of the Bid Documents. In this respect, the Owner reserves the right, in its sole and unfettered discretion, to waive minor errors and matters of non-compliance contained in a Bid.

10.3.2 If all Bids fail at least one of the Mandatory Requirements the Owner, in its sole discretion, may:

(a) evaluate one or more Bids and proceed with the Bid Process and treat such Bid(s) as having met all of the Mandatory Requirements; and/or

(b) negotiate a Contract for the whole or any part of the Work with any Bidder; and/or

(c) take any action in accordance with paragraph 12.2.1.

10.4 EVALUATION

10.4.1 Only Bids which pass all of the Mandatory Criteria or that are selected in accordance with paragraph 10.3.2(a) will be awarded points based on criteria set out below. The points awarded to each Bid will be its "Evaluation Score".

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Points Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid Price offered, as it may be adjusted by the amount of any separate, itemized and/or alternative price(s) which the Owner, in its discretion, decides to accept (&quot;Adjusted Bid Price&quot;). For certainty, where the Owner does not accept any separate, itemized or alternative prices, the Adjusted Bid Price will be the same as the Bid Price.</td>
<td>100</td>
</tr>
</tbody>
</table>

MAXIMUM POINTS AVAILABLE

100

10.4.2 A Bidder's Evaluation Score will be calculated in accordance with the formula below:

(a) the Bidder with the lowest Adjusted Bid Price will be awarded 100 points;

(b) the points to be awarded to each of the other Bidders will be calculated as follows:

\[
\frac{\text{lowest Adjusted Bid Price}}{\text{other Bidder’s Adjusted Bid Price}} \times 100 = \text{points awarded}
\]

10.4.3 If there is a tie in the Evaluation Score of two or more Bids, the tie will be broken by a coin toss or by the drawing of lots performed by the Owner in the presence of the tied Bidders.
11. AWARD OF THE CONTRACT, DOCUMENTS TO BE DELIVERED, AND SIGNING THE CONTRACT

11.1 AWARD OF THE CONTRACT

11.1.1 Subject to receiving the approval of the Board, and subject to the other provisions of the Bid Documents, if the Owner decides to award the Contract it will issue an award letter to the Bidder that submitted the Bid which received the highest Evaluation Score.

11.2 DOCUMENTS TO BE DELIVERED

11.2.1 Within 10 business days of receiving an award letter from the Owner the successful Bidder shall deliver to the Owner:

(a) where the Bidder submitted an agreement to bond / surety's consent, the Bidder shall deliver the performance bond and the labour and material payment bond described in the Bid Documents, the forms of such bonds to comply with the requirements of the Contract;

(b) certified true copies of the insurance policies required by the Contract or certificates of insurance, at the option of the Owner;

(c) the Bidder's current WSIB clearance certificate;

(d) the Bidder’s health and safety policy for the Work; and

(e) a copy of the notice of project issued by the Ministry of Labour naming the Bidder as the “constructor” for the Work.

11.2.2 A Bidder's failure to comply with paragraph 11.2.1 will constitute a breach of the Bid Contract.

11.3 SIGNING THE CONTRACT

11.3.1 The successful Bidder shall sign the Contract and shall deliver the signed original to the Owner within 10 business days of the Bidder’s receipt of the execution copy of the Contract. A Bidder’s failure to comply with this paragraph will constitute a breach of the Bid Contract.

12. OWNER’S RIGHTS

12.1 GENERAL

12.1.1 In addition to any other express rights contained in the Bid Documents or any other rights which may be implied in the circumstances, the Owner reserves the right to exercise any or all or a combination of the rights described in this Article. The Owner shall not be liable for any costs, expenses or damages incurred or claimed by a Bidder resulting from the Owner’s exercise of any of its rights.

12.1.2 A Bidder's submission or the Owner’s evaluation of any Bid, even where only one Bid is submitted before the Submission Deadline and even where only one Bid meets all Mandatory Requirements, will not obligate the Owner to accept any Bid, award the Contract, or proceed further with this Bid Process.
12.2 **THE OWNER’S RIGHTS**

12.2.1 The Owner may, in its sole discretion, and for any or no reason:

(a) reject any or one or more or all Bids, even if only one Bid is received;
(b) reject the whole or any part of any Bid;
(c) accept the whole or any part of a Bid;
(d) if only one Bid meets all of the Mandatory Requirements, elect to accept or reject all or any part of it;
(e) cancel this Bid Process at any time before the award of the Contract;
(f) cancel this Bid Process at any time before the award of the Contract and issue a new procurement process for work which is same or similar to the Work, with the same or different participants.

12.2.2 The board reserves the right to disqualify a Bidder and reject a Tender on the basis of: (I) past performance on previous Contracts awarded by the Simcoe County District School Board; (II) other relevant information that arises during this RFT Process, or (III) information provided by references.

12.2.3 The Owner reserves the right to:

(a) waive minor errors and matters of non-compliance contained in a Bid;
(b) adjust an Evaluation Score or reject a Bid on the basis of information received in response to a Request for Additional Information;
(c) disqualify any Bidder whose Bid contains misrepresentations or any other inaccurate or misleading information relating to matters which the Owner, in its sole discretion, considers material;
(d) where the Owner has accepted any separate, itemized and/or alternative price(s) offered by the Bidders, the Owner reserves the right to award the Contract to other than the Bidder with the lowest Bid Price.

13. **GENERAL**

13.1 **PROHIBITION ON LOBBYING AND COLLUSION**

13.1.1 Bidders and their directors, officers, employees, consultants, agents, advisors and other representatives are strictly prohibited from engaging in conduct which is or could reasonably be considered as any form of political or other lobbying, or as an attempt to influence the outcome of this Bid Process. Without limiting the generality of the foregoing, and except as provided in the Bid Documents, no such person shall contact, communicate with or attempt to contact or communicate with, directly or indirectly and in any manner whatsoever, any staff, personnel or representative of the Owner or the Board in connection with this Bid Process, including for the purpose of:

(a) commenting on, or attempting to influence the views on, the merits of the Bidder’s Bid, or in relation to the Bids of other Bidders;
(b) influencing or attempting to influence the evaluation of the Bids;
(c) promoting the Bidder or its interests, including in preference to that of other Bidders;

(d) commenting on or criticizing aspects of this Bid Process, the Bid Documents, the Work, or the Contract, including in a manner which may give the Bidder a competitive or other advantage over other Bidders;

(e) criticizing other Bidders or the Bids of other Bidders.

13.1.2 Bidders and their directors, officers, employees, consultants, agents, advisors and other representatives are prohibited from communicating with or attempting to contact or communicate with, directly or indirectly and in any manner whatsoever, any information whatsoever regarding the preparation of a Bid to any other Bidder.

13.1.3 Failure of a Bidder to comply with this Section may result in the disqualification of the Bidder and the rejection of its Bid.

13.2 CONFLICT OF INTEREST

13.2.1 Bidders shall disclose all perceived, potential and actual Conflicts of Interest. For the purposes of this Bid Process, “Conflict of Interest” includes:

(a) any situation or circumstances where, in relation to this Bid Process, the Work, and/or the Contract, the Bidder’s other commitments, relationships or financial interests could or could be perceived to exert an improper influence over the objective, unbiased and impartial exercise of independent judgment by any member or representative of the Owner or the Board;

(b) any situation or circumstances where any person employed by the Owner in any capacity:
   (i) has a direct or indirect financial or other interest in any Bidder;
   (ii) is an employee or a consultant to or under contract to any Bidder;
   (iii) is negotiating or has an arrangement concerning future employment or contracting with any Bidder;
   (iv) has an ownership interest in or is an officer or director or partner of any Bidder.

13.2.2 If a Bidder discovers, before or after the Submission Deadline, any perceived, potential or actual Conflict of Interest, the Bidder shall immediately send a written statement to the Bid Coordinator describing the perceived, potential or actual Conflict of Interest, along with a written proposal that, if implemented, would address the identified perceived, potential or actual Conflict of Interest. The Owner will review the Bidder’s written statement and proposal and, without limiting the generality of Article 12, the Owner may, in its sole discretion:

(a) disqualify the Bidder from participating in this Bid Process and reject its Bid;

(b) waive any and all perceived, potential or actual Conflict of Interest upon such terms and conditions as the Owner, in its sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately managed, mitigated and minimized.

13.2.3 Failure of a Bidder to comply with this Section may result in the disqualification of the Bidder and the rejection of its Bid.
13.3 **CONFIDENTIALITY, DISCLOSURE AND MFIPPA**

13.3.1 All information provided by or obtained from the Owner in connection with this Bid Process, the Work, and/or the Contract, including all Reports, is and shall remain the property of the Owner and must be treated as confidential, and such confidentiality obligations shall survive the Bid Process. Such information is not to be used for any purpose other than responding to this Bid Process and, upon conclusion of this Bid Process, if requested by the Owner, Bidders shall return all such information.

13.3.2 Bidders acknowledge that the contents of their Bids will be disclosed within the Owner’s organization and/or to the Owner’s consultants and advisors. The Owner will use reasonable efforts to protect sensitive and confidential information provided by the Bidders, however, the Owner shall not be liable in any way whatsoever if such information, or any part of it, is disclosed, even if the Owner, its consultants, advisors, staff or any other person associated with them may have been negligent with respect to such disclosure. By submitting a Bid each Bidder agrees to such disclosure and releases the Bid Coordinator and the Owner from any liability for the same.

13.3.3 The Owner may be required to disclose parts or all of a Bid pursuant to the provisions of MFIPPA or other legislation. Subject to the provisions of such legislation, the Owner will use reasonable efforts to safeguard the confidentiality of any information identified by a Bidder as confidential, however, the Owner shall not be liable in any way whatsoever if such information is disclosed based on an order or decision made under such legislation or any other applicable law. By submitting a Bid each Bidder agrees to such disclosure and releases the Bid Coordinator and the Owner from any liability for the same.

13.4 **DEBRIEFING**

13.4.1 Following the conclusion of this Bid Process, and provided the Contract has been signed, the Owner will offer separate debriefings to unsuccessful Bidders, but only if requested in accordance with paragraph 13.4.2. Debriefings will be held in person or by telephone conference call, at the Owner's discretion, and will be scheduled on a date and time and for a duration to be confirmed by the Owner.

13.4.2 If an unsuccessful Bidder desires a debriefing it shall submit a written e-mail request to the Bid Coordinator within sixty (60) days after the expiry of the Irrevocability Period, failing which no debriefing will be provided.

13.4.3 Evaluations and scoring of Bids are confidential and during a debriefing the Owner will not provide critiques or discuss the scores or the merits of any Bid other than the Bid submitted by the Bidder that requested the debriefing.

13.5 **PUBLIC STATEMENTS**

13.5.1 Bidders shall not publish, issue, advertise, distribute or make any statements, postings, blogs or releases, electronic or otherwise, concerning their or any other Bid, the Bid Process, the Contract, the evaluation of Bids, or the award of the Contract, without the Owner’s prior express written consent. A Bidder’s failure to comply with this paragraph may result in the disqualification of the Bidder and the rejection of its Bid.
13.6 AWARD DOES NOT CONSTITUTE ENDORSEMENT

13.6.1 The Owner’s award of the Contract, if any, does not constitute a general endorsement of the successful Bidder’s work or services.

13.7 LIMIT OF LIABILITY

13.7.1 Each Bidder agrees that the liability of the Owner to any Bidder and the aggregate amount of damages recoverable against the Owner for any and all claims relating to or arising from this Bid Process including:

(a) claims arising from negligence, wilful misconduct or other conduct; and/or

(b) claims arising from a breach of the Bid Contract or any other contractual or other relationship or obligation that may arise as a result of a Bidder’s participation in this Bid Process and/or submission of a Bid,

shall be limited to the Bidder’s reasonable demonstrated costs of preparing its Bid.

13.8 DISPUTES

13.8.1 If a dispute arises in connection with this Bid Process including, without limitation, a dispute concerning the existence of the Bid Contract or a breach of the Bid Contract, or a dispute as to whether a Bid meets the Mandatory Requirements, the parties to the dispute agree:

(a) to use their best efforts to resolve the dispute through amicable and good faith negotiations for a period of at least fifteen (15) days, having such written and oral communications and meetings as appropriate;

(b) if the dispute is not resolved through negotiations the Owner, in its unqualified subjective discretion, may refer the dispute to confidential final binding arbitration before a single arbitrator, selected by the Owner, to be held at Barrie, Ontario pursuant to the Arbitration Act, 1991 (Ontario), as amended. If the Owner refers the dispute to arbitration, each Bidder agrees that it is bound to arbitrate such dispute. Unless the Owner refers such dispute to arbitration, there shall be no arbitration of such dispute.

13.8.2 The Owner may give notice of a dispute to one or more Bidders, each of whom shall be a party to and shall be entitled to participate in the negotiation and/or arbitration, as the case may be and, in the case of arbitration, each of whom shall be bound by the arbitrator’s award, whether or not they participated in the arbitration.

13.8.3 If the Owner refers a dispute to arbitration, the parties to the arbitration shall exchange brief statements of their respective positions on the dispute, together with the relevant documents, and submit to an arbitration hearing which shall last no longer than two (2) days, subject to the discretion of the arbitrator to increase such time. The parties to the arbitration further agree that the arbitrator’s award shall be final and binding and shall not be subject to appeal. The costs of the arbitrator and the venue shall be shared equally among the parties to the arbitration.

END OF DOCUMENT
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These Supplementary Conditions modify, delete and/or add to the Agreement between Owner and Contractor, the Definitions and the General Conditions of the Stipulated Price Contract, Standard Construction Document CCDC 2 – 2008.

Where any article or paragraph in the CCDC 2 – 2008 document is supplemented by one of the following, the provisions of such article or paragraph shall remain in effect and the supplemental provisions shall be considered as added thereto. Where any article or paragraph in the CCDC 2 – 2008 document is amended, deleted, or superseded by any of the following, the provisions of such article or paragraph not so amended, deleted or superseded shall remain in effect.

The CCDC 2 – 2008 document is amended as follows:

**SC1. AGREEMENT BETWEEN OWNER AND CONTRACTOR**

**SC1.1 ARTICLE A-5 PAYMENT**

1.1.1 Amend paragraph 5.1.3, in the first line, by deleting the words “the issuance of the” and replacing them with “receipt of the Consultant’s”.

1.1.2 Amend paragraph 5.3.1 as follows:

(a) Delete “2%” and replace it with “0%” in paragraph 5.3.1(1); and

(b) Delete “4%” and replace it with “2%” in paragraph 5.3.1(2).

**SC1.2 ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING**

1.2.1 Amend paragraph 6.1 by deleting the words “or other form of electronic communication” in the second and seventh lines.

**SC1.3 ARTICLE A-9 TIME IS OF THE ESSENCE**

1.3.1 Add a new Article A-9 as follows:

**“ARTICLE A-9 TIME IS OF THE ESSENCE”**

9.1 The Contractor represents and warrants that it will attain Substantial Performance of the Work by the date stipulated in paragraph 1.3 of Article A-1 – THE WORK and acknowledges that it has been advised by the Owner that it is critical to the Owner that Substantial Performance of the Work is attained by such date. The Contractor agrees that time shall be of the essence in the performance of the Contractor’s obligations under this Contract.”

**SC2. DEFINITIONS**

**SC2.1 Definitions**

2.1.1 Amend Definition 4, “Consultant”, by adding the following to the end of that definition:

“For purposes of this Contract, the terms “Consultant”, “Architect” and “Engineer”, wherever used in the Contract Documents, shall be considered synonymous

2.1.2 Amend Definition 6, “Contract Documents”, by adding the words “in writing” after the word “upon” in the second line.

2.1.3 Amend Definition 12, “Owner”, by adding the following to the end of that Definition:

“For purposes of the Contract, the terms “Owner”, “SCDSB” and the “Board” shall be considered synonymous.”
2.1.4 Amend Definition 16, “Provide”, by adding the following to the end of that Definition:

“Provide has this meaning whether or not the first letter is capitalized.”

2.1.5 Add the following new Definitions:

“27. As-Built Drawings
As-Built Drawings means drawings prepared by the Contractor by marking on a copy of the Drawings the changes from the Drawings which occur during construction including, but not limited to, the exact location of major building components and structures that were shown generally on the Drawings. For certainty, As-Built Drawings shall be in computer-aided design (CAD) format, as well as in hard copy and pdf formats.

28. Construction Schedule
Construction Schedule means the schedule for the performance of the Work provided by the Contractor pursuant to GC 3.5 – CONSTRUCTION SCHEDULE, including any amendments to the Construction Schedule made pursuant to the Contract Documents.

29. Environmental Programs
Environmental Programs means the environmental plans, programs, procedures and requirements of the Owner. The Environmental Programs include Owner’s asbestos control program, its mould program and a program for controlling and handling designated substances.

30. Install
Install means install and connect. Install has this meaning whether or not the first letter is capitalized.

31. Labour Dispute
Labour Dispute means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractor’s association of which the Contractor is a member or to which the Contractor is otherwise bound), job action, slow down, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the Work.

32. OHSA
OHSA means the Occupational Health and Safety Act (Ontario), as amended, and all rules and regulations made thereunder.

33. WSIB
WSIB means the Ontario Workplace Safety & Insurance Board.”

SC3. GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

SC3.1 GC 1.1 CONTRACT DOCUMENTS

3.1.1 Amend paragraph 1.1.1 by adding the following to the end of that paragraph:

“If the Contractor finds discrepancies in, or omissions from, or has any doubt about the meaning or intent of any of the Contract Documents, the Contractor shall at once notify the Consultant.”

3.1.2 Amend paragraph 1.1.3 by adding the following to the end of that paragraph:

“The intent of the Contract Documents is to include all labour, Products, materials, Construction Equipment and services necessary or normally considered necessary for the performance of the Work in accordance with the Contract Documents. Any item of Work mentioned in the Contract Documents or reasonably inferable from the Contract Documents but not otherwise shown or described shall be provided by the Contractor as if shown or otherwise described or inferable. Any items omitted from the Contract Documents which are reasonably necessary or inferable for the completion of the Work, or
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related work, shall be considered a portion of the Work and included in the scope of Work to be performed under this Contract.”

3.1.3 Amend paragraph 1.1.6 by adding new paragraphs 1.1.6.1 and 1.1.6.2:

“1.1.6.1 The Specifications shall be read as a whole and are the minimum construction requirements. Neither the organization nor the division of the Specifications nor anything else contained in the Contract Documents will be construed to place responsibility on the Consultant to settle disputes among the Subcontractors and Suppliers in respect to such organization or division.

1.1.6.2 The Drawings are, in part, diagrammatic and are intended to convey the scope of the Work and indicate elevations and general and approximate locations, arrangement and sizes of fixtures, equipment, outlets, utilities and underground services. The Contractor shall obtain more accurate information and shall satisfy itself as to the conditions of the pre-grade elevations and the locations, arrangement and sizes of fixtures, equipment, outlets, utilities and underground services from study and coordination of the Drawings, including Shop Drawings, and shall satisfy itself and become familiar with conditions and spaces affecting these matters before proceeding with the Work. Where site conditions require reasonable minor changes in indicated locations and arrangements, the Contractor shall make such changes at no additional cost to the Owner. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the Contractor shall include such relocation in the Work. The Contractor shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible.”

3.1.4 Amend paragraph 1.1.7 by adding the following at the end of the paragraph:

“Notwithstanding the foregoing, if there is a conflict or discrepancy between Drawings or between Drawings and Specification or any other Contract Documents in relation to the Products to be supplied or the amount of labour or materials required to complete a particular item of Work, the Contractor shall supply and shall include in the Work the Products, labour and materials which would provide the greatest benefit to the Owner, as determined by the Owner.”

3.1.5 Delete paragraph 1.1.8 and replace it with the following:

“1.1.8 The Owner shall provide the Contractor, without charge, 6 copies of the Contract Documents. Additional copies of the Contract Documents may be obtained from the Consultant at a reasonable cost.”

SC3.2 GC 1.3 RIGHTS AND REMEDIES

3.2.1 Add a new paragraph 1.3.3 as follows:

“1.3.3 To be effective, a waiver of a right, remedy, duty or obligation under this Contract must be expressly written by an authorized representative of the party. For greater certainty, actions of the Owner which shall not constitute a waiver include, but are not limited to, the following:
.1 making payments to the Contractor;
.2 any partial or entire use or occupancy of the Project by the Owner;
.3 final acceptance of the Work by the Owner;
.4 failure of the Owner or its representatives to object to known defects;
.5 specifying a list of defects will not be held a waiver of defects not listed.”

SC3.3 GC 2.2 ROLE OF THE CONSULTANT

3.3.1 Amend paragraph 2.2.7 by deleting the words “Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER” from the beginning of the paragraph.

3.3.2 Amend paragraph 2.2.13 by adding the following to the end of that paragraph:
“If, in the opinion of the Contractor, a Supplemental Instruction involves an adjustment in the Contract Price or the Contract Time, the Contractor shall, within five (5) Working Days of receipt of the Supplemental Instruction, provide the Consultant with a written notice to that effect and shall await further instructions. The Contractor’s failure to provide such written notification within the time stipulated in this paragraph shall be deemed an acceptance of the Supplemental Instruction by the Contractor without adjustment in the Contract Price or Contract Time. Without limiting the generality of the foregoing, every item on the Drawings shall be deemed to be included within the scope of the Work, unless noted ‘not in contract’.”

3.3.1 Add a new paragraph 2.2.19 as follows:

“2.2.19 Neither the Contractor nor any Subcontractor or Supplier shall have any claim against the Consultant as a result of the performance or non-performance of the Consultant’s services. The Contractor shall include this provision in any contracts it makes with its Subcontractors and Suppliers, and shall require such Subcontractors and Suppliers to include the same term in their contracts with their subcontractors and suppliers.”

SC3.4 GC 2.3 REVIEW AND INSPECTION OF THE WORK

3.4.1 Amend paragraph 2.3.5 by adding the following to the end of the second sentence:

“, and there shall be no extensions of the Contract Time resulting from any delay caused by such examination and correction.”

SC3.5 GC 2.4 DEFECTIVE WORK

3.5.1 Add new paragraphs 2.4.1.1 and 2.4.1.2 as follows:

“2.4.1.1 The Contractor shall rectify, in a manner acceptable to the Owner and the Consultant, all defective Work and deficiencies throughout the Work, whether or not they are specifically identified by the Owner or the Consultant.

2.4.1.2 The Contractor shall prioritize the correction of any defective Work which, in the sole discretion of the Owner, adversely affects the day to day operations of the Owner.”

SC3.6 GC 3.0 PRE-CONSTRUCTION SUBMITTALS

3.6.1 Add a new GC 3.0 as follows:

“GC 3.0 PRE-CONSTRUCTION SUBMITTALS

3.0.1 Prior to site mobilization, the Contractor shall submit to the Owner:

.1 a current WSIB clearance certificate;

.2 certified true copies of the Contractor’s insurance policies having application to the Project or certificates of insurance, at the option of the Owner;

.3 the bonds described in GC 11.2 – CONTRACT SECURITY;

.4 documentation of the Contractor’s in-house safety program to be implemented for the Project;

.5 a copy of the Notice of Project filed with the appropriate Ministry naming the Contractor as “constructor” under the OHSA; and

.6 the Construction Schedule referred to in paragraph 3.5.1.1 of GC 3.5 – CONSTRUCTION SCHEDULE.”

SC3.7 GC 3.1 CONTROL OF THE WORK

3.7.1 Add new paragraphs 3.1.3 to 3.1.6 as follows:

“3.1.3 Notwithstanding paragraphs 3.1.1 and 3.1.2, the Contractor agrees that it shall fully incorporate and comply with all policies and procedures of the Owner which are relevant to
any activity to be performed under the Contract. The Contractor shall inquire from the Owner if such policies or procedures exist and the Owner agrees that it will use reasonable efforts to communicate to the Contractor all relevant policies or procedures.

3.1.4 Prior to commencing fabrication and construction activities, the Contractor shall verify all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the Work and shall further carefully compare such field measurements and conditions with the requirements of the Contract Documents. Where dimensions are not included or exact locations are not apparent, the Contractor shall immediately notify the Consultant in writing and shall obtain written instructions from the Consultant before proceeding with any part of the affected Work.

3.1.5 The Contractor shall be entirely responsible for the proper laying out of the whole of the Work. The Contractor shall employ an experienced and licensed land surveyor to establish and check grades, benchmarks, references, elevations, points and lines as from time to time may be required for the purposes of the Work, or layout of same, and the Contractor shall at every appropriate stage of the Work take all proper steps to have all proper checks and surveys made so as to ensure that the Work and all components thereof will be wholly within the boundaries of the Project site and in the exact position (or respective positions) established for such Work, and shall assume full responsibility for the correctness of all such lines, levels and measurements.

3.1.6 The Contractor shall perform the Work in accordance with modern practice and shall employ only good workmanship in accordance with the Contract Documents, applicable laws, ordinances, rules, regulations, or codes relating to the performance of the Work. Without limiting the generality of the foregoing, the Contractor is responsible for the coordination of the various parts of the Work so that no part shall be left in an unfinished or incomplete condition owing to any disagreement between Subcontractors, or between any of the Subcontractors and the Contractor as to where the Work of one begins or ends with relation to the Work of the other.”

SC3.8 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.8.1 Delete paragraphs 3.2.2.1 and 3.2.2.2.

3.8.2 Amend paragraph 3.2.3.2 by deleting the semi-colon towards the end of that paragraph and adding the following after the words “schedules and”:

“co-ordinate and schedule the activities and work of other contractors and Owner’s own forces with the Work of the Contractor and connect as specified or shown in the Contract Documents;”

3.8.3 Amend paragraph 3.2.3.3 by adding the following to the end of that paragraph:

“Failure by the Contractor to so report shall invalidate any claims against the Owner by reason of the deficiencies in the work of other contractors or Owner’s own forces except those deficiencies not then reasonably discoverable.”

3.8.4 Add a new paragraph 3.2.3.4 as follows:

“3.2.3.4 assume overall responsibility for compliance with all aspects of the applicable health and construction safety legislation at the Place of the Work, including all the responsibilities of the "constructor" under the OHSA.”

3.8.5 Add a new paragraph 3.2.7 as follows:

“3.2.7 If the Contractor is of the view that the work of other contractors or the work of the Owner’s own forces will compromise, void or nullify any of the warranties to be provided pursuant to this Contract, the Contractor shall give Notice in Writing to the Owner as soon as reasonably possible and shall include in such notice the reasons why, in the Contractor’s view, a warranty or warranties will be compromised, voided or nullified, together with the Contractor’s recommendations for avoiding such result.”
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SC3.9 GC 3.4 DOCUMENT REVIEW
3.9.1 Amend paragraph 3.4.1 by deleting the second and third sentences of that paragraph and replacing them with the following:

“Such review by the Contractor shall meet the standard of care described in GC 3.14 – STANDARD OF CARE. Except for the obligation to make such review and report the result, the Contractor does not assume any responsibility to the Owner or the Consultant for the accuracy of the Contract Documents. Provided it has exercised the degree of care and skill described in this paragraph, the Contractor shall not be liable for damages or costs resulting from such errors, inconsistencies, or omissions in the Contract Documents, which the Contractor did not discover.”

3.9.2 Add new paragraphs 3.4.2 and 3.4.3 as follows:

“3.4.2 Notwithstanding the foregoing, errors, inconsistencies, discrepancies and/or omissions shall not include lack of reference on the Drawings or in the Specifications to labour and/or Products that are required or normally recognized within respective trade practices as being necessary for the complete execution of the Work.

3.4.3 If the Contractor finds discrepancies in and/or omissions from the Contract Documents or has any doubt as to the meaning or intent of any part thereof, the Contractor must immediately notify the Consultant, who will provide written instructions or explanations. Neither the Owner nor the Consultant will be responsible for oral instructions.”

SC3.10 GC 3.5 CONSTRUCTION SCHEDULE
3.10.1 Delete paragraph 3.5.1 and replace it with the following:

“3.5.1 The Contractor shall:

.1 within ten (10) Working Days of signing this Contract submit to the Owner, for the Owner’s approval, a Construction Schedule that indicates the timing of major activities and critical milestone dates for the Project, demonstrating that the Work will be performed in conformity with the Contract Time. Such schedule:

(A) shall be in editable electronic format approved by the Owner and shall include and show all logic links between activities; and

(B) shall be prepared in collaboration with, and supported by, the Subcontractors and Suppliers whose activities affect the critical path of the Work, and

(C) shall include and make provision for statutory holidays, the rectification of defects and deficiencies, and all warranty obligations, and

(D) shall provide sufficient detail of the critical events and their inter-relationship and shall include a baseline schedule indicating the critical path for the Project; and

.2 provide the expertise and resources, including manpower and Construction Equipment, as are necessary to maintain progress under the Construction Schedule or any successor or revised schedule approved by the Owner; and

.3 monitor the progress of the Work relative to the Construction Schedule or any successor or revised schedule approved by the Owner and update the Construction Schedule on a monthly basis or at such other interval as instructed by the Owner and/or the Consultant; and

.4 advise the Consultant and the Owner in writing of any variation from the baseline or slippage in the Construction Schedule within 24 hours of such variation or slippage becoming apparent; and

.5 at each site meeting, provide (in writing or verbally to be recorded in minutes) to the Owner and the Consultant a look-ahead schedule indicating the major activities to be undertaken or constructed in the next month.”
3.10.2 Add new paragraphs 3.5.2, 3.5.3 and 3.5.4 as follows:

“3.5.2 If at any time it should appear to the Owner or the Consultant that the actual progress of the Work is behind the Construction Schedule or any other schedule or is likely to fall behind schedule, based on critical path methodology, or if the Contractor has so advised the Consultant pursuant to paragraph 3.5.1.3, the Contractor shall take appropriate steps to cause the actual progress of the Work to conform to the Construction Schedule and shall produce and present to the Owner and the Consultant a recovery plan demonstrating how the Contractor will achieve the recovery of the Construction Schedule. If the Contractor intends to apply for a change in the Contract Price in relation to a schedule recovery plan, the Contractor shall proceed pursuant to GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

3.5.3 If after applying the expertise and resources required under paragraphs 3.5.1 and 3.5.2 the Contractor forms the opinion that the slippage in the Construction Schedule or any other schedule cannot be recovered by the Contractor, it shall give Notice in Writing to the Consultant and the Owner if the Contractor intends to apply for an extension of Contract Time.

3.5.4 Without limiting the other obligations of the Contractor under GC 3.5, the Contractor shall not amend the Construction Schedule without the prior written consent of the Owner. In addition, at each site construction meeting, the Contractor shall provide to the Owner and the Consultant a two (2) week look-ahead schedule indicating the major activities to be undertaken or constructed in such two (2) week period.”

SC3.11 GC 3.6 SUPERVISION

3.11.1 Amend paragraph 3.6.1 by adding the following to the end of that paragraph:

“, and upon the Contractor obtaining the Owner’s prior written consent, which consent will not be unreasonably withheld.”

3.11.2 Add a new paragraph 3.6.3 as follows:

“3.6.3 The Owner, acting reasonably, shall have the right to order the Contractor to remove from the Project any representative or employee of the Contractor, Subcontractors or Suppliers who, in the opinion of the Owner, are a detriment to the Project.”

SC3.12 GC 3.7 SUBCONTRACTORS AND SUPPLIERS

3.12.1 Add new paragraph 3.7.1.4 as follows:

“3.7.1.4 ensure that all Subcontractors and Suppliers, and anyone employed or engaged by them directly or indirectly, have the qualifications, technical skills, levels of experience and knowledge required (including with respect to all applicable health and construction safety rules and regulations), and all applicable permits, licenses and approvals necessary, to discharge the work to be performed by them in accordance with the terms of the Contract.”

3.12.2 Amend paragraph 3.7.2 by adding the following to the end of that paragraph:

“The Contractor agrees not to change Subcontractors without the prior written consent of the Owner, which consent will not be unreasonably withheld.”

3.12.3 Amend paragraph 3.7.3 by deleting the words “before the Owner has signed the Contract” in the first line of that paragraph.

3.12.4 Add a new paragraph 3.7.7 as follows:

“3.7.7 Notwithstanding paragraph 3.7.5, the Owner may assign to the Contractor, and the Contractor agrees to accept, the assignment of any contract procured by the Owner for Work or services
or Products required on the Project that has been pre-tendered or pre-negotiated by the Owner."

**SC3.13 GC 3.8 LABOUR AND PRODUCTS**

3.13.1 Amend paragraph 3.8.1 by adding the following sentence to the end of that paragraph:

"The Contractor represents and warrants that the Products provided in accordance with the Contract Documents are not subject to any conditional sales contracts and are not subject to any security rights claimed or obtained by any third party which may subject any of the Products to seizure and/or removal from the Place of the Work."

3.13.2 Delete paragraph 3.8.2 and replace it with the following:

"3.8.2 Products provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, Ontario Building Code and all governmental authorities having jurisdiction at the Place of the Work, unless otherwise specified. Products which are not specified shall be of a quality consistent with those specified and their use acceptable to the Consultant. Products brought on to the Place of the Work by the Contractor shall be deemed to be the property of the Owner, but the Owner shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever, and such Products shall be brought to the Place of the Work at the sole risk of the Contractor"

3.13.3 Amend paragraph 3.8.3 by adding the words ", agents, Subcontractors and Suppliers" after the word "employees" toward the end of the first line.

3.13.4 Add new paragraphs 3.8.4 to 3.8.7 as follows:

"3.8.4 The Contractor is responsible for the safe on-site storage of Products and their protection (including Products supplied by the Owner and other contractors to be installed under the Contract) in such ways as to avoid dangerous conditions or contamination to the Products or other persons or property and in locations at the Place of the Work to the satisfaction of the Owner and the Consultant.

3.8.5 The Contractor shall cooperate with the Owner and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the Work, including cooperation to attempt to avoid work stoppages, trade union jurisdictional disputes, and other Labour Disputes. The Contractor shall not, and shall ensure that its Subcontractors and Suppliers do not, employ any persons on the Project whose labour affiliation, or lack thereof, is incompatible with other labour employed in connection with the Work. Any costs arising from Labour Disputes as a result of the employment of any such person by the Contractor, its Subcontractors or Suppliers, shall be the sole expense of the Contractor.

3.8.6 Without in any way limiting the Contractor’s obligations under this Contract, the Contractor shall prepare and implement job site rules more particularly described in the Contract Documents. If no job site rules are described in the Contract Documents, the Contractor shall draft job site rules for the review and approval of the Owner. Such job site rules shall be consistent with the Contractor's duties and obligations under the OHSA, and shall include provisions making smoking and the consumption of alcohol or non-prescription drugs on the Project the subject of discipline proceedings and/or termination of employment.

3.8.7 The Owner, acting reasonably, shall have the right to order the Contractor to remove from the Project, without cost to the Owner, any representative or employee of the Contractor or any representative or employee of any Subcontractor or Supplier who, in the opinion of the Owner, is a detriment to the Project. In addition, where the Work is being carried out at or near an existing school during the school year, the Contractor shall, upon the Owner’s request, provide to the Owner criminal background checks on all of the Contractor’s employees who will be providing work or services at the Place of the Work, and the Contractor shall require its Subcontractors and Suppliers to provide criminal background checks on any of their employees who will be providing work or services at the Place of the Work. Where such
background checks indicate that an employee of the Contractor or any Subcontractor or Supplier has a criminal record, the Owner shall be entitled to cause the removal of that person from the Project.”

**SC3.14 GC 3.9 DOCUMENTS AT THE SITE**

3.14.1 Delete paragraph 3.9.1 and replace it with the following:

"3.9.1 The Contractor shall keep one copy of the current Contract Documents, As-Built Drawings, Supplemental Instructions, contemplated change orders, Change Orders, Change Directives, cash allowance disbursement authorizations, reviewed Shop Drawings, Submittals, reports and records of meetings at the Place of the Work, in good order and available to the Owner and Consultant."

**SC3.15 GC 3.10 SHOP DRAWINGS**

3.15.1 Delete paragraph 3.10.3 in its entirety and replace it with the following:

"3.10.3 The Contractor shall prepare a Shop Drawing schedule acceptable to the Owner and the Consultant prior to the first application for payment. A draft of the proposed Shop Drawing schedule shall be submitted by the Contractor to the Consultant and the Owner for approval. The draft Shop Drawing schedule shall clearly indicate the phasing of Shop Drawing submissions."

3.15.2 Add new paragraphs 3.10.13 to 3.10.16 as follows:

"3.10.13 Reviewed Shop Drawings shall not authorize a change in the Contract Price and/or the Contract Time.

3.10.14 The Contractor shall not use the term "by others" on Shop Drawings or other submittals, but shall identify the responsible trade, Subcontractor or Supplier where such work is within the scope of the Work.

3.10.15 Where Specifications require the Shop Drawings to bear the seal and signature of a professional engineer, such professional engineer shall be registered in the jurisdiction of the Place of the Work and shall have expertise in the area of practice reflected in the Shop Drawings.

3.10.16 The Owner's approval of Shop Drawings will be an approval of general detail and arrangement only. The Owner's approval shall not relieve the Contractor from its responsibility for deviations from the Contract Documents, unless the Contractor in writing has notified the Owner of such deviations at the time of submission of the Shop Drawings and the Owner has given written approval to the specific deviations. The Owner's approval also shall not relieve the Contractor from responsibility for defective Work resulting from errors or omissions of any kind on the approved Shop Drawings and shall not constitute authorization to the Contractor to perform additional Work or changed Work. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes, or techniques of construction and installation."

**SC3.16 GC 3.11 USE OF THE WORK**

3.16.1 Add new paragraphs 3.11.3 and 3.11.4:

"3.11.3 The Owner or its contractors shall have the right to enter or occupy the Place of the Work, in whole or part, and whether partially or entirely completed, for the purpose of installing, testing or storing fixtures, equipment or machinery before the issuance of a final certificate for payment if such entry and occupancy does not materially interfere with the Contractor in the performance and completion of this Contract within the Contract Time. Such entry or occupancy shall not be considered as acceptance of the Work, in whole or in part, nor shall it relieve the Contractor of its responsibility to complete the Contract."
3.11.4 The Owner reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the Project, even though Substantial Performance of the Work may not have been attained, provided that such taking of possession and use will not interfere, in any material way, with the progress of the Work. The taking of possession or use of any such portion of the Project shall not be deemed to be the Owner’s acknowledgement or acceptance of the Work or the Project, nor shall it relieve the Contractor of any of its obligations under the Contract. In particular, the Contractor’s obligations respecting construction health and safety, including all duties of the “constructor” under the OHSA, shall continue to apply notwithstanding such taking of possession and use.”

SC3.17 GC 3.13 CLEANUP
3.17.1 Amend paragraph 3.13.1 by adding the following to the end of that paragraph:
“The Contractor shall ensure the Place of the Work is cleaned and left in a tidy condition on a daily basis. In the event that the Contractor fails to remove waste and debris as provided in this GC 3.13, then, the Owner or the Consultant may give the Contractor twenty-four (24) hours’ written notice to meet its obligations respecting clean up. Should the Contractor fail to meet its obligations pursuant to this GC 3.13 within the twenty-four (24) hour period next following delivery of the notice, the Owner may remove such waste and debris and deduct from payments otherwise due to the Contractor the Owner’s costs for such clean up, including a reasonable mark-up for administration.”

SC3.18 GC 3.14 STANDARD OF CARE
3.18.1 Add new GC 3.14 as follows:
“GC 3.14 STANDARD OF CARE
3.14.1 In performing this Contract the Contractor shall exercise a standard of care, skill and diligence that would normally be exercised by an experienced and prudent contractor supplying similar services for similar projects. The Contractor acknowledges and agrees that throughout the Contract, the Contractor’s obligations, duties and responsibilities shall be interpreted in accordance with this standard. The Contractor shall exercise the same standard of care, skill and diligence in respect of any Products, Subcontractors, Suppliers, personnel, or procedures which it may recommend to the Owner or employ on the Project.

3.14.2 The Contractor represents, covenants and warrants to the Owner that:
.1 the personnel it assigns to the Project are appropriately experienced;
.2 it has a sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the Owner’s approval, in the event of death, incapacity, removal or resignation; and
.3 there are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the Contractor to perform this Contract.

3.14.3 The Contractor shall perform the Work so as to avoid disturbing the occupants of the Place of the Work and any adjacent structures or the public in general, and shall perform the Work in the least intrusive manner possible and shall respect and comply with local regulations and requirements regarding permitted work hours, noise levels and work conditions. The Contractor, without in any way limiting its responsibilities under this Contract, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise, to avoid conditions likely to propagate mould or fungus of any kind, and shall take all other steps reasonably necessary to promote and maintain the safety and comfort of the occupants of the Place of the Work and any adjacent structures and the public in general, and/or to maintain access to and the operation of the same. Without Owner’s prior approval, the Contractor shall not permit any personnel, workers or Subcontractors to use any existing facilities including, without limitation, elevators, lavatories, toilets, entrances and parking areas other than those designated by the Owner.”
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SC3.19 GC 3.15 CONTRACTOR’S USE OF PERMANENT EQUIPMENT OR SYSTEMS
3.19.1 Add a new GC 3.15 as follows:

“GC 3.15 CONTRACTOR’S USE OF PERMANENT EQUIPMENT OR SYSTEMS

3.15.1 Upon receiving the Contractor’s written request the Owner may, but is under no obligation to, permit the Contractor to make use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the Work for the purpose of completing the Project. In such event the Contractor shall:

.1 perform all preventative maintenance services on such systems and equipment as and when specified by the manufacturer;

.2 prior to applying for the certificate of Substantial Performance of the Work, clean and make good, to the satisfaction of the Consultant, all such systems and equipment;

.3 pay any and all costs associated with such use, preventative maintenance services, cleaning and making good.

3.15.2 Where the Contractor has made use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the Work, as described in paragraph 3.15.1, the Contractor shall obtain, from the manufacturer or Supplier of the systems or equipment used, a confirmation from such manufacturer or Supplier that the warranty on such systems or equipment begins on the date of Substantial Performance of the Work and is not impaired in scope or reduced in time by virtue of the Contractor’s use of such systems or equipment.”

SC3.20 GC 4.1 CASH ALLOWANCES
3.20.1 Delete paragraphs 4.1.4 and 4.1.5 and replace them with the following:

“4.1.4 Where the actual cost of the Work under any cash allowance exceeds or is expected to exceed the amount of the allowance, the Contractor shall notify the Owner in writing indicating the amount of additional funds required and, in such case, the Contractor shall not proceed with the cash allowance work until the Contractor receives written instructions from the Owner. Unexpended amounts from other cash allowances may be reallocated at the Consultant’s direction to cover the shortfall and, in that case, the Contractor is not entitled to any amount for overhead and profit. Where no such direction is given, or where the actual cost exceeds the allowance even after reallocation of unexpended amounts from other cash allowances, the Contractor shall be compensated for the excess incurred and substantiated, plus an amount for overhead and profit as set out in the Contract Documents, but on the excess only.

4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the Contract Price by Change Order without any adjustment for the Contractor’s overhead and profit on such amount.”

3.20.2 Add new paragraphs 4.1.8 and 4.1.9 as follows:

“4.1.8 Purchases from cash allowances must be authorized by written instructions issued by the Consultant and the form and methods of accounting for costs shall be agreed to by the Consultant and the Contractor before proceeding with the purchase.

4.1.9 The Owner reserves the right to call, or to have the Contractor call, for competitive bids for portions of the Work to be paid for from cash allowances.”

SC3.21 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER
3.21.1 Delete GC 5.1.

SC3.22 GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT
3.22.1 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:
“No amount claimed shall include Products delivered to the Place of the Work unless the Products are free and clear of all security interests, liens, and other claims of third parties.”

3.22.2 Amend paragraph 5.2.7 by adding the following to the end of that paragraph:

“Any Products delivered to the Place of the Work but not yet incorporated into the Work shall remain at the risk of the Contractor notwithstanding that title has passed to the Owner pursuant to GC 13.1 – OWNERSHIP OF MATERIALS.”

3.22.3 Add new paragraphs 5.2.8 and 5.2.9 as follows:

“5.2.8 As a condition of receiving each progress payment the Contractor shall include with each application for payment:
  .1 a CCDC 9 Statutory Declaration attesting to the truth of the statements made therein;
  .2 a current WSIB clearance certificate; and
  .3 in respect of any subcontract whose value exceeds $100,000, a statutory declaration in form CCDC 9B – 2001.”

SC3.23 GC 5.3 PROGRESS PAYMENT

3.23.1 Amend paragraph 5.3.1.2 by deleting the words “calendar days” in the first line and replacing them with “Working Days”.

3.23.2 Delete paragraph 5.3.1.3 and replace it with the following:

“5.3.1.3 the Owner shall make payment to the Contractor on account as provided in Article A-5 of the Agreement – PAYMENT no later than 15 Working Days after the Owner’s receipt of a certificate of payment issued by the Consultant.”

3.23.3 Add new paragraphs 5.3.2 and 5.3.3 as follows:

“5.3.2 If the Contractor fails to provide the necessary supporting documentation with each application for progress payment in accordance with GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT, the Owner reserves the right to withhold payment to the Contractor until such time as the supporting documentation is provided.

5.3.3 Payment by the Owner shall not preclude the Owner from thereafter disputing any of the items for which payment was made and shall not be construed as acceptance of any part of the Work.”

SC3.24 GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

3.24.1 Delete paragraph 5.4.3 and replace it with the following:

“5.4.3 Immediately after the issuance of the certificate of Substantial Performance of the Work, the Contractor, in consultation with the Consultant, shall establish reasonable dates for finishing the Work and correcting deficiencies.

5.4.4 Before submitting the written application referred to in paragraph 5.4.1, the Contractor shall submit to the Consultant all:
  .1 guarantees, warranties and certificates;
  .2 testing and balancing reports and spare parts;
  .3 distribution system diagrams and Shop Drawings;
  .4 maintenance and operational manuals, instructions and materials;
  .5 existing reports and correspondence from authorities having jurisdiction, and other close-out materials or documentation required to be submitted under the Contract, together with written proof acceptable to the Owner and the Consultant that the Work has been performed in conformance with the requirements of municipal, governmental, and utility

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authorities having jurisdiction at the Place of the Work. The Contractor shall deliver the materials and documentation listed in this paragraph in an electronic format that is readable on the Owner’s information technology infrastructure.

5.4.5 Within thirty (30) days of the date of Substantial Performance of the Work the Contractor shall deliver to the consultant final As-Built Drawings, failing which the Consultant may assign a reasonable amount to cover the cost the Owner would incur to prepare the As-Built Drawings or, where applicable, an amount specified in the Contract Documents, and retain that amount from any future amount owing to the Contractor, until the final As-Built Drawings are delivered.

5.4.6 If the Contractor fails to deliver the documents and materials described in paragraph 5.4.4, then, provided that none of the missing documents and materials interferes with the use and occupancy of the Project in a material way, the failure to deliver shall not be grounds for the Consultant to refuse to certify Substantial Performance of the Work. The Consultant may assign a reasonable amount or, where applicable, an amount specified in the Contract Documents, and retain that amount from the written application for Substantial Performance of the Work, until the required materials are delivered.

5.4.7 Should any documents or materials not be delivered in accordance with paragraph 5.4.4 or 5.4.5 by the earlier of: (1) forty-five (45) days following the issuance of the certificate of Substantial Performance of the Work, and (2) the Contractor’s application for final payment under paragraph 5.7.1 of GC 5.7 – FINAL PAYMENT, then the amount(s) previously retained pursuant to paragraphs 5.4.5 and/or 5.4.6 shall be forfeited to the Owner as compensation for the damages deemed to have been incurred by the Owner, and not as a penalty, arising from the Contractor’s failure to deliver the specified documents or materials, and the Contract Price shall be reduced accordingly.”

SC3.25 GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

3.25.1 Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph:

“A reserve fund may be retained by the Owner to secure the correction of deficiencies, the amount of such reserve fund to be based on the Consultant’s reasonable estimate of the cost of correcting deficient items.”

3.25.2 Delete paragraph 5.5.3.

3.25.3 Amend paragraph 5.5.4 by deleting the word “first” in the second line of that paragraph and replacing it with the word “fifth”.

SC3.26 GC 5.7 FINAL PAYMENT

3.26.1 Amend paragraph 5.7.1 by adding the following to the end of that paragraph:

“The Contractor’s application for final payment shall be accompanied by any documents or materials not yet delivered pursuant to paragraphs 5.4.4 and 5.4.5 of GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK.”

3.26.2 Amend paragraph 5.7.2 as follows:

(a) by deleting the words “10 calendar days” in the first line of that paragraph and replacing them with “10 Working Days”; and

(b) by adding the following to the end of that paragraph:

“The application will not be considered valid until Products installed are tested and conform to the requirements specified in the Contract Documents and all documentation required by the Contract Documents including but not limited to the documents and materials listed in paragraphs 5.4.4 and
5.4.5 of GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK have been received and accepted by the Consultant.”

3.26.3 Amend paragraph 5.7.4 by deleting the words “5 calendar days after the issuance” and substituting the words “15 Working Days after receipt” in the second line.

SC3.27 GC 5.8 WITHHOLDING OF PAYMENT

3.27.1 Add new paragraphs 5.8.2 and 5.8.3 as follows:

“5.8.2 Notwithstanding any provision in the Contract Documents to the contrary, the Owner may withhold payment on any certificate for payment to the extent required to offset any previous over-payment made to the Contractor, damages or costs incurred by the Owner, or to the extent as may be necessary to protect the Owner from loss or damage as a result of:

.1 Contractor’s failure to perform any of its material obligations, or where the Contractor is otherwise in default under the Contract Documents and any such default is continuing;
.2 defective Work not remedied;
.3 damage done by the Contractor to work carried out by other contractors or by Owner’s forces;
.4 Contractor’s failure to make prompt payment to its Subcontractors and Suppliers respecting Work for which the Owner has made payment to the Contractor;
.5 claims or reasonable evidence indicating possible commencement of claims for which the Contractor may be responsible to indemnify the Owner;
.6 there is a reasonable indication that the Work will not be substantially performed in accordance with the Construction Schedule or within the Contract Time;
.7 Contractor’s failure to remove liens arising from the Work or otherwise to satisfy its obligations under GC 13.4 – LIENS AND ACTIONS.

5.8.3 Where the Owner has withheld payment to the Contractor pursuant to the provisions of this Contract, the Owner shall be entitled to apply the funds withheld toward the cost of any required remedial work, or toward damages or losses suffered and for which the Owner is entitled to compensation under the Contract.”

SC3.28 GC 6.1 OWNER’S RIGHT TO MAKE CHANGES

3.28.1 Amend paragraph 6.1.2 by adding the following to the end of that paragraph:

“This requirement is of the essence and it is the express intention of the parties that any claims by the Contractor for a change in the Contract Price, Contract Time and/or the Contract shall be barred unless there has been strict compliance with PART 6 – CHANGES IN THE WORK. No course of conduct or dealing between the parties, no express or implied acceptance of alterations or additions to the Work, and no claims that the Owner has been unjustly enriched by any alteration or addition to the Work, whether in fact there is any such unjust enrichment or not, shall be the basis of a claim for additional payment under this Contract or a claim for any extension of the Contract Time, or a claim for an amendment to the Contract. Without limiting the generality of the foregoing, under circumstances of expediency, the Contractor may proceed with a change in the Work without first obtaining a Change Order or a Change Directive where it has received from the Owner or the Owner’s authorized representative some form of written or electronic direction agreeing to a change in the Contract Price, the Contract Time or the Contract, in which case such change, and the value of such change, if any, will be determined pursuant to GC 6.2 or GC 6.3, at the option of the Owner.”

3.28.2 Add a new paragraph 6.1.3 as follows:

“6.1.3 The Contractor agrees that changes resulting from construction coordination including but not limited to site surface conditions, site coordination and Subcontractor and Supplier coordination, are included in the Contract Price and shall not entitle the Contractor to claim any increase to the Contract Price in relation to coordination.”
SC3.29 GC 6.2 CHANGE ORDER

3.29.1 Amend paragraph 6.2.1 by adding the following sentence to the end of that paragraph:

“Such adjustments and method of adjustment must be submitted by the Contractor to the Consultant in sufficient time to prevent interruption of the orderly process of construction and, in any event, no later than ten (10) days from the Contractor's receipt of the proposed change in the Work.”

3.29.2 Add new paragraphs 6.2.3 to 6.2.6 as follows:

“6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the Owner:

.1 by estimate and acceptance of a lump sum. The lump sum shall include overhead, profit and other reasonable charges of the Contractor and shall be the total cost to the Owner;

.2 by unit prices established in the Contract or subsequently agreed upon. Unit prices shall include overhead, profit, and other reasonable charges of the Contractor and shall be the total cost to the Owner. Adjustment to the Contract Price shall be based on a net quantity difference from the original quantity.

.3 by the amount, net of all credits, of time, materials and Products expended:

(A) by a Subcontractor, applying the labour charge out rates set out in the wage schedule in the Contract Documents together with the actual costs, without mark-up, of materials and Products utilized in the change, plus the Subcontractor's mark-up disclosed in Column A of the table below which applies to material and Product costs only;

(B) by the Contractor, applying the labour charge out rates set out in the wage schedule in the Contract Documents together with the actual costs, without mark-up, of materials and Products utilized in the change, plus the mark-up disclosed in Column B of the table below which applies to material and Product costs only. For greater certainty, the Contractor is not entitled to a mark-up disclosed in Column B of the table below on self-performed additional work.

The Contractor shall also be entitled to the mark-up disclosed in Column B of the table below, on the value of additional work performed by Subcontractors.

<table>
<thead>
<tr>
<th>Value of Additional Work</th>
<th>Column A Subcontractor Mark-Up on Material and Products only</th>
<th>Column B Contractor Mark-Up on Material and Products Supplied by the Contractor, and on Subcontractor work</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 to no more than $25,000</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>$0 to no more than $50,000</td>
<td>10%</td>
<td>7.5%</td>
</tr>
<tr>
<td>$0 to in excess of $50,000</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

*Interpretive Note: The mark-ups disclosed in the above table are flat not graduated. For example, a Subcontractor performed change valued at $35,000 attracts a mark-up of 10% for the Subcontractor (on the cost of material and Products only) and 7.5% for the Contractor. The table is not intended to provide one set of mark-ups for the first $25,000 of the change and a different set of mark-ups for the balance.*

6.2.4 The mark-ups described in paragraph 6.2.3.3 are intended to cover all general expenses and overhead costs incurred by the Contractor in relation to the change. For greater certainty, the following items are covered by and included in the mark-ups: additional bonding and insurance costs, supervision, project management, general account items, small tools, estimating, safety, preparation of record drawings, coordination and administration and...
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warranty costs, and general clean-up and disposal costs necessary to perform the change in the Work.

6.2.5 An adjustment to the Contract Time will be considered only when the Contractor demonstrates to the Owner that a change in the Work affects the critical path of the Work. Any costs associated with an adjustment to the Contract Time shall be identified by the Contractor and shall be limited to the reasonable direct costs directly attributable to the adjustment to the Contract Time, excluding the items described in paragraph 6.2.4.

6.2.6 The Contractor shall not be entitled to any additional compensation arising out of changes to the Work aside from the amounts determined in accordance with this GC 6.2. In no event shall the Owner be liable to the Contractor for any costs, including indirect, impact or consequential costs, arising out of changes to the Work beyond the agreed upon amount of the Change Order.”

SC3.30 GC 6.3 CHANGE DIRECTIVE

3.30.1 Delete paragraph 6.3.3.

3.30.2 Amend paragraph 6.3.7 by inserting the words “Subject to paragraph 6.3.14,” at the beginning of that paragraph. Further amend paragraph 6.3.7 as follows:

(a) Delete paragraph 6.3.7.1 and replace it with the following:

“6.3.7.1 salaries, wages and benefits paid to personnel in the direct employ of the Contractor, applying the labour rates set out in the wage schedule in the Contract Documents or as otherwise agreed between the Owner and Contractor for personnel

(A) carrying out the Work, including necessary supervisory services;

(B) engaged in the preparation of Shop Drawings, fabrication Drawings, coordination Drawings and As-Built Drawings; or

(C) including clerical staff engaged in processing changes in the Work.”

(b) Delete paragraphs 6.3.7.15 and 6.3.7.17.

3.30.3 Amend paragraph 6.3.12 by adding the following to the beginning of that paragraph:

“An adjustment of the Contract Time will be considered only where the change in the Work affects the critical path of the Work.”

3.30.4 Add a new paragraph 6.3.14 as follows:

“6.3.14 Without limitation, the following shall not form part of the cost of performing the work attributable to a Change Directive, and shall not be recoverable by the Contractor:

.1 head office salaries and benefits and all other overhead or general expenses, except only for the salaries, wages and benefits of personnel described in paragraph 6.3.7.1 and the contributions, assessments or taxes referred to in paragraph 6.3.7.2;

.2 capital expenses and interest on capital;

.3 general cleanup, except where the performance of the work attributed to the Change Directive causes specific additional cleanup requirements;

.4 wages paid for field supervision of Subcontractors;

.5 wages, salaries, rentals or other expenses that exceed the rates that are standard in the locality of the Place of the Work or that are otherwise deemed unreasonable by the Consultant;

.6 any costs or expenses attributable to the negligence, improper work, deficiencies, or breaches of contract by the Contractor or any Subcontractor;
.7 any costs of quality assurance, such as inspection and testing services, charges levied by authorities having jurisdiction, and any legal fees unless any such costs or fees are pre-approved in writing by the Owner; and

.8 the costs of the items listed in paragraph 6.2.4."

SC3.31 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

3.31.1 Add a new paragraph 6.4.0 as follows:

“6.4.0 The Contractor confirms that, before signing the Contract, it carefully investigated and examined the Place of the Work, the Contract Documents and any other documents made available by the Owner, and applied to such investigations and examinations the degree of care, skill and diligence described in paragraph 3.14.1 of GC 3.14 – STANDARD OF CARE. Through such investigations and examinations, the Contractor has satisfied itself as to the conditions, circumstances, limitations and requirements necessary for the Contractor to perform the Work in accordance with the Contract Documents including, but not necessarily limited to, such things as:

.1 the nature and location of the Work and the Project site, including the availability / restrictions of access to the Project site;
.2 the character and content of the Work to be done;
.3 the character and scope of work to be done by other contractors and Owner’s forces;
.4 the availability of labour, equipment, material, Products and facilities needed for the on-time performance and completion of the Work;
.5 all labour restrictions, including availability of skilled trades;
.6 safety hazards and labour contract negotiations which may have an impact on the performance of the Work;
.7 the location of any required utility service;
.8 without limiting the generality of the foregoing, any contingency and/or circumstances which may affect the Work.

If the Contractor has not conducted the investigations and examinations described in this paragraph 6.4.0, it is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the Work which could make the Work more expensive or more difficult to perform than was contemplated at the time the Contract was signed. No allowances will be made for additional costs and no claims by the Contractor will be considered for an adjustment in the Contract Price or Contract Time in connection with conditions which were reasonably apparent or which could reasonably have been discovered by such investigations or examinations made before the signing of the Contract.”

3.31.2 Amend paragraphs 6.4.1.1 and 6.4.1.2 by adding the following words to the end of each of those paragraphs:

“and which were concealed from discovery notwithstanding the conduct of the investigations and examinations described in paragraph 6.4.0.”

3.31.3 Amend paragraph 6.4.2 by inserting the words “and were concealed from discovery notwithstanding the conduct of the investigations and examinations described in paragraph 6.4.0” after the word “materially” in the second line.

3.31.4 Delete paragraph 6.4.3 and substitute the following:

“6.4.3 If the Consultant makes a finding pursuant to paragraph 6.4.2 that no change in the Contract Price or Contract Time is justified, the Consultant shall report in writing the reasons for this finding to the Owner and the Contractor.”
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SC3.32 GC 6.5 DELAYS

3.32.1 Amend paragraphs 6.5.1 and 6.5.2 by deleting the last sentence in each paragraph and substituting the following in each case:

“The Contractor shall be reimbursed by the Owner for reasonable direct costs directly flowing from the delay, but excluding the costs of the Contractor’s head office personnel and overhead costs, and excluding any consequential, indirect or special damages, and excluding any claims for loss of profit or opportunity.”

3.32.2 Amend paragraph 6.5.3 by adding the following to the end of that paragraph:

“...in which case the Contractor shall be reimbursed by the Owner for reasonable direct costs directly flowing from the delay, but excluding the costs of the Contractor’s head office personnel and overhead costs, and excluding any consequential, indirect or special damages, and excluding any claims for loss of profit or opportunity.”

3.32.3 Amend paragraph 6.5.4 by adding the following to the end of that paragraph:

“For greater certainty, it is the intention of the parties that an extension for delay will be considered only when the Contractor demonstrates to the Owner that the delay affects the critical path of the Work. Without in any way limiting the generality of the foregoing, it is a condition precedent to the Contractor’s claim for extension of the Contract Time and for additional compensation that the notice provisions in this paragraph be strictly adhered to in each instance, except where the event of delay itself reasonably precludes strict adherence to such notice provisions. If the Contractor fails to comply with such notice provisions, it shall be deemed to have waived the right to claim for the effects of delay.”

3.32.4 Add new paragraphs 6.5.6, 6.5.7, 6.5.8 and 6.5.9 as follows:

6.5.6 If the Contractor is delayed in the performance of the Work by an act or omission of the Contractor or anyone directly or indirectly employed or engaged by the Contractor, or by any cause within the Contractor’s control, then the Contract Time shall be extended for such reasonable time as the Consultant may decide in consultation with the Owner and the Contractor. The Owner shall be reimbursed by the Contractor for all reasonable costs incurred by the Owner as the result of such delay including, but not limited to, the cost of all additional services required by the Owner from the Consultant or any subconsultants, project managers, or others employed or engaged by the Owner.

6.5.7 The Contractor shall be responsible for the care, maintenance and protection of the Work in the event of any suspension of construction as a result of the delay described in paragraphs 6.5.1, 6.5.2 or 6.5.3. In the event of such suspension, the Contractor shall be reimbursed by the Owner for the reasonable costs incurred by the Contractor for such care, maintenance and protection, but excluding the costs of the Contractor’s head office personnel. The Contractor’s entitlement to costs pursuant to this paragraph, if any, shall be in addition to and in any, to which the Contractor is entitled pursuant to paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.8 Without limiting the obligations of the Contractor described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS and GC 9.4 – CONSTRUCTION SAFETY, the Owner may, by Notice in Writing, direct the Contractor to stop the Work where the Owner determines that there is an imminent risk to the safety of persons or property at the Place of the Work. In the event that the Contractor receives such notice, it shall immediately stop the Work and secure the Project site. The Contractor shall not be entitled to an extension of the Contract Time or to an increase in the Contract Price unless the resulting delay, if any, would entitle the Contractor to an extension of the Contract Time or the reimbursement of the Contractor’s costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.9 If the Contractor is delayed in the performance of the Work by a Labour Dispute, civil disobedience, riot, sabotage, acts of God or any of the events described in paragraphs 6.5.3.1 through 6.5.3.4 for a period of sixty (60) calendar days or longer, the Owner may terminate the Contract by giving Notice in Writing to that effect. In such event, the Owner shall pay for the
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Work performed up to the effective date of termination, including mobilization and
demobilization costs, and for such additional costs, if any, directly flowing from such
termination which are a reasonable consequence of the termination, but excluding any
consequential, indirect or special damages, and any claims for loss of profit or opportunity.
The Owner shall not be liable to the Contractor for any other claims, costs or damages
whatsoever arising from such termination of the Contract.”

SC3.33 GC 7.1 OWNER’S RIGHT TO PERFORM THE WORK, TERMINATE THE
CONTRACTOR’S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE
CONTRACT

3.33.1 Delete paragraph 7.1.2 and replace it with the following:

“7.1.2 If the Contractor neglects to prosecute the Work properly, or fails or neglects to maintain the
latest approved Construction Schedule, or otherwise fails to comply with the requirements of
the Contract in a material way, the Owner may, without prejudice to any other right or remedy
the Owner may have, give the Contractor Notice in Writing that the Contractor is in default of
the Contractor’s contractual obligations and instruct the Contractor to correct the default in the
5 Working Days immediately following the receipt of such Notice in Writing, but without
affecting in any respect the liability of the Contractor in respect of earlier defaults.”

3.33.2 Add a new paragraph 7.1.5A immediately after paragraph 7.1.5 as follows:

“7.1.5A The Owner may terminate the Contract at any time for any or no reason. In such event, the
Owner shall pay for the Work performed up to the effective date of termination, including
demobilization costs, and for such additional costs, if any, directly flowing from such
termination which are a reasonable consequence of the termination, but excluding any
consequential, indirect or special damages, and any claims for loss of profit or opportunity.
The Owner shall not be liable to the Contractor for any other claims, costs or damages
whatsoever arising from such termination of the Contract.”

SC3.34 GC 7.2 CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE
CONTRACT

3.34.1 Amend paragraph 7.2.2, in line 1, by deleting “20” and replacing it with “45”.

3.34.2 Amend paragraph 7.2.3 as follows:

(a) Delete paragraph 7.2.3.1;

(b) Amend paragraph 7.2.3.3 by adding the words “, except where the Owner has a bona fide
claim for setoff,” after the word “Consultant”;

(c) Amend paragraph 7.2.3.4 by deleting the words “, except for GC 5.1 – FINANCING
INFORMATION REQUIRED OF THE OWNER”;

(d) Add the following at the end:

“The foregoing defaults in contractual obligations shall not apply to the withholding of certificates or
payments, or both, in accordance with the Contract Documents.”

3.34.3 Delete paragraph 7.2.5 and replace it with the following:

“7.2.5 If the default cannot be corrected within the 5 Working Days specified in paragraph 7.2.4, the
Owner shall be deemed to have cured the default if it:

.1 commences the correction of the default within the specified time, and

.2 provides the Contractor with an acceptable schedule for such correction, and

.3 completes the correction in accordance with such schedule.”
7.2.6 If the Contractor terminates the Contract under the conditions described in this GC 7.2, the Contractor shall ensure the Place of the Work is left in a safe and secure condition as required by authorities having jurisdiction and the Contract Documents, and shall be entitled to be paid for all Work performed to the date of termination. Subject to the Contractor’s obligation to mitigate costs, the Contractor shall also be entitled to recover the costs directly flowing from and which are a reasonable consequence of the termination, including the costs of demobilization and direct losses sustained on Products and Construction Equipment, but excluding the costs of the Contractor’s head office personnel and overhead costs, and excluding any consequential, indirect or special damages, and excluding any claims for loss of profit or opportunity.”

**SC3.35 GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION**

3.35.1 Amend paragraphs 8.2.6, 8.2.7 and 8.2.8, in the first line of each paragraph, by deleting “10” and replacing it with “20” in each case.

3.35.2 Add new paragraphs 8.2.9, 8.2.10, 8.2.11, 8.2.12, 8.2.13 and 8.2.14 as follows:

*8.2.9* Within 10 Working Days of receipt of a Notice in Writing given pursuant to paragraph 8.2.6, the Owner or the Contractor may give the Consultant a Notice in Writing containing:

1. a copy of the notice of arbitration;
2. a copy of GC 8.2, as amended by these Supplementary Conditions;
3. any claims or issues which the Contractor or the Owner, as the case may be, wishes to raise in relation to the Consultant arising out of the issues in dispute in the arbitration.

8.2.10 The Owner and the Contractor agree that, upon giving the Notice in Writing provided in paragraph 8.2.9, the Consultant may elect to become a full party to the arbitration commenced pursuant to paragraph 8.2.6. The Owner and the Contractor acknowledge that, if the Consultant so elects, the Consultant shall be a party to the arbitration within the meaning of the Rules referred to in paragraph 8.2.6 by virtue of the agreement between the Consultant and the Owner.

8.2.11 Failure of the Owner or the Contractor to give the Notice in Writing provided in paragraph 8.2.9 shall not prevent either the Owner or the Contractor from commencing or pursuing an application, action, counterclaim or any other proceeding against the Consultant arising out of the issues in dispute in the arbitration between the Owner and the Contractor brought under paragraph 8.2.6.

8.2.12 If the Consultant is given the Notice in Writing contemplated by paragraph 8.2.9, the Consultant may participate in the appointment of the arbitrator and, notwithstanding the Rules referred to in paragraph 8.2.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date on which the Consultant receives the notice described in paragraph 8.2.9.

8.2.13 The arbitrator in an arbitration in which the Consultant is a party may:

1. determine whether any notice given pursuant to paragraph 8.2.9 is, in substance, sufficient, the notice requirements being interpreted liberally; and,
2. make any procedural order considered necessary to facilitate the participation of the Consultant as a party to the arbitration.

8.2.14 The provisions of paragraph 8.2.9 shall apply mutatis mutandis to written notice to be given by the Consultant to any subconsultant, except that the subconsultant is not entitled to any election as outlined in paragraph 8.2.10 and is deemed to be bound by the arbitration proceeding.*

**SC3.36 GC 9.1 PROTECTION OF WORK AND PROPERTY**

3.36.1 Amend paragraph 9.1.1.1 by adding the following to the end of that paragraph:
3.36.2 Delete paragraph 9.1.2 in its entirety and replace it with the following:

"9.1.2 Before commencing any Work, the Contractor shall determine the locations of all underground utilities and structures indicated in the Contract Documents or that are discoverable by applying to an inspection of the Place of the Work the degree of care and skill described in GC 3.14 – STANDARD OF CARE."

3.36.3 Add a new paragraph 9.1.5 as follows:

"9.1.5 Without in any way limiting the Contractor's obligations under this GC 9.1, should the Contractor or any Subcontractor or Supplier cause loss or damage to property, including roads, buildings, structures, paving, grass, sod, trees or other plantings, whether owned by the Owner or others, and whether at the Place of the Work or adjoining it, the Contractor shall be liable for the cost of making good such damage and for the replacement cost of the grass, sod, trees or other plantings damaged, including the cost of any arborist or other consultant, and such costs may be deducted by the Owner from amounts otherwise owing to the Contractor."

SC3.37 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

3.37.1 Amend paragraph 9.2.6 by inserting the following after the word "responsible" in line 2 of that paragraph:

"or whether any toxic or hazardous substances already at the Place of the Work and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements were dealt with by the Contractor, or anyone for whom the Contractor is responsible, in a manner which does not comply with legal and regulatory requirements,"

3.37.2 Amend paragraph 9.2.7.3 by inserting the following words after the word "delay" in the second line of that paragraph:

", but excluding the costs of the Contractor's head office personnel and overhead costs, and excluding any consequential, indirect or special damages, and excluding any claims for loss of profit or opportunity"

3.37.3 Delete paragraph 9.2.7.4.

3.37.4 Amend paragraph 9.2.8 by inserting the following after the word “responsible” in line 2 of that paragraph:

"or that any toxic or hazardous substances already at the Place of the Work and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements were dealt with by the Contractor, or anyone for whom the Contractor is responsible, in a manner which does not comply with legal and regulatory requirements,"

3.37.5 Add a new paragraphs 9.2.10 and 9.2.11 as follows:

"9.2.10 Without limiting its other obligations under this GC 9.2, the Contractor acknowledges that its obligations under the Contract include compliance with the Environmental Programs. The Contractor acknowledges that the Owner may suffer loss and damage should the Contractor fail to comply with the Environmental Programs and agrees to indemnify and hold harmless the Owner with respect to any loss or damage to which the Owner is exposed by the Contractor’s failure to comply. The Contractor acknowledges that should it fail to comply with the Environmental Programs, such failure will constitute a failure to comply with the Contract to a substantial degree within the meaning of paragraph 7.1.2 of GC 7.1 – OWNER’S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR’S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT."
9.2.11 The Contractor shall indemnify the Owner and the officers, directors, employees and agents of the Owner in respect of any loss, costs or expense or any fine which might be imposed in respect of any failure by the Contractor to satisfy its obligations under this GC 9.2 and, without limiting the general nature of this indemnity, the Contractor shall indemnify the Owner, its officers, directors, employees and agents if the Project is made subject to an order from a court or government agency requiring remediation of any contamination caused as a result of the Work performed by the Contractor or its Subcontractors.”

SC3.38 GC 9.4 CONSTRUCTION SAFETY

3.38.1 Amend paragraph 9.4.1 by deleting the first line of that paragraph and replacing it with the following: “The Contractor”.

3.38.2 Add new paragraphs 9.4.2 to 9.4.5 as follows:

“9.4.2 Without limiting the generality of paragraph 9.4.1, the Contractor shall be and shall assume all of the responsibilities of the “constructor” under the OHSA and shall file the “Notice of Project” as “constructor” with the appropriate Ministry.

9.4.3 The Contractor represents and warrants to the Owner that appropriate health and construction safety instruction and training have been provided and will be provided to the Contractor’s employees, Subcontractors, Suppliers and all others attending at the Place of the Work. The Contractor also undertakes to provide such health and construction safety instruction and training to the Owner’s representatives, the Owner’s own forces, and other contractors. No comments, suggestions or instructions from the Owner or the Consultant are to be relied upon or assumed to reduce or replace the Contractor’s designation as the “constructor” under the OHSA or its responsibility for construction safety on the Project.

9.4.4 The Contractor shall indemnify and save harmless the Owner and its agents, officers, directors, employees, consultants, successors and assigns from and against any and all liability, costs, expenses, fines, damages and all other consequences arising from any and all safety infractions on the Project, including the payment of legal fees and disbursements on a full indemnity basis.

9.4.5 The Contractor shall ensure that every “controlled Product” used at the Project site shall meet the labelling requirements and shall have an updated corresponding “Material Safety Data Sheet”, all as required by the WHMIS legislation. The Contractor shall ensure that all Material Safety Data Sheets are and are made available for review at the Project site.”

SC3.39 GC 9.5 MOULD

3.39.1 Amend paragraph 9.5.3.3 by inserting the following words after the word “delay,” in line 3 of that paragraph:

“, but excluding the costs of the Contractor’s head office personnel and overhead costs, and excluding any consequential, indirect or special damages, and excluding any claims for loss of profit or opportunity,”

SC3.40 GC 10.1 TAXES AND DUTIES

3.40.1 Amend paragraph 10.1.2 by adding the words “, without any mark-up” to the end of that paragraph.

3.40.2 Add new paragraphs 10.1.3, 10.1.4, 10.1.5 and 10.1.6 as follows:

“10.1.3 Where the Owner is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or Value Added Taxes applicable to the Contract, the Contractor shall, at the request of the Owner or the Owner’s representative, assist with application for any exemption, recovery or refund of such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the Owner. The Contractor agrees to endorse over to the Owner any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.
10.1.4 The Contractor shall maintain accurate records of equipment, material and component costs reflecting the taxes, customs duties, excise taxes and Value Added Taxes paid.

10.1.5 Any refund of taxes including, without limitation, any government sales tax, customs duty, excise tax or Value Added Tax, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the Owner. The Contractor agrees to cooperate with the Owner and to obtain from all Subcontractors and Suppliers cooperation with the Owner in the application for any refund of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such refund or exemption and providing to the Owner copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications or exemptions or refunds. All such refunds shall either be paid to the Owner, or shall be a credit to the Owner against the Contract Price, in the Owner’s discretion.

10.1.6 Customs duties penalties, or any other penalty, fine or assessment levied against the Contractor shall not be treated as a tax or customs duty for purposes of this GC 10.1.”

SC3.41 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

3.41.1 Amend paragraph 10.2.5 by adding the words: “Subject to paragraph 3.4.1 of GC 3.4 – DOCUMENT REVIEW” to the beginning of that paragraph.

3.41.2 Amend paragraph 10.2.6 as follows:

(a) delete the words “performs work knowing it to be” in the second line and substitute “performs work when it knew or ought to have known that such work is”; and

(b) delete the words “bear the” in the third line and substitute “indemnify and save the Owner harmless against any”

(c) add the following sentence to the end of that paragraph:

“In the event the Owner suffers loss or damage as a result of the Contractor’s failure to comply with paragraph 10.2.5, and notwithstanding any limitations described in paragraph 12.1.1 of GC 12.1 – INDEMNIFICATION, the Contractor agrees to indemnify and to hold harmless the Owner and the Consultant from and against all claims, demands, losses, costs, damages, actions, suits or proceedings resulting from such failure by the Contractor.”

SC3.42 GC 10.4 WORKERS’ COMPENSATION

3.42.1 Amend paragraph 10.4.1 by inserting the words “with each application for any progress payment, and” after the word “Work,” in the first line of paragraph 10.4.1.

SC3.43 GC 11.1 INSURANCE

_The Contractor shall provide, maintain and pay for insurance. The contractor shall supply a Certificate of Insurance confirming insurance that will indemnify the Owner for loss of use of the property and property damage with limits not less than: $5,000,000.00._

3.43.1 Amend paragraph 11.1.1.1 by adding the following sentence to the end of that paragraph:

“To the extent not already described in this paragraph, the Contractor shall provide legal liability coverage for compensatory damages because of bodily injury or property damage to third parties arising from all operations of the insured, including premises and operations, Subcontractors’ contingent liability, personal injury resulting from protection of persons / property, contractual liability (blanket), broad form property damage, employees as named insureds, cross liability clause and voluntary medical payments.”

3.43.2 Add a new paragraph 11.1.1.4A immediately after paragraph 11.1.1.4 as follows:
“11.1.1.4A In addition to the coverage's described in CCDC 41, include:
   • all risks of direct physical loss including flood;
   • full replacement value, as basis for settlement;
   • the following deductibles: for flood at $50,000 and other at $50,000.”

3.43.3 Amend paragraph 11.1.2 by adding the following to the end of that paragraph:

   “11.1.2 The Owner's acceptance of the Contractor's delivery of any document evidencing the required policies of insurance does not constitute approval or agreement by the Owner that the insurance requirements have been met or that the insurance policies are in compliance with the requirements of this Contract. Failure of the Owner to identify a deficiency from evidence provided will not be construed as a waiver of the Contractor's obligation to maintain the insurance policies required by this Contract.”

3.43.4 Add new paragraphs 11.1.9 to 11.1.13 as follows:

   “11.1.9 All occurrences and claims shall be reported immediately in writing to the Owner providing at least the following particulars:
   .1 date, time and location of occurrence;
   .2 cause and description of circumstances;
   .3 estimate of loss or damage;
   .4 names and telephone numbers of persons to contact.

   11.1.10 Except for policies of automobile insurance, all insurance policies in any way related to the Work and secured and maintained by the Contractor shall include clauses stating each underwriter will waive all rights of recovery, under subrogation or otherwise, against the Owner and the Consultant (except in the event of design related acts errors and omissions).

   11.1.11 All insurance policies and coverage required of the Contractor will be primary over any other insurance that might be carried by the Owner.

   11.1.12 By requiring insurance, the Owner does not represent that coverage and limits will necessarily be adequate to protect the Contractor. The insurance effected or procured by the Contractor will not reduce or limit the Contractor's contractual obligation to indemnify and defend the Owner for claims or suits which result from or are connected with the performance of this Contract.

   11.1.13 Except for policies of automobile insurance, all insurance policies in any way related to the Work and secured and maintained by the Contractor shall include clauses stating each insurer will waive all rights of recovery, under subrogation or otherwise, against the Owner.”

**SC3.44 GC 11.2 CONTRACT SECURITY**

3.44.1 Delete paragraphs 11.2.1 and 11.2.2 and replace them with the following:

   “11.2.1 The Contractor shall furnish a labour and material payment bond in favour of the Owner, securing payment by the Contractor of all labour and materials to be supplied pursuant to the Contract, in a form satisfactory to the Owner and issued by such surety company as the Owner may approve. The bond shall be for fifty per cent (50%) of the Contract Price.

   11.2.2 The Contractor shall furnish a performance bond in favour of the Owner, securing the performance by the Contractor of its obligations under the Contract, including the payment obligations arising thereunder, in a form satisfactory to the Owner and issued by such surety company as the Owner may approve. The bond shall be for fifty per cent (50%) of the Contract Price.

   11.2.3 It is the intention of the Contract that the performance bond shall be applicable to all of the Contractor's obligations under this Contract and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply.
The Contractor represents and warrants that it has provided its surety with a copy of the Contract prior to the issuance of such performance bond.

11.2.4 All premiums and related charges for all bonds shall be included in the Contract Price.”

SC3.45 GC 12.1 INDEMNIFICATION

3.45.1 Delete paragraphs 12.1.1 through 12.1.5 and replace them with the following:

“12.1.1 The Contractor shall defend, indemnify and hold harmless the Owner, its agents, employees, trustees, officers, directors and assigns from and against all claims, demands, damages, losses, expenses, costs including legal fees, actions, suits or proceedings (collectively “Claims”) by whomsoever made, brought or prosecuted in any manner, arising out of, resulting from or attributable, directly or indirectly, to the Contractor’s or any Subcontractor’s performance or non-performance of the Contract, including Claims arising out of the condition of the Work, the Project site, adjoining land, driveways, streets or alleys used in connection with the performance of the Work, regardless of whether or not caused in part by a party indemnified hereunder. It is expressly understood that the Contractor will save harmless the Owner from all Claims made by any party other than the Contractor itself, financial or otherwise, relating to labour and materials furnished by the Contractor or by others for the Work.

12.1.2 The Owner shall indemnify and hold harmless the Contractor, its agents and employees from and against Claims arising out of the Contractor’s performance of the Contract which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the Place of the Work.

12.1.3 Notwithstanding the provisions of paragraph 1.1.7 of GC 1.1 – CONTRACT DOCUMENTS, the provisions of GC 12.1 shall govern over the provisions of paragraph 1.3.1 of GC 1.3 – RIGHTS AND REMEDIES.”

SC3.46 GC 12.2 WAIVER OF CLAIMS

3.46.1 Delete paragraphs 12.2.1 through 12.2.10 and replace them with the following:

“12.2.1 As of the date on which the Owner makes final payment to the Contractor, the Owner expressly waives and releases the Contractor from all claims against the Contractor including without limitation those that might arise from negligence or breach of contract by the Contractor except for one or more of the following:

.1 those made in writing prior to the date of the final certificate for payment and still unsettled;

.2 those arising from the provisions of GC12.1 – INDEMNIFICATION or GC12.3 – WARRANTY;

.3 those arising from GC9.2 – TOXIC AND HAZARDOUS SUBSTANCES and arising from the Contractor bringing or introducing any toxic or hazardous substances to the Place of the Work after the Contractor commences the Work;

.4 those made by Notice in Writing within a period of six years from the date of Substantial Performance of the Work as set out in the certificate of substantial performance, or within such shorter period as may be prescribed in any limitation statute of the province or territory of the Place of the Work and arising from any liability of the Contractor for damages resulting from the Contractor’s performance of the Contract or substantial defects or deficiencies in the Work for which the Contractor is proven responsible. As used herein, “substantial defects or deficiencies” means those defects or deficiencies in the Work where the reasonable cost of repair of such defects or deficiencies, either individually or in the aggregate, exceeds:

(A) if the Contract Price is $2,000,000 or less, the sum of $50,000, before Value Added Taxes;
SUPPLEMENTARY CONDITIONS  
AMENDMENTS TO CCDC 2 – 2008 
STIPULATED PRICE CONTRACT

(B) if the Contract Price exceeds $2,000,000, the sum of $100,000, before Value Added Taxes.

12.2.2 As of the date of Substantial Performance of the Work, the Contractor expressly waives and releases the Owner from all claims which it has or reasonably ought to have knowledge of that could be advanced against the Owner including without limitation those that might arise from the negligence or breach of contract by the Owner except:

1. those for which Notice in Writing was given prior to the Contractor’s application for Substantial Performance of the Work and still unsettled; and

2. claims for payment for Work completed after the Contractor’s application for Substantial Performance of the Work.”

SC3.47 GC 12.3 WARRANTY

3.47.1 Amend paragraph 12.3.1 by adding the following to the end of that paragraph:

“Notwithstanding the foregoing, if an item of Work is not completed at Substantial Performance of the Work, except for extended warranties as described in paragraph 12.3.6, the warranty period for such item of Work shall be one year from the date that such item of Work has been completed and accepted in writing by the Owner.”

3.47.2 Amend paragraph 12.3.2 as follows:

(a) by inserting the words, “Subject to paragraph 3.4.1 of GC 3.4 – DOCUMENT REVIEW” at the beginning of that paragraph; and

(b) by adding the following to the end of that paragraph:

“If the Contractor has been permitted to make use of permanent equipment or systems, as provided in GC 3.15 – CONTRACTOR’S USE OF PERMANENT EQUIPMENT OR SYSTEMS, such permanent equipment or systems shall be subject to the same warranty as described in this GC 12.3 and shall be judged, for purposes of assessing compliance with the warranty, as though the equipment or system was new, clean and unused by the Contractor, except for normal commissioning and startup activities, prior to the date of Substantial Performance of the Work.”

3.47.3 Add the following to the end of paragraph 12.3.4:

“The Contractor shall perform all remedial and warranty work at its own cost and expense and at a time convenient to the Owner; which may be outside of normal working hours. The Owner shall provide reasonable access to those portions of the Project necessary to perform such work, subject to the Owner’s operational requirements. Prior to performing the remedial and warranty work, the Contractor shall provide, for the Owner's review and approval, a proposed schedule for the performance of such work.”

3.47.4 Add a new paragraph 12.3.7 as follows:

“12.3.7 The Contractor shall assign to the Owner all warranties, guarantees or other obligations for Work, services or Products performed or supplied by any Subcontractor, Supplier or other person in connection with the Work, and such assignment shall be with the consent of the assigning party where required by law or by the terms of that party’s contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the Owner under the Contract Documents.”

SC3.48 PART 13 – OTHER PROVISIONS

3.48.1 Add new “PART 13 – OTHER PROVISIONS” as follows:

“PART 13 OTHER PROVISIONS

GC 13.1 CONTRACTOR LIABILITY FOR DAMAGES
13.1.1 Notwithstanding any other provision in this Contract, if the Owner, as a result of the Contractor’s act or omission or breach of contract, incurs damages, costs, fees or expenses, including costs of additional services performed by the Consultant or any subconsultants and including the Owner’s reasonable solicitor and own client costs, whether or not such act, omission or breach results in any lien, lien action or other legal proceeding, and whether or not such act, omission or breach results in the Owner taking any of the steps provided for in GC 7.1, all such damages, costs, fees and expenses shall be charged to the Contractor and the Owner shall be entitled to set off and deduct all such damages, costs, fees and expenses from any amount owing to the Contractor and any security or other funds held by the Owner. If there is no amount owing by the Owner to the Contractor at that time, then the Contractor shall reimburse the Owner for all of the said damages, costs, fees and expenses.

GC 13.2 OWNERSHIP OF MATERIALS
13.2.1 Unless otherwise specified, all materials existing at the Place of the Work at the time of execution of the Contract shall remain the property of the Owner. All Work and Products delivered to the Place of the Work by the Contractor shall be the property of the Owner, and shall be free of any encumbrances. The Contractor shall remove all surplus or rejected materials when notified to do so by the Consultant.

GC 13.3 DAILY REPORTS / DAILY LOGS
13.3.1 The Contractor shall cause its supervisor, or another competent person, to prepare a daily log or diary reporting on weather conditions, workforce of the Contractor, Subcontractors, Suppliers and any other forces on site and also record the general nature of Project activities. Such log or diary shall also include any extraordinary or emergency events which may occur and also the identities of any persons who visit the site who are not part of the day-to-day workforce.

13.3.2 The Contractor shall also maintain records, either at its head office or at the Project site, recording manpower and material resourcing on the Project, including records which document the activities of the Contractor both as planned and actual.

13.3.3 Upon request by the Owner or the Consultant, the Contractor shall make available for inspection and copying all of the records generated pursuant to this GC 13.3, along with any other routine Project records ordinarily maintained by the Contractor.

GC 13.4 LIENS AND ACTIONS
13.4.1 The Contractor shall save and keep the Owner and the Place of the Work free from all construction liens and all other liens whatsoever arising out of the Work. If any lien is claimed, filed or registered or any written notice of lien is received by reason of labour, services, equipment, materials or any Work supplied or claimed to have been supplied by or through a Subcontractor or Supplier, the Contractor shall, at its own expense, within ten (10) Working Days of being notified of the lien or written notice of lien, secure the discharge, release, vacating or withdrawal of such lien or written notice of lien by payment or by giving security or in such other manner as is or may be required or permitted by law, failing which the Owner may, but shall not be required, take such steps as it, in its absolute discretion, may deem necessary to release, vacate or discharge the lien or written notice of lien.

13.4.2 If a lien action or any other action or legal proceeding arising out of the Project is commenced, the Contractor shall take all reasonable steps to remove the Owner from such action or legal proceeding, and shall indemnify the Owner and hold it harmless in such action or legal proceeding.

13.4.3 All amounts, including solicitor and own client costs, disbursements, interest, borrowing and premium or other bonding costs and/or charges incurred by the Owner in releasing, vacating, discharging or otherwise dealing with a lien, written notice of lien and/or defending or otherwise dealing with an action or legal proceeding, shall be charged to the Contractor and shall be set off and deducted from any amount owing to the Contractor. If there is no amount owing by the Owner to the Contractor at that time, then the Contractor shall reimburse the Owner for all of the said costs and associated expenses.
GC 13.5 ADVERTISING AND PUBLIC STATEMENTS

13.5.1 The Contractor shall not publish, issue or make any statements or news release, electronic or otherwise, concerning the Contract, the Work, or the Project, and shall not use the Owner’s name or logo without the prior express written consent of the Owner. For greater certainty, the Contractor shall obtain the prior written approval of the Owner for any public advertising, written public sales promotions, press release or other general publicity matter, in which the name or logo of the Owner is mentioned or used, or in which words are used from which any connection with the Owner may be inferred. The Contractor will not erect or permit the erection of any sign or advertising without the prior written approval of the Owner.

GC 13.6 AMENDMENTS TO THE CONTRACT

13.6.1 No alteration or amendment to this Contract, no course of conduct or dealing between the parties, and no express or implied acceptance of alterations or amendments to the Contract shall be binding unless it is in writing and signed by each party.

13.6.2 No waiver by or on behalf of a party of any breach of a provision of this Contract shall be binding upon the party unless it is expressed in writing and duly executed by the party or signed by its fully authorized representatives, and such a waiver shall not operate as a waiver of any future breach, whether of a like or different character. No waiver shall be inferred from or implied by the conduct of any party.”

END OF SUPPLEMENTARY CONDITIONS
PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises a roof replacement, structural reinforcements, new rooftop units, and fascia and soffit upgrades with ACM panels. The school is Uptergrove Public School, located at 4833 Muley Point Road, Ramara, Ontario L3V 8C3; and further identified as SCDSB Tender 12186T.

1.2 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.

.2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.

.3 The SCDSB has advised the fire alarm monitoring agent is GIT Security, Contact: Francis Van Amelscoort, ph. 705 726-1271, cell 705 794-8800, email operations@gitsecuritysystems.com.

.4 Work of this Project must include provisions for coorindating related work, identified in Contract Documents, for the following principal items.

.1 Re-roofing.
.2 Mechanical and Electrical items.
.3 Structural Reinforcements.
.4 General Contractor's scope of work as it relates to the above noted items.

1.3 WORK SEQUENCE

.1 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

.2 Note:

.1 Owner Occupancy: Refer to Item 1.6 Important Dates.
.2 Mobilization will be permitted - July 2, 2019.
.3 General Contractor is to provide Construction Schedule to complete the Work.
.4 Date of substantial performance is August 23, 2019.

.3 Maintain fire access/control.

1.4 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, storage and for access to allow:

.1 Owner occupancy.
1.4 CONTRACTOR USE OF PREMISES
(Cont'd)

.1 (Cont'd)

.2 Partial owner occupancy.

.2 Co-ordinate use of premises under direction of Consultant.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 OWNER OCCUPANCY

.1 Owner will occupy premises during a portion of the construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.6 IMPORTANT DATES

.1 Student and School year ends - June 26, 2019.

.2 Teaching Staff on site until - June 28, 2019.

.3 Office Staff on site until - July 5, 2019.

.4 Office and Teaching Staff return - August 26, 2019.

.5 Date of Substantial Performance - August 23, 2019.

1.7 FURNISHED ITEMS

.1 Contractor Responsibilities:

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Consultant.

.2 Deliver supplier's bill of materials to Consultant.

.3 Arrange and pay for delivery to site in accordance with Progress Schedule.

.4 Inspect deliveries jointly with Owner.

.5 Submit claims for transportation damage.

.6 Arrange for replacement of damaged, defective or missing items.
1.7 FURNISHED ITEMS (Cont'd)  
.7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Owner.  
.8 Designate submittals and delivery date for each product in progress schedule.  
.9 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.  
.10 Receive and unload products at site.  
.11 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.  
.12 Handle products at site, including uncrating and storage.  
.13 Protect products from damage, and from exposure to elements.  
.14 Assemble, install, connect, adjust, and finish products.  
.15 Provide installation inspections required by public authorities.  
.16 Repair or replace items damaged by Contractor or subcontractor on site (under his control).

1.8 ALTERATIONS, OR REPAIRS TO EXISTING BUILDING  
Execute work with least possible interference or disturbance to building operations occupants, public and normal use of premises. Arrange with Consultant to facilitate execution of work.

1.9 EXISTING SERVICES  
Notify, Consultant and utility companies of intended interruption of services and obtain required permission.  
.2 Where Work involves breaking into or connecting to existing services, give Consultant 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.  
.3 Provide alternative routes for personnel, pedestrian and vehicular traffic.  
.4 Establish location and extent of service lines in area of work before starting Work. Notify Consultant of findings.  
.5 Submit schedule to and obtain approval from Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.  
.6 Provide temporary services to maintain critical building and tenant systems.
1.9 EXISTING SERVICES
(Cont'd) .7 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

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

.10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.10 DOCUMENTS
REQUIRED .1 Maintain at job site, one copy each document as follows:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents.
.11 Other documents as specified.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 ACCESS AND EGRESS
Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 SPECIAL REQUIREMENTS
Submit schedule in accordance with SCDSB Supplementary Conditions, and with these Specifications.

.2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of work and avenues of ingress and egress.

.4 NO equipment or materials are to be stored on the roof. Material is to be brought up to the ROOF on an as needed basis ONLY, and all excess material and equipment are to be removed from the roof at the end of each work day.

1.3 BUILDING SMOKING ENVIRONMENT
Comply with smoking restrictions. Smoking is not permitted.

PART 2 - PRODUCTS

2.1 NOT USED
Not Used.

PART 3 - EXECUTION

3.1 NOT USED
Not Used.
PART 1 - GENERAL

1.1 REFERENCES .1 Canadian Construction Documents Committee (CCDC) - CCDC 2-2008, Stipulated Price Contract.


1.2 CASH ALLOWANCES .1 Refer to CCDC 2, GC 4.1.

.2 Include in Contract Price specified cash allowances.

.3 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.4 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.

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

.6 Allowance for Work is specified as follows - TOTAL $20,000.00

.1 As-Built drawings prepared in AutoCAD and PDF, plus one hard copy (Architectural).

.2 Structural Review of reinforcements NOT stipulated in Base Bid documents.

.3 Inspection and Testing.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
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PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC) - CCDC-2-2008, Stipulated Price Contract.

.2 Project Supplementary Conditions - SCDSB Supplementary Conditions, Amendments to Standard Construction Documents CCDC2-2008.

1.2 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant's review.

.10 Keep one reviewed copy of each submission on site.
1.3 SHOP DRAWINGS
AND PRODUCT DATA

.1 Refer to CCDC 2 GC 3.10.

.2 Provide a Shop Drawing Schedule. The Shop Drawing Schedule shall clearly indicate the phasing of shop drawings.

.3 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.4 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to drawings and specifications.

.6 Allow five days for Consultant's review of each submission.

.7 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.8 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify in writing of revisions other than those requested.

.9 Accompany submissions with transmittal letter, in duplicate, containing:
   .1 Date.
   .2 Project title and number.
   .3 Contractor's name and address.
   .4 Identification and quantity of each shop drawing, product data and sample.
   .5 Other pertinent data.

.10 Shop drawing shall clearly indicate trade responsible for the work.

.11 Submissions include:
   .1 Date and revision dates.
   .2 Project title and number.
   .3 Name and address of:
      .1 Subcontractor.
      .2 Supplier.
      .3 Manufacturer.
1.3 SHOP DRAWINGS AND PRODUCT DATA

.11 (Cont'd)

.3 (Cont'd)

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.12 After Consultant's review, distribute copies.

.13 Submit electronic copies of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.14 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.15 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accordance with specified requirements.

.2 Testing must have been within three years of date of contract award for project.

.16 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.
1.3 SHOP DRAWINGS AND PRODUCT DATA

(Cont'd)

17. Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant. Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

18. Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

19. Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

20. Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

21. Delete information not applicable to project.

22. Supplement standard information to provide details applicable to project.

23. If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.4 SAMPLES

1. Submit for review samples in triplicate as requested in respective specification Sections. Label samples with origin and intended use.

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

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

4. Where colour, pattern or texture is criterion, submit full range of samples.

5. Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

6. Make changes in samples which Consultant may require, consistent with Contract Documents.
1.4 SAMPLES
(Cont'd) .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 MOCK-UPS .1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.6 PHOTOGRAPHIC DOCUMENTATION .1 Submit electronic copy of colour digital photography in jpeg format, fine standard resolution, monthly with progress statement and as directed by Consultant.

   .2 Project identification: name and number of project and date of exposure indicated.

   .3 Number of viewpoints: viewpoints and their location as determined by Consultant.

   .4 Frequency of photographic documentation: weekly as directed by Consultant. Upon completion of: demolition / removals, framing and services before concealment of Work, and as directed by Consultant.

1.7 CERTIFICATES AND TRANSCRIPTS .1 Immediately after award of Contract, submit Workplace Safety & Insurance Board (WSIB) status.

1.8 INSURANCE .1 Immediately after award of Contract, submit General Liability Insurance. Ensure General Liability Insurance lists the Consulting team as additional insured.

   .1 Roderick H. Young Architect, 102 Laclie Street, Orillia, ON, L3V 4M8.

   .2 Tacoma Engineers, 176 Speedvale Avenue West, Guelph, ON, N1H 1C3.

   .3 DEI & Associates Inc., 55 Northland Road, Waterloo, ON, N2V 1Y8.

   .4 Simcoe County District School Board, 1170 The King's Highway 26, Midhurst, ON, L0L 1X0

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.
PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
PART 1 - GENERAL

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.


1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Contractor to assign a designated Health and Safety Co-ordinator from their firm.

.3 Submit site-specific Health and Safety Plan: Within seven days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include results of site specific safety hazard and risk assessment.

.4 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to designated Health and Safety Co-ordinator or authority having jurisdiction, weekly.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets.

.7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within five days after receipt of comments from Consultant.

.8 The designated Health and Safety Co-ordinator's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.
1.4 SAFETY ASSESSMENT

Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

Schedule and administer Health and Safety meeting with respective trades and project personnel prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

1.9 COMPLIANCE REQUIREMENTS


1.10 UNFORESEEN HAZARDS

When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee’s Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.
1.10 UNFORESEEN HAZARDS

When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise designated Health and Safety Co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

1. Have minimum five years site-related working experience specific to activities associated with medium to large size institutional projects.
2. Have working knowledge of occupational safety and health regulations.
3. Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
5. Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.12 POSTING OF DOCUMENTS

Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

1.13 CORRECTION OF NON-COMPLIANCE

Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

2. Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

3. Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 WORK STOPPAGE

Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.
PART 1 - GENERAL

1.1 REFERENCES AND CODES .1 Perform Work in accordance with Ontario Building Code (OBC), latest editions, including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:
   .1 Contract documents.
   .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Consultant.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Consultant.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Consultant.

1.3 BUILDING SMOKING ENVIRONMENT .1 Comply with smoking restrictions and municipal by-laws.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

________________________________________________________________________ END OF SECTION __________________________________________________________________
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PART 1 - GENERAL

1.1 REFERENCES
.1 Canadian Construction Documents Committee (CCDC) - CCDC 2-2008, Stipulated Price Contract.

1.2 INSPECTION
.1 Refer to CCDC 2, GC 2.3.

1.3 INDEPENDENT INSPECTION AGENCIES
.1 Independent inspection/testing agencies will be engaged by Consultant for purpose of inspecting and/or testing portions of Work.
.2 Allocated costs: to Section 01 21 00 - Allowances.
.3 Provide equipment required for executing inspection and testing by appointed agencies.
.4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
.5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and reinspection.

1.4 ACCESS TO WORK
.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
.2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES
.1 Notify appropriate agency Consultant in advance of requirement for tests, in order that attendance arrangements can be made.
.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
1.5 PROCEDURES
(Cont'd) .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORK .1 Refer to CCDC, GC 2.4.
.2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents. Refer to SCDSB Supplementary Conditions, SC 3.3.
.3 Make good other Contractor's work damaged by such removals or replacements promptly.
.4 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.7 REPORTS .1 Submit four copies of inspection and test reports to Consultant.
.2 Provide copies to Contractor for distribution to appropriate subcontractors, manufacturers or fabricators.

1.8 TESTS AND MIX DESIGNS .1 Furnish test results and mix designs as requested.
.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Consultant and may be authorized as recoverable.

1.9 MOCK-UPS .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
.2 Construct in locations acceptable to Consultant as specified in specific Section.
.3 Prepare mock-ups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
1.9 MOCK-UPS

(Cont'd) Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Remove mock-up at conclusion of Work or when acceptable to Consultant. If mock-up is deemed acceptable for workmanship and location, it may remain as part of the construction Work.

.6 Mock-ups may remain as part of Work.

1.10 MILL TESTS Submit mill test certificates as required of specification Sections.

PART 2 - PRODUCTS

2.1 NOT USED Not Used.

PART 3 - EXECUTION

3.1 NOT USED Not Used.
PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

.3 Pay for utility charges at prevailing rates.

1.4 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a minimum supply of 200A 120/240V single phase temporary construction power service.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

1.5 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.
PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.
PART 1 - GENERAL

1.1 REFERENCES

1. Standards Council of Canada
   .1 CSA-O121-17, Douglas Fir Plywood.

   .1 MPI #5 Primer Alkyd / Oil for Exterior Wood.
   .2 MPI #6 Exterior Latex Primer for Wood.
   .3 MPI #9 Alkyd, Exterior Gloss.

1.2 INSTALLATION AND REMOVAL

1. Provide temporary controls in order to execute Work expeditiously.

2. Remove from site all such work after use.

1.3 GUARD RAILS AND BARRICADES

1. Provide secure, rigid guard rails and barricades around open shafts, open pits, open edges of roofs and floors.

2. Provide as required by governing authorities.

1.4 DUST TIGHT SCREENS

1. Provide dust tight screens and / or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work on the interior of the building ONLY.

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

1.5 FIRE ROUTES

1. Maintain access to property including overhead clearances for use by emergency response vehicles.

1.6 PROTECTION OF BUILDING FINISHES

1. Provide protection for finished and partially finished building finishes and equipment during performance of Work.

2. Provide necessary screens, covers, and hoardings.

3. Confirm with Consultant locations and installation schedule three days prior to installation.

4. Be responsible for damage incurred due to lack of or improper protection.
PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION
PART 1 - GENERAL

1.1 REFERENCES  
.1 Canadian Construction Documents Committee (CCDC) - CCDC 2-2008, Stipulated Price Contract.  
.3 Within text of each specifications section, reference may be made to reference standards. List of standards, reference writing organizations, is contained in Ontario Building Code, 2012 including latest amendments, and specific literature.  
.4 Conform to these reference standards, in whole or in part as specifically requested in specifications.  
.5 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.  
.6 Cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY  
.1 Refer to CCDC2-2008 and SCDSB Supplementary Conditions.  
.2 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.  
.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.  
.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.  
.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
1.2 QUALITY
(Cont'd) .6
Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY .1
Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION .1
Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

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

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

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

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

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

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

.8 Remove and replace damaged products at own expense and to satisfaction of Consultant.
1.4 STORAGE, HANDLING AND PROTECTION

(Cont’d)

1.4 STORAGE, HANDLING AND PROTECTION

.9 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.6 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.
1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

1.10 REMEDIAL WORK

.1 Refer to CCDC2-2008, SCDSB Supplementary Conditions, and Section 01 73 00 - Execution.

.2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.12 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
1.13 FASTENINGS - EQUIPMENT

(Cont’d) Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Consultant.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
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PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Requirements and limitations for cutting and patching the work.

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work

.2 Section 01 33 00 - Submittal Procedures.

1.3 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 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 or patching means acceptance of existing conditions.

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

.5 Provide protection from elements for areas which are to be exposed by uncovering work.

.6 Obtain Consultants approval before cutting, boring or sleeving loadbearing members.

1.5 EXECUTION

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

.2 Fit 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.
1.5 EXECUTION

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

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

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

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

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element, to match existing fire resistance ratings.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

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

.15 Make cuts with clean, true smooth edges.

.16 Where new work connects with existing, and where existing work is altered, cut patch and make good to match existing work.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
PART 1 - GENERAL

1.1 REFERENCES
.1 Canadian Construction Documents Committee (CCDC) - CCDC2-2008, Stipulated Price Contract.

1.2 PROJECT CLEANLINESS
.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
.4 Provide on-site dumpster containers for collection of waste materials and debris.
.5 Dispose of waste materials and debris.
.6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
1.3 FINAL CLEANING .1 Refer to CCDC 2, GC 3.14.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
PART 1 - GENERAL

1.1 REFERENCES

1 Contractor's Inspection: Contractor to conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
   .1 Notify Consultant in writing of satisfactory completion of Contractor's Design-Builder's inspection and submit verification that corrections have been made.
   .2 Request Consultant's inspection.

2 Consultant's Inspection:
   .1 Consultant to inspect Work and identify defects and deficiencies.
   .2 Contractor to correct Work as directed.

3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
   .1 Work: completed and inspected for compliance with Contract Documents.
   .2 Defects: corrected and deficiencies completed.
   .3 Equipment and systems: tested, adjusted and balanced and fully operational.
   .4 Certificates required by Boiler Inspection Branch, Utility companies: submitted.
   .5 Work: complete and ready for final inspection.

4 Final Inspection:
   .1 When completion tasks are done, request final inspection of Work by Consultant, and Contractor.
   .2 When Work incomplete according to Owner and Consultant, complete outstanding items and request re-inspection.

5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

6 Commencement of Lien and Warranty Periods: Owner's acceptance of submitted declaration of Substantial Performance, and publication thereof in the Daily Commercial News, to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

7 Final Payment:
1.2 ADMINISTRATIVE REQUIREMENTS (Cont'd)

.1 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 Refer to CCDC2-2008: when Work deemed incomplete by Consultant, complete outstanding items and request re-inspection.

.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, and publication thereof in the Daily Commercial News, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING .1

Clean in accordance with Section 01 74 11 - Cleaning. Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 2 - PRODUCTS

2.1 NOT USED .1

Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1

Not Used.
PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:
   .1 Convene meeting two weeks prior to contract completion with contractor's representative and Consultant to:
      .1 Verify Project requirements.
      .2 Review manufacturer's installation instructions and warranty requirements.
   .2 Consultant to establish communication procedures for:
      .1 Notifying construction warranty defects.
      .2 Determine priorities for type of defects.
      .3 Determine reasonable response time.
   .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
   .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Two weeks prior to Substantial Performance of the Work, submit to Consultant, one electronic copy of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
1.3 FORMAT (Cont'd)  
.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide scaled CAD files in dwg format on CD or USB stick as well as PDF's.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS  
.1 Table of Contents for Each Volume: provide title of project;  
.1 Date of submission; names.

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

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

.2 For each product or system: list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS -BUILT DOCUMENTS AND SAMPLES  
.1 Maintain, in addition to requirements in General Conditions, at site for Consultant Owner one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.
1.5 AS-BUILT DOCUMENTS AND SAMPLES

(Cont'd)

.1 Inspection certificates.
.7 Manufacturer's certificates.
.8

(Cont'd)

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Consultant.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided Consultant.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
   .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
   .3 Field changes of dimension and detail.
   .4 Changes made by change orders.
   .5 Details not on original Contract Drawings.
   .6 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:
   .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
   .2 Changes made by Addenda and change orders.
1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS (Cont’d)  .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos for site records with each progress billing application.

1.7 MATERIALS AND FINISHES  .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional requirements: as specified in individual specifications sections.

1.8 MAINTENANCE MATERIALS  .1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Deliver to site; place and store.
.4 Receive and catalogue items.
.5 Submit inventory listing to Consultant.
.6 Include approved listings in Maintenance Manual.
.7 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Deliver to site; place and store.
.4 Receive and catalogue items.
.5 Submit inventory listing to Consultant.
.6 Include approved listings in Maintenance Manual.
.7 Obtain receipt for delivered products and submit prior to final payment.
1.8 MAINTENANCE MATERIALS

(Cont'd)

.3 Special Tools:
   .1 Provide special tools, in quantities specified in individual specification section.
   .2 Provide items with tags identifying their associated function and equipment.
   .3 Deliver to site; place and store.
   .4 Receive and catalogue items.
      .1 Submit inventory listing to Consultant.
      .2 Include approved listings in Maintenance Manual.

1.9 DELIVERY, STORAGE AND HANDLING

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

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

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

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Consultant.

1.10 WARRANTIES AND BONDS

.1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
   .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
   .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
   .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
   .4 Verify that documents are in proper form, contain full information, and are notarized.
   .5 Co-execute submittals when required.
   .6 Retain warranties and bonds until time specified for submittal.

.2 Respond in timely manner to oral or written notification of required construction warranty repair work.
PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.
PART 1 - GENERAL

1.1 REFERENCES .1 Definitions:
.1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.

.2 Reference Standards:
.1 Department of Justice Canada (Jus)
.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
.2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 RELATED REQUIREMENTS .1 Refer to STRUCTURAL REPORT, Roof Condition Assessment, April 15, 2019 by Tacoma Engineers (7 pages) attached at the end of this Section. Structural Drawings and Specifications are to follow under separate cover in an Addendum.

.2 Pre-Renovation Designated Substances and Hazardous Materials Survey, March 27, 2019 by ARCADIS Canada Inc. (37 pages) attached at the end of Section 02 81 01 - HAZARDOUS MATERIALS.

1.3 ADMINISTRATIVE REQUIREMENTS .1 Meetings:
.1 Convene meeting 1 week prior to beginning work of this Section with Contractor's Representative and Consultant to:
.1 Verify project requirements.
.2 Verify existing site conditions adjacent to demolition work.
.3 Co-ordination with other construction subtrades.
.2 Hold project meetings bi-weekly.
.3 Ensure key personnel, site supervisor, project manager and subcontractor representatives attend.
1.3 ADMINISTRATIVE REQUIREMENTS

(Cont’d)

.4 Consultant will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

.2 Scheduling: Meet project time lines without compromising specified minimum rates of material diversion. In the event of unforeseen delay notify Consultant in writing.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial and Municipal regulations.

1.5 SITE CONDITIONS

.1 Environmental protection:

.1 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.2 Fires and burning of waste or materials is not permitted on site.

.3 Do not bury rubbish waste materials.

.4 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

.5 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

.6 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.

.7 Protect trees, plants and foliage on site and adjacent properties where indicated.

.8 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.

.9 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on job site.
PART 3 - EXECUTION

3.1 DEMOLITION

.1 Do demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.

.3 At end of each day's work, leave Work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times.

.4 Demolish to minimize dusting. Keep materials wetted as directed by Consultant.

.5 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.

.6 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.2 CLEANING

.1 Designate appropriate security resources / measures to prevent vandalism, damage and theft.

.2 Do not stockpile demolished materials. Remove on a daily basis.

.3 Remove demolished materials off site to an approved waste facility.

END OF SECTION
Background
Tacoma Engineers has been retained by Rod Young Architect carry out a structural condition survey of the existing Rapidex roof framing at the Upptergrove Public School located at 4833 Muley Point Road, Ramara, Ontario. This report includes a summary of the following items:

- The main structural systems comprising the roof
- Areas of potential concern
- Summary of recommendations related to proposed roof replacement project

This report is limited to review of the condition of the roof in the school. The other building components (such as slabs on grade, and concrete block walls) are outside the scope of this report. This report is based on a visual inspection only and does not include any destructive testing. The structure is assumed to have been constructed in accordance with best building practices common at the time of construction and no further structural analysis or building code analysis has been carried out as part of this report. The visual review was completed on March 27, 2019.

Observations
The single-storey school was constructed out of conventional load bearing concrete masonry walls complete with a brick veneer and a proprietary roof system known as Rapidex. In most of the rooms the underside of the Rapidex roof system was visible and easily observed during the site review.

The condition of the roof system was assessed from the underside of the Rapidex on the main floor. The roof slabs were supported by exterior concrete block walls and interior corridor walls. Slabs also appeared to be side-bearing on interior non-load bearing partition walls.

The Rapidex system is not conventional in modern design and construction; however, it was very popular during the 1960-70s (especially in schools and motels/hotels). Rapidex Floor or Roof system is a concrete masonry structural slab comprised of multiple panels of interlocking hollow concrete masonry units reinforced with steel bars. It was common for the panels of the exact length to be cast and prepared off-site and delivered to the jobsite for installation. The installers on site then had to lift the panels into place, ensuring correct and tight alignment, and finally grout the panels into position.
Historically, this system of construction was found to be susceptible to long-term deflection (creep), differential deflection between the panels, and infiltration of water due to the use of porous, lightweight block. The infiltration of water to the interior of the blocks is especially concerning, leading to the corrosion of the reinforcing steel.

**Roof Review**

Our review of the Rapidex comprising the roof structure was conducted by reviewing the top of the roofing membrane and the underside of the panels from the main floor. Overall, the roof slab appeared to be in good condition with isolated but repeated cracking between panels, narrow cracks between block units along the panel, and localized evidence of water infiltration. An example of the longitudinal cracks observed between the Rapidex panels that were typical to each room can be seen in Photos 1 to 3.

Localized discolouration of the underside of the Rapidex panel was observed in Classroom 114 and 116 (refer to Photo 4). This type of staining is typically associated with the infiltration of water through the roof system. At the time of the site review the surface of the panels did not appear to be damp and no open cracks were observed in the surrounding areas to indicate ongoing water ingress.

Spalling and evidence of differential deflection at non-load-bearing concrete block wall can be seen in Photo 5.

Narrow cracks were observed in the Rapidex blocks themselves (transverse cracking) in Classroom 114 and 116 (refer to Photo 6).

**Assessment:**

This assessment is based on visual review only. No deflection measurements were taken during the review. Based on our site review and engineering assessment, we are of the opinion that the roof system is performing as expected compared to building where Rapidex or similar systems have been utilized. Historically, this style of segmented panelized slabs has been observed to undergo long term creep and be susceptible to water infiltration.

The longitudinal cracks observed during our site review are due to differential deflection between adjacent Rapidex panels and is typically seen when this type of system is utilized. The longitudinal cracks are not an indication of a structural concern; however, they create a possible location for the infiltration of water.

Minor transverse cracking was observed at or near the midspan of the panels; indicating that the Rapidex panels are not currently overloaded. However, it is important that existing cracks be monitored regularly to determine of the slabs are deflecting further or have reached an equilibrium position.
Photo 1 – Longitudinal cracking between slabs (room 112)

Photo 2 - Longitudinal cracking between slabs (room 115)
Photo 3 – Longitudinal cracking between slabs (room 114)

Photo 4 – Water staining observed at underside of slab (room 114)
Photo 5 – Transverse cracking through blocks at underside of slab (room 114)

Photo 6 – Longitudinal cracking and spalling of slabs (room 116)
Conclusions / Recommendations

Our review of the roof system at the Uptergrove Public School concluded that most of the areas reviewed as part of this structural assessment appeared to be in fair condition. Localized longitudinal and transverse cracks through the Rapidex units were observed. In several locations staining on the underside of the roof slab was observed.

It is our opinion that the following remedial actions be undertaken to ensure that the building continues to perform adequately:

- Monitor the roof structural for signs of further differential cracking and deflection. Rapidex systems should be monitored to determine if the observed deflection is increasing (creep). It is recommended that this type of structure is reviewed by a professional engineer every 5 years.
- While not a structural concern, the observed water staining is indicative of water infiltration problem. It is not known if this staining is the result of an active leak or a previously resolved issue. It is recommended that the roof is further reviewed by a reputable contractor (if the roof replacement project does not proceed) to ensure this problem has been previously addressed.

It is our understanding that the proposed roof replacement project will address the water infiltration concerns. It is recommended that the following structural items are considered with the proposed project.

1) Weight replacement roof should be lighter than or equal to the roofing system removed.
2) Ponding of water on the roof structure must be avoided. It is our understanding that the architect is proposing use of tapered insulation to improve roof drainage. Another alternative would be to add rain water leaders to further aid in the drainage of the existing roof.
3) It is recommended that steel H-frame structures are installed at locations of replacement roof top units. The new units will cast a larger snow shadow on the existing roof that can be addressed with new support structures. The supporting H-frames will span between existing concrete block walls.

If there are any questions or comments or any other structural issues, please don’t hesitate to call for assistance.

Per

Kevin Hughes, M.A.Sc., P.Eng., CAHP
Structural Engineer, Senior Associate
Tacoma Engineers Inc.

Encl. Appendix A: Material Condition Definitions
Appendix A: Material Condition Definitions

Definitions
The following is a summary of definitions of terms used in this report describing the condition of the structure and recommended remedial actions:

- **Condition States**¹:
  1. Good – Element(s) where the first signs of minor defects are visible. These types of defects would not normally trigger remedial action since the overall performance is not affected.
  2. Fair – Element(s) where medium defects are visible. These types of defects may trigger a “preventative maintenance” type of remedial action where it is economical to do so.
  3. Poor – Element(s) where severe or very severe defects are visible. These types of defects would normally trigger rehabilitation or replacement if the extent and location affect the overall performance of that element.

- **Masonry / Concrete Cracking**¹:
  1. Hairline Cracks – Less than 0.1 mm wide.
  2. Narrow Cracks – Between 0.1 and 0.3 mm wide.
  3. Medium Cracks – Between 0.3 and 1.0 mm wide.
  4. Wide Cracks – Greater than 1.0 mm wide.

- **Masonry / Concrete Spalling**¹:
  1. Light - Spalled area measuring less than 150 mm or less than 25 mm in depth.
  2. Medium - Spalled area measuring between 150 mm to 300 mm in any direction or between 25 mm and 50 mm in depth.
  3. Severe - Spalled area measuring between 300 mm to 600 mm in any direction or between 50 mm and 100 mm in depth.
  4. Very Severe - Spalled area measuring more than 600 mm in any direction or greater than 100 mm in depth.

- **Immediate remedial action**²:
  Items that present an immediate structural and/or safety. The remedial recommendations will need to be implemented immediately and may include restricting access, temporary shoring/supports or removing the hazard.

- **Priority remedial action**²:
  Items that do no present an immediate hazard but still require action in an expedited manner. The postponement of these items will likely result in the further degradation of the structural systems and finishes. This may include interim repairs, further investigations, etc. and are broken down into timelines as follows:
  1. **Short-term:** it is recommended that items listed as short-term remedial action are acted on within the next 24 months.
  2. **Long-term:** it is recommended that items listed as long-term remedial action are acted on within the next 5-10 years. Many of these items include recommendations of further review/investigation.

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¹ Adapted from “Ontario Structure Inspection Manual (OSIM), 2000 (Rev. 2008)” by the Ministry of Transportation Ontario (MTO)
² Adapted from “Structural Condition Assessment”, 2005, American Society of Civil Engineers/Structural Engineering Institute
1.1 REFERENCES

.1 Definitions:
.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.2 Reference Standards:
.2 Department of Justice Canada (Jus)
.2 Transportation of Dangerous Goods Regulations (including amendment SOR/2007-253).
.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.2 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

1.2 RELATED REQUIREMENTS

Refer to Pre-Rehabilitation Designated Substance and Hazardous Materials Survey, March 27, 2019 by ARCADIS Canada Inc. (37 pages) attached at the end of this Section.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

Submit in accordance with Section 01 33 00 - Submittal Procedures.
1.3 ACTION AND INFORMATIONAL SUBMITTALS

Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS and MSDS in accordance with Section 01 35 29 - Health and Safety Requirement to Consultant for each hazardous material required prior to bringing hazardous material on site.
.3 Submit hazardous materials management plan to Consultant that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

1.4 DELIVERY, STORAGE AND HANDLING

Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

Storage and Handling Requirements:
.1 Co-ordinate storage of hazardous materials with Consultant and abide by internal requirements for labelling and storage of materials and wastes.
.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
.3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of Consultant.
.5 Transfer of flammable and combustible liquids is prohibited within buildings.
.6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
1.4 DELIVERY, STORAGE AND HANDLING

(Cont’d)

.4 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
.7 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
.9 Observe smoking regulations, smoking is prohibited on site.
.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
  .1 Store hazardous materials and wastes in closed and sealed containers.
  .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
  .3 Store hazardous materials and wastes in containers compatible with that material or waste.
  .4 Segregate incompatible materials and wastes.
  .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
  .6 Store hazardous materials and wastes in secure storage area with controlled access.
  .7 Maintain clear egress from storage area.
  .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
  .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
  .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
  .11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
  .12 Report spills or accidents immediately to appropriate agency and notify Consultant. Submit a written spill report to Consultant within 24 hours of incident.

PART 2 - PRODUCTS

2.1 MATERIALS

Description:
.1 Bring on site only quantities hazardous material required to perform Work.
.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
.3 Sustainability Characteristics:
  .1 Adhesives and Sealants in accordance with Section 07 92 00 - Joint Sealants.
2.1 MATERIALS  
(Cont'd)  
(Cont'd)  
(Cont'd)  
.1 Primers, Paints, Coatings in accordance with manufacturer’s recommendations for surface conditions and Section 09 91 23 - Painting.

PART 3 - EXECUTION

3.1 CLEANING  
.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
PRE-RENOVATION DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY
UPTERGROVE PUBLIC SCHOOL

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Project Engineer

Paul Smith, B.Sc., IHT
Senior Industrial Hygienist

Uptergrove Public School
4833 Muley Point Road, Orillia, Ontario

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Our Ref.:
701543-110

Date:
March 27, 2019

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TABLES

Table 3.1. Summary of Results of Analyses of Bulk Samples for Asbestos Content ...................................3-1

APPENDICES

A  Floor Plan/Roof Plan
B  Laboratory Report
C  Summary of Asbestos, Lead and Silica Work Classifications
EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by the Simcoe County District School Board to conduct a pre-renovation designated substances and hazardous materials survey in designated areas of Uptergrove Public School located at 4833 Muley Point Road in Orillia, Ontario. The designated areas included Roof Areas A, C and D, and the exterior walls adjacent to these roofs.

Asbestos-containing material found to be present in the designated study areas was limited to the texture spray applied to exterior soffits along the south and west wall of the original building, and the exterior of the canopy at the main entrance.

Materials observed in the designated study areas which should be considered to contain silica included concrete, cement block walls, brick, asphaltic roofing materials, texture spray, and mortar.

No equipment potentially containing PCBs or mercury was identified in the designated study areas during the course of the site investigation.

Three HVAC units, potentially containing Ozone-Depleting Substances (ODS), were observed on the roof.

No readily-evident mould was observed during the course of the site investigation.

No other designated substances (vinyl chloride, acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide and coke oven emissions) were observed to be present in the designated study areas in a form that would represent an exposure concern.
1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by the Simcoe County District School Board to conduct a pre-renovation designated substances and hazardous materials survey in designated areas of Uptergrove Public School located at 4833 Muley Point Road in Orillia, Ontario.

It is our understanding that renovations are planned for the removal and replacement of the exterior soffits and fascia adjacent to Roof Areas A, C and D, and the removal and replacement of the exterior canopy at the main entrance. The designated areas included Roof Areas A, C and D, and the exterior walls adjacent to these roofs. A floor plan and roof plan showing the designated areas is provided in Appendix A. Only exterior building surfaces were included in this survey.

The information in this report is to be provided to all bidders on a project in accordance with the requirements of the Occupational Health and Safety Act.

The survey was undertaken to report on the presence or suspected presence of readily observable designated substances and hazardous materials.

1.1 Scope of Work

The scope of work for our investigation included:

- review of existing information;
- investigation of readily-accessible areas in the designated study areas for the presence of designated substances and hazardous materials used in building construction materials;
- obtaining representative bulk samples of materials suspected of containing asbestos;
- laboratory analyses of bulk samples for asbestos content; and,
- preparation of a report outlining the findings of the investigation.

Mr. Joseph Jones of Arcadis visited the site on March 12, 2019 to conduct the designated substances and hazardous materials survey.
2 REGULATORY DISCUSSION AND METHODOLOGY

Ontario Occupational Health and Safety Act (OHSA)

The Ontario Occupational Health and Safety Act (OHSA) sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)];
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)];
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)]; and
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, Section 30 of the OHSA deals with the presence of designated substances on construction projects. Compliance with the OHSA and its regulations requires action to be taken where there is a designated substance hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if designated substances are present on a project and, if so, to inform all potential contractors as part of the bidding process. Contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project.

Regulation for Construction Projects, O.Reg. 213/91

The Regulation for Construction Projects, O.Reg. 213/91, applies to all construction projects. The following sections of the regulation would apply to situations where there is the potential for workers to be exposed to designated substances:

Section 14 (5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.

Section 21 (1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.

(2) A worker’s employer shall require the worker to comply with subsection (1).
(3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.

Section 30  Workers who handle or use substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.

Section 46  (1) A project shall be adequately ventilated by natural or mechanical means,

(a) if a worker may be injured by inhaling a noxious...dust or fume;

(2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.

Section 59  If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation for Designated Substances (O.Reg. 490/09)

The Designated Substance Regulation (O.Reg. 490/09) specifies occupational exposure limits (OELs) for designated substances and requires an assessment and a control program to ensure compliance with these OELs.

Although, O.Reg. 490/09 and the OELs do not apply to an employer on a construction project, or to their workers at the project, employers still have a responsibility to protect the health of their workers and to comply with the OHSA and other applicable regulations. Section 25(2)(h) of the OHSA requires that employers take "every precaution reasonable in the circumstances for the protection of a worker".

Other regulatory requirements (and guidelines) which apply to control of exposure to designated substances and hazardous materials are referenced in the sections below.

2.1 Asbestos

Asbestos has been widely used in buildings, both in friable applications (materials which can be crumbled, pulverized or powdered by hand pressure, when dry) such as pipe and tank insulation, sprayed-on fireproofing and acoustic texture material and in non-friable manufactured products such as floor tile, gaskets, cement board and so on. The use of asbestos in friable applications was curtailed around the mid-1970s and, as such, most buildings constructed prior to about 1975 contain some form of friable construction material with an asbestos content. The use of asbestos in certain non-friable materials continued beyond the mid-1970s.

Control of exposure to asbestos is governed in Ontario by Regulation 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations. Disposal of asbestos waste
(friable and non-friable materials) is governed by Ontario Regulation 278/05 and by Ontario Regulation 347, Waste Management – General. O.Reg. 278/05 classifies asbestos work operations into three types (Type 1, 2 and 3), as shown in Table C-1 in Appendix C, and specifies procedures to be followed in conducting asbestos abatement work.

### 2.2 Lead

Lead is a heavy metal that can be found in construction materials such as paints, coatings, mortar, concrete, pipes, solder, packings, sheet metal, caulking, glazed ceramic products and cable splices. Lead has been used historically in exterior and interior paints.

The Surface Coating Materials Regulations made under the Hazardous Products Act (SOR/2005-109) sets a maximum concentration of total lead of 90 mg/kg (0.009 percent or 90 parts per million) for surface coating materials, including paints, effective 21 October 2010. This criterion level applies to the sale and importation of new surface coating materials.

The National Plumbing Code allowed lead as an acceptable material for pipes until 1975 and in solder until 1986.

The Ministry of Labour Guideline, Lead on Construction Projects, dated April 2011, provides guidance in the measures and procedures that should be followed when handling lead containing materials during construction projects. In the guideline, lead-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of lead, as shown in Appendix C, Table C-2. Any operation that may expose a worker to lead that is not a Type 1, Type 2, or Type 3b operation, is classified as a Type 3a operation.

### 2.3 Mercury

Mercury has been used in electrical equipment such as alkaline batteries, fluorescent light bulbs (lamps), high intensity discharge (HID) lights (mercury vapour, high pressure sodium and metal halide), “silent switches” and in instruments such as thermometers, manometers and barometers, pressure gauges, float and level switches and flow meters. Mercury-containing lamps, the bulk of which are 1.22 m (four foot) fluorescent lamps contain between 7 and 40 mg of mercury each. Mercury compounds have also been used historically as additives in latex paint to protect the paint from mildew and bacteria during production and storage.

The intentional addition of mercury to Canadian-produced consumer paints for interior use was prohibited in 1991. Mercury may have remained in paints after 1991, however, as a result of impurities in the paint ingredients or cross-contamination due to other manufacturing processes. The Surface Coating Materials Regulations made under the Hazardous Products Act set a maximum total mercury concentration of 10 mg/kg (0.001 percent) for surface coating materials (including paint). This criterion level applies to the sale and importation of new surface coating materials.
Mercury-containing thermostats and silent light switches are mercury tilt switches which are small tubes with electrical contacts at one end of the tube. A mercury tilt switch is usually present when no switch is visible. Mercury switches often have the word “TOP” stamped on the upper end of the switch, which is visible after removing the cover plate. If mercury switches are to be removed, the entire switch should be removed and placed into a suitable container for storage and disposal.

Waste light tubes generated during renovations or building demolition and waste mercury from equipment must either be recycled or disposed of in accordance with the requirements of Ont. Reg. 347 - Waste Management, General.

Waste mercury in amounts less than 5 kg (per month) are exempt from the generator registration requirements prescribed by O.Reg. 347 – Waste Management – General. Waste mercury from mercury switches or gauges should, however, be properly collected and shipped to a recycling facility or disposed of as a hazardous waste. Removal of mercury-containing equipment (e.g., switches, gauges, controls, etc.) should be carried out in a manner which prevents spillage and exposure to workers.

2.4 Silica

Silica exists in several forms of which crystalline silica is of most concern with respect to potential worker exposures. Quartz is the most abundant type of crystalline silica. Some commonly used construction materials containing silica include brick, refractory brick, concrete, concrete block, cement, mortar, rock and stone, sand, fill dirt, topsoil and asphalt containing rock or stone.

The Ministry of Labour Guideline, Silica on Construction Projects, dated April 2011, provides guidance in controlling exposure to silica dust during construction activities. In the guideline, silica-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz and tripoli as shown in Appendix C, Table C-3.

2.5 Vinyl Chloride

Vinyl chloride vapours may be released from polyvinyl chloride (PVC) products in the event of heating or as a result of decomposition during fire. PVC is used in numerous materials that may be found in building construction, including, for example, piping, conduits, siding, window and door frames, plastics, garden hoses, flooring and wire and cable protection.

2.6 Acrylonitrile

Acrylonitrile is used to produce nitrile-butadiene rubber, acrylonitrile-butadiene-styrene (ABS) polymers and styrene-acrylonitrile (SAN) polymers. Products made with ABS resins which may be found in buildings include telephones, bottles, packaging, refrigerator door liners, plastic pipe, building panels and shower stalls. Acrylonitrile can be released into the air by combustion of products containing ABS.
2.7 Other Designated Substances

Isocyanates are a class of chemicals used in the manufacture of certain types of plastics, foams, coatings and other products. Isocyanate-based building construction materials may include rigid foam products such as foam-core panels and spray-on insulation and paints, coatings, sealants and adhesives. Isocyanates may be inhaled if they are present in the air in the form of a vapour, a mist or a dust.

Benzene is a clear, highly flammable liquid used mainly in the manufacture of other chemicals. The commercial use of benzene as a solvent has practically been eliminated, however it continues to be used as a solvent and reactant in laboratories.

Arsenic is a heavy metal used historically in pesticides and herbicides. The primary use in building construction materials was its use in the wood preservative chromated copper arsenate (CCA). CCA was used to pressure treat lumber since the 1940s. Pressure-treated wood containing CCA is no longer being produced for use in most residential settings.

Ethylene oxide is a colourless gas at room temperature. It has been used primarily for the manufacture of other chemicals, as a fumigant and fungicide and for sterilization of hospital equipment.

Coke oven emissions are airborne contaminants emitted from coke ovens and are not a potential hazard associated with building construction materials.

2.8 Polychlorinated Biphenyls (PCBs)

The management of equipment classified as waste and containing Polychlorinated Biphenyls (PCBs) at concentrations of 50 parts per million (mg/kg) or greater is regulated by Ontario Regulation 362, Waste Management – PCBs. Under this regulation, PCB waste is defined as any waste material containing PCBs in concentrations of 50 mg/kg or greater. Any equipment containing PCBs at or greater than this level, such as transformers, switchgear, light ballasts and capacitors, which is removed from service due to age, failure or as a result of decommissioning, is considered to constitute a PCB waste. Although current federal legislation (effective 1 July 1980) has prohibited the manufacture and sale of new equipment containing PCBs since that time, continued operation of equipment supplied prior to this date and containing PCBs is still permitted. Handling, storage and disposition of such equipment is, however, tightly regulated and must be managed in accordance with provincial and federal government requirements as soon as it is taken out of service or becomes unserviceable.

In most institutional, commercial facilities and in smaller industrial facilities, the primary source of equipment potentially containing PCBs is fluorescent and H.I.D. light ballasts. Small transformers may also be present. In larger industrial facilities, larger transformers and switch gear containing, or potentially containing, PCBs may also be present.

PCBs were also commonly added to industrial paints from the 1940s to the late 1970s. PCBs were added directly to the paint mixture to act as a fungicide, to increase durability and flexibility, to improve resistance to fires and to increase moisture resistance. The use of PCBs in new products was banned in Canada in
the 1970s. PCB amended paints were used in specialty industrial/institutional applications prior to the 1970s including government buildings and equipment such as industrial plants, radar sites, ships as well as non-government rail cars, ships, grain bins, automobiles and appliances.

Removal of in-service equipment containing PCBs, such as fluorescent light ballasts, capacitors and transformers, is subject to the requirements of the federal *PCB Regulations* (discussed below).

The *PCB Regulations*, which came into force on 5 September 2008, were made under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) with the objective of addressing the risks posed by the use, storage and release to the environment of PCBs, and to accelerate their destruction. The *PCB Regulations* set different end-of-use deadlines for equipment containing PCBs at various concentration levels.

The Regulations Amending the PCB Regulations and Repealing the Federal Mobile PCB Treatment and Destruction Regulations were published on 23 April 2014, in the Canada Gazette, Part II, and came into force on 1 January 2015. The most notable part of the amendments is the addition of an end-of-use deadline date of 31 December 2025 for specific electrical equipment located at electrical generation, transmission and distribution facilities.

When the PCB materials are classified as waste, jurisdiction falls under the Ontario Ministry of the Environment and Climate Change (MOECC) and O.Reg. 362. All remedial and PCB management work must be carried out under the terms of a Director’s Instruction issued by an MOECC District Office (for quantities of PCB fluid greater than 50 litres). The PCB waste stream, regardless of quantity, must be registered with the MOECC, in accordance with O.Reg. 347, *General - Waste Management*. O.Reg. 362 applies to any equipment containing greater than 1 kg of PCBs.

### 2.9 Ozone-Depleting Substances (ODS) and Other Halocarbons

Ontario Regulation 463/10 – *Ozone Depleting Substances and Other Halocarbons*, applies to the use, handling and disposal of Class 1 ozone-depleting substances, including various chlorofluorocarbons (CFCs), halons and other halocarbons, Class 2 ozone-depleting substances, including various hydrochlorofluorocarbons (HCFCs) and halocarbons, and other halocarbons, including fluorocarbons (FCs) and hydrofluorocarbons (CFCs). The most significant requirements for handling of ozone-depleting substances (ODS) and other Halocarbons, which include, for example, refrigerants used in refrigeration equipment and chillers, include the following:

- certification is required for all persons testing, repairing, filling or emptying equipment containing ODS and other halocarbons;

- the discharge of a Class 1 ODS or anything that contains a Class 1 ODS to the natural environment or within a building is prohibited;

- the making, use of, selling of or transferring of a Class 1 ODS is restricted to certain conditions;
the discharge of a solvent or sterilant that contains a Class 2 ODS is prohibited;

• the making, use of, selling of or transferring of a solvent or sterilant that contains a Class 2 ODS is restricted to certain conditions;

• fire extinguishing equipment that contains a halon may be discharged to fight fires, except fires for firefighting training purposes;

• portable fire extinguishing equipment that contains a halon may be used or stored if the extinguisher was sold for use for the first time before 1 January 1996;

• records of the servicing and repair of equipment containing ODS and other halocarbons must be prepared and maintained by the owner of the equipment; and

• equipment no longer containing ODS and other halocarbons must be posted with a notice completed by a certified person.

Ontario Regulation 347, General – Waste Management, has also been amended to provide for more strict control of CFCs. The requirements under the amended regulation apply primarily to the keeping of records for the receipt or recycling of CFC waste.

2.10 Mould

Moulds are forms of fungi that are found everywhere both indoors and outdoors all year round. Outdoors, moulds live in the soil, on plants and on dead and decaying matter. More than 1000 different kinds of indoor moulds have been found in buildings. Moulds spread and reproduce by making spores, which are all small and light-weight, able to travel through air, capable of resisting dry, adverse environmental conditions, and hence capable of surviving a long time. Moulds need moisture and nutrients to grow and their growth is stimulated by warm, damp and humid conditions.

Control of exposure to mould is required under Section 25(2)(h) of the Ontario Occupational Health and Safety Act, which states that employers shall take every precaution reasonable in the circumstances for the protection of workers. Recommended work practices are outlined in the following documents:


3 RESULTS AND DISCUSSION

3.1 Asbestos

During the course of our site investigation, representative bulk samples of material were collected by Arcadis staff. The samples were forwarded to EMSL Canada Inc. for asbestos analyses. The results of bulk sample analysis for asbestos content are provided in Table 3.1. The laboratory report is provided in Appendix B.

Table 3.1
Summary of Results of Analyses of Bulk Samples for Asbestos Content
Uptergrove Public School
March 12, 2019

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Sample Location</th>
<th>Sample Description</th>
<th>Asbestos Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Roof Area A</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>1A</td>
<td>Roof Area A</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>1B</td>
<td>Roof Area A</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>1B</td>
<td>Roof Area A</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>1C</td>
<td>Roof Area A</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>1C</td>
<td>Roof Area A</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2A</td>
<td>Roof Area C</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2A</td>
<td>Roof Area C</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2A</td>
<td>Roof Area C</td>
<td>Roofing materials – grey paper portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2B</td>
<td>Roof Area C</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2B</td>
<td>Roof Area C</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2C</td>
<td>Roof Area C</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2C</td>
<td>Roof Area C</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>2C</td>
<td>Roof Area C</td>
<td>Roofing materials – paper portion</td>
<td>None detected</td>
</tr>
<tr>
<td>3A</td>
<td>Roof Area D</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>3A</td>
<td>Roof Area D</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>3B</td>
<td>Roof Area D</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>3B</td>
<td>Roof Area D</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected</td>
</tr>
<tr>
<td>3C</td>
<td>Roof Area D</td>
<td>Roofing materials – tar portion</td>
<td>None detected</td>
</tr>
<tr>
<td>Sample No.</td>
<td>Sample Location</td>
<td>Sample Description</td>
<td>Asbestos Content</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3C</td>
<td>Roof Area D</td>
<td>Roofing materials – fibreboard portion</td>
<td>None detected (TEM)</td>
</tr>
<tr>
<td>4A</td>
<td>Roof Area D</td>
<td>Asphalt shingles</td>
<td>None detected</td>
</tr>
<tr>
<td>4B</td>
<td>Roof Area D</td>
<td>Asphalt shingles</td>
<td>None detected</td>
</tr>
<tr>
<td>4C</td>
<td>Roof Area D</td>
<td>Asphalt shingles</td>
<td>None detected (TEM)</td>
</tr>
<tr>
<td>5A</td>
<td>Roof Area D</td>
<td>Mortar – brick exterior walls</td>
<td>&lt;0.43% chrysotile (1)</td>
</tr>
<tr>
<td>5B</td>
<td>Roof Area D</td>
<td>Mortar – brick exterior walls</td>
<td>&lt;0.48% chrysotile (1)</td>
</tr>
<tr>
<td>5C</td>
<td>Roof Area D</td>
<td>Mortar – brick exterior walls</td>
<td>&lt;0.25% chrysotile (1) (400 PLM PtCt) &lt;0.51% chrysotile (1) (PLM Grav. Red.)</td>
</tr>
<tr>
<td>6A</td>
<td>Exterior</td>
<td>Mortar – brick exterior walls</td>
<td>None detected</td>
</tr>
<tr>
<td>6B</td>
<td>Exterior</td>
<td>Mortar – brick exterior walls</td>
<td>None detected</td>
</tr>
<tr>
<td>6C</td>
<td>Exterior</td>
<td>Mortar – brick exterior walls</td>
<td>None detected</td>
</tr>
<tr>
<td>7A</td>
<td>Exterior</td>
<td>Caulking (grey) – along window frames</td>
<td>None detected</td>
</tr>
<tr>
<td>7B</td>
<td>Exterior</td>
<td>Caulking (grey) – along window frames</td>
<td>None detected</td>
</tr>
<tr>
<td>7C</td>
<td>Exterior</td>
<td>Caulking (grey) – along window frames</td>
<td>None detected (TEM)</td>
</tr>
<tr>
<td>8A</td>
<td>Exterior</td>
<td>Caulking (light brown) – along fascia, ground level</td>
<td>&lt;1.0% chrysotile (1)</td>
</tr>
<tr>
<td>8B</td>
<td>Exterior</td>
<td>Caulking (light brown) – along fascia, ground level</td>
<td>&lt;1.0% chrysotile (1)</td>
</tr>
<tr>
<td>8C</td>
<td>Exterior</td>
<td>Caulking (light brown) – along fascia, ground level</td>
<td>&lt;0.25% chrysotile (1) (PLM Grav. Red.) &lt;0.1% chrysotile (1) (TEM)</td>
</tr>
<tr>
<td>9A</td>
<td>Roof Area D</td>
<td>Caulking (dark brown) – along fascia, Roof Area D</td>
<td>None detected</td>
</tr>
<tr>
<td>9B</td>
<td>Roof Area D</td>
<td>Caulking (dark brown) – along fascia, Roof Area D</td>
<td>None detected</td>
</tr>
<tr>
<td>9C</td>
<td>Roof Area D</td>
<td>Caulking (dark brown) – along fascia, Roof Area D</td>
<td>None detected (TEM)</td>
</tr>
<tr>
<td>10A</td>
<td>Roof Area D</td>
<td>Caulking (grey) – along fascia, Roof Area D</td>
<td>None detected</td>
</tr>
<tr>
<td>10B</td>
<td>Roof Area D</td>
<td>Caulking (grey) – along fascia, Roof Area D</td>
<td>None detected</td>
</tr>
<tr>
<td>10C</td>
<td>Roof Area D</td>
<td>Caulking (grey) – along fascia, Roof Area D</td>
<td>None detected (TEM)</td>
</tr>
<tr>
<td>10A-TC-</td>
<td>Exterior</td>
<td>Texture coat</td>
<td>1.0% chrysotile (2)</td>
</tr>
<tr>
<td>Soffit</td>
<td>soffit at Exit 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sample No. | Sample Location | Sample Description | Asbestos Content
---|---|---|---
6 | Soffit outside Room 114 | Texture coat | 1-5% chrysotile (2)

NOTES:

Bulk samples were analyzed by Polarized Light Microscopy (PLM) analysis, except where “TEM” is noted, in which case Transmission Electron Microscopy analysis was also performed.

(1) “Asbestos-containing material” is defined as material that contains 0.5% or more asbestos by dry weight.


Based on visual observations and results of laboratory analyses of samples collected by Arcadis, asbestos-containing material found to be present in the designated study areas was limited to texture spray applied to exterior soffits along the south and west wall of the original building and the exterior of the canopy at the main entrance.

Texture spray is a friable material. Removal of less than 1 m² of friable asbestos-containing materials is classified as a Type 2 enclosure operation as specified in O.Reg. 278/05. Removal of more than 1 m² of friable asbestos-containing materials is classified as a Type 3 operation.

If any materials which may contain asbestos and which were not tested during the course of the designated substances and hazardous materials survey are discovered during any construction activities, the work shall not proceed until such time as the required notifications have been made and an appropriate course of action is determined.

### 3.2 Lead

No samples of plaint were collected during the survey.

### 3.3 Mercury

No mercury-containing equipment was observed in the designated study areas. Only exterior building surfaces were included in this survey.

### 3.4 Silica

Materials observed in the designated study areas which should be considered to contain silica included concrete, cement block walls, brick, asphaltic roofing materials, texture spray, and mortar.

The Ministry of Labour Guideline, Silica on Construction Projects, April 2011, provides guidance in controlling exposure to silica dust during construction activities. In the guideline, silica-containing
construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of silica, as shown in Appendix C, Table C-3.

Additional precautionary measures should also be implemented for certain types of materials (e.g., concrete block, etc.). For minor disturbances such as drilling, a HEPA-filtered attachment should be used. For removal of more than a minor amount of material, enclosures should be constructed for dust control and separation of the work area from adjacent areas.

3.5 Vinyl Chloride

As mentioned in Section 2.5 above, vinyl chloride would only be a potential exposure concern in the event of combustion of PVC products.

3.6 Acrylonitrile

As mentioned in Section 2.6 above, acrylonitrile would only be a potential exposure concern in the event of combustion of ABS products.

3.7 Other Designated Substances

No other designated substances (benzene, isocyanates, arsenic, ethylene oxide and coke oven emissions) were observed to be present in the designated study areas, and none would be expected to be encountered in any building materials in a form that would represent an exposure concern. Arsenic may be present at low levels in paint applications. Ontario Regulation 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations for control of potential exposure to asbestos in texture spray, and the MOL Guideline, Silica on Construction Projects for control of potential exposure to silica in texture spray, cement block walls, brick, asphaltic roofing materials and mortar during construction activities will also serve to control potential exposure to any arsenic (or mercury) in paint on the metal facia panels.

3.8 Polychlorinated Biphenyls (PCBs)

No equipment potentially containing PCBs was identified in the designated study areas during the course of the site investigation. Only exterior building surfaces were included in this survey.

3.9 Ozone-Depleting Substances (ODS) and Other Halocarbons

Three HVAC units, potentially containing Ozone-Depleting Substances (ODS), were observed on the roof.

3.10 Mould

No readily evident mould was observed during the course of the site investigation.

The inspection of mould was limited to visual observations of readily-accessible surfaces and did not include intrusive inspections. During renovations, any mould-impacted materials uncovered/discovered should be
4 USE AND LIMITATIONS OF THIS PRE-RENOVATION DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY REPORT

This report, prepared for the Simcoe County District School Board, does not provide certification or warranty, expressed or implied, that the investigation conducted by Arcadis Canada Inc. identified all designated substances and hazardous materials (as defined in the Ontario Occupational Health and Safety Act) in the subject facility. The work undertaken by Arcadis Canada Inc. was directed to provide information on the presence of designated substances and hazardous building materials based on review of existing information, visual investigation in the designated study areas of the building, and on the results of laboratory analysis of a limited number of bulk samples of material for asbestos content. The survey did not include for identification of asbestos in process materials and equipment (including electrical equipment and wiring), nor material outside of the building (e.g. asphaltic pavement).

The material in this report reflects Arcadis Canada Inc.’s best judgment in light of the information available at the time of the investigation, which was performed on March 12, 2019.

This report is not intended to be used as a scope of work or technical specification for remediation of designated substances or hazardous materials.

This report was prepared by Arcadis Canada Inc. for the Simcoe County District School Board. Any use which any other party makes of the report, or reliance on, or decisions to be based on it, is the responsibility of such parties.
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PROJECT TITLE: UPTERGROVE
DRAWING TITLE: PUBLIC SCHOOL
DRAWN BY: A3
APPROVED BY: 14/12/2016
COMMISSIONED: UPTERGROVE
4833 MULEY POINT ROAD RR#7, ORILLIA, ON. L3V 6H7

ROOF PLAN

Public School

ROOF AREA SCHEDULE

<table>
<thead>
<tr>
<th>Mark</th>
<th>Area</th>
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<tbody>
<tr>
<td>A</td>
<td>1102 m²</td>
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<tr>
<td>A1</td>
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</tr>
<tr>
<td>B</td>
<td>294 m²</td>
</tr>
<tr>
<td>C</td>
<td>293 m²</td>
</tr>
<tr>
<td>D</td>
<td>144 m²</td>
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<tr>
<td>E</td>
<td>505 m²</td>
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<td>Total</td>
<td>2400 m²</td>
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NOTE: ROOF TOTAL AREA DOES NOT REPRESENT BUILDING GFA.
APPENDIX B

Laboratory Report
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**Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method**

<table>
<thead>
<tr>
<th>Client Sample ID</th>
<th>Sample Description</th>
<th>Lab Sample ID</th>
</tr>
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<tbody>
<tr>
<td>1A-Tar</td>
<td>Roof Area A/Roofing Materials</td>
<td>551903107-0001</td>
</tr>
<tr>
<td>1A-Fibreboard</td>
<td>Roof Area A/Roofing Materials</td>
<td>551903107-0001A</td>
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<tr>
<td>1B-Tar</td>
<td>Roof Area A/Roofing Materials</td>
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<td>Roof Area A/Roofing Materials</td>
<td>551903107-0002A</td>
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<tr>
<td>1C-Tar</td>
<td>Roof Area A/Roofing Materials</td>
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### 1A-Tar

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<thead>
<tr>
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<td>3/21/2019</td>
<td>PLM</td>
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### 1A-Fibreboard

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<td>90.0%</td>
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# Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

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Roof Area C/Roofing Materials

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Roof Area C/Roofing Materials

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## Client Sample ID: 2B-Tar
### Sample Description:
Roof Area C/Roofing Materials

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<tr>
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<th>Non-Asbestos Non-Fibrous</th>
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<th>Comment</th>
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## Client Sample ID: 2C-Tar
### Sample Description:
Roof Area C/Roofing Materials

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Roof Area C/Roofing Materials

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Roof Area C/Roofing Materials

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## Client Sample ID: 3A-Tar
### Sample Description:
Roof Area D/Roofing Materials

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## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

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</tr>
<tr>
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<tr>
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<td>Roof Area D/ Asphalt Shingles</td>
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<td>551903107-0011</td>
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<th>Non-Asbestos Non-Fibrous</th>
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### Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

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EMSL Canada Inc.
2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

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<tr>
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Test Report:EPAMultiTests-7.32.2.D Printed: 3/22/2019 03:23PM
# Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via
EPA600/R-93/116 Method

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<th>Fibrous</th>
<th>Non-Fibrous</th>
<th>Asbestos</th>
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**Analyst(s):**

Anne Balayboa  TEM Grav. Reduction (8)
Harman Sohi    PLM (23)
               400 PLM PtCt Grav. Red (1)
               PLM Grav. Reduction (18)

**Reviewed and approved by:**

Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0
TABLE C-1
SUMMARY OF CLASSIFICATION OF
TYPE 1, 2 AND 3 OPERATIONS
(Ont. Reg. 278/05)

**TYPE 1 OPERATIONS**

- removing less than 7.5 m$^2$ asbestos-containing ceiling tiles;
- removing non-friable asbestos-containing material other than ceiling tiles, if the material is removed without being broken, cut, drilled, abraded, ground, sanded or vibrated;
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the material is wetted and the work is done only using non-powered, hand-held tools; and
- removing less than 1 m$^2$ of drywall in which asbestos-containing joint compounds have been used.

**TYPE 2 OPERATIONS**

- removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling;
- removal of one square metre or less of friable asbestos-containing material;
- enclosing friable asbestos-containing material;
- applying tape or a sealant or other covering to asbestos-containing pipe or boiler insulation;
- removing 7.5 m$^2$ or more asbestos-containing ceiling tiles (if removed without being broken, cut, drilled, abraded, ground, sanded or vibrated);
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the material is not wetted and the work is done using power tools that are attached to dust-collecting devices equipped with HEPA filters;
- cleaning or removing filters used in air-handling equipment in a building that has asbestos-containing sprayed fireproofing.
### TABLE C-1 (Continued)
**SUMMARY OF CLASSIFICATION OF TYPE 1, 2 AND 3 OPERATIONS**
*(Ont. Reg. 278/05)*

**TYPE 3 OPERATIONS**

- removal of more than one square metre of friable asbestos-containing material;
- spray application of a sealant to friable asbestos-containing material;
- cleaning or removing air-handling equipment, including rigid ducting but not including filters, in a building that has sprayed asbestos-containing fireproofing;
- repairing or demolishing a kiln, metallurgical furnace or similar structure that is made in part of asbestos-containing refractory materials;
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing materials, if the work is done using power tools that are not attached to dust-collecting devices equipped with HEPA filters.
TABLE C-2
SUMMARY OF CLASSIFICATION OF
LEAD-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE – LEAD ON CONSTRUCTION PROJECTS, APRIL 2011

<table>
<thead>
<tr>
<th>Type 1 Operations</th>
<th>Type 2 Operations</th>
<th>Type 3 Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 2a</td>
<td>Type 2b</td>
</tr>
<tr>
<td></td>
<td>&gt;0.05 to 0.50 mg/m^3</td>
<td>&gt;0.50 to 1.25 mg/m^3</td>
</tr>
<tr>
<td>&lt;0.05 mg/m^3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The classification of Type 1, 2 and 3 operations is based on presumed airborne concentrations of lead, as shown above.

**TYPE 1 OPERATIONS**

- application of lead-containing coatings with a brush or roller;
- removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap;
- removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter;
- installation or removal of lead-containing sheet metal;
- installation or removal of lead-containing packing, babbit or similar material;
- removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding;
- soldering.

**TYPE 2 OPERATIONS**

**Type 2a Operations**

- welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise it will be considered a Type 3a operation;
- removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools;
- manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.

**Type 2b Operations**

- spray application of lead-containing coatings.
TABLE C-2 (Continued)
SUMMARY OF CLASSIFICATION OF
LEAD-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE – LEAD ON CONSTRUCTION PROJECTS, APRIL 2011

TYPE 3 OPERATIONS

Type 3a Operations

- welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space;
- burning of a surface containing lead;
- dry removal of lead-containing mortar using an electric or pneumatic cutting device;
- removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter;
- removal or repair of a ventilation system used for controlling lead exposure;
- demolition or cleanup of a facility where lead-containing products were manufactured;
- an operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation

Type 3b Operations

- abrasive blasting of lead-containing coatings or materials;
- removal of lead-containing dust using an air mist extraction system.
TABLE C-3
SUMMARY OF CLASSIFICATION OF SILICA-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE, SILICA ON CONSTRUCTION PROJECTS, APRIL 2011

<table>
<thead>
<tr>
<th></th>
<th>Type 1 Operations</th>
<th>Type 2 Operations</th>
<th>Type 3 Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cristobalite and Tridymite</td>
<td>&gt;0.05 to 0.50 mg/m³</td>
<td>&gt;0.50 to 2.50 mg/m³</td>
<td>&gt;2.5 mg/m³</td>
</tr>
<tr>
<td>Quartz and Tripoli</td>
<td>&gt;0.10 to 1.0 mg/m³</td>
<td>&gt;1.0 to 5.0 mg/m³</td>
<td>&gt;5.0 mg/m³</td>
</tr>
</tbody>
</table>

Note: The classification of silica-containing construction tasks is based on presumed concentrations of respirable crystalline silica, as shown above.

**TYPE 1 OPERATIONS**

- The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction.
- Milling of asphalt from concrete highway pavement.
- Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica).
- Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
- Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
- Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.

**TYPE 2 OPERATIONS**

- Removal of silica containing refractory materials with a jackhammer.
- The drilling of holes in concrete or rock that is part of a tunnelling or road construction.
- The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
- The use of a power tool to remove silica containing materials.
- Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation).
- Tuckpoint and surface grinding.
- Dry mortar removal with an electric or pneumatic cutting device.
- Dry method dust cleanup from abrasive blasting operations.
- The use of compressed air outdoors for removing silica dust.
- Entry into area where abrasive blasting is being carried out for more than 15 minutes.
TABLE C-3 (Continued)
SUMMARY OF CLASSIFICATION OF SILICA-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE, SILICA ON CONSTRUCTION PROJECTS, APRIL 2011

**TYPE 3 OPERATIONS**

- Abrasive blasting with an abrasive that contains ≥ 1 per cent silica.
- Abrasive blasting of a material that contains ≥ 1 per cent silica.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1 Section 06 10 00 - Rough Carpentry.

2 Structural drawings and specifications to be issued in an Addendum, under separate cover.

1.2 REFERENCES

1 ASTM International

1.1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.


1.3 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

2 CSA International

2.1 CSA G40.20-13//G40.21-2013(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel. Includes Update No. 1 (2014).

2.2 CAN/CSA G164-2018, Hot Dip Galvanizing of Irregularly Shaped Articles.

2.3 CSA S16-14, Design of Steel Structures.

2.4 CSA W48-2018, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

2.5 CSA W59-2018, Welded Steel Construction.

2.6 Environmental Choice Program

2.1 CCD-047-98(R2005), Architectural Surface Coatings.

2.2 CCD-048-98(R2006), Surface Coatings - Recycled Water-borne.

2.7 Green Seal Environmental Standards (GS)


2.8 Health Canada / Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).


1.3 ACTION AND INFORMATIONAL SUBMITTALS

1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
1.3 ACTION AND INFORMATIONAL SUBMITTALS

Product Data:
1. Submit manufacturer's instructions, printed product literature and data sheets for sections plates pipe tubing bolts and include product characteristics, performance criteria, physical size, finish and limitations.
2. Submit two copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements. For finishes, coatings, primers and paints applied on site: indicate VOC concentration in g/L.

3. Shop Drawings:
1. Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
2. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

1. Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

2. Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

3. Welder's Certificate: submit to Section 01 33 00 - Submittal Procedures requirements, certifying welders employed on the Work, verifying qualification within the previous 12 months to CSA-W47.1 and CSA-W55.3.


5. Prepare shop drawings under the direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.

1.5 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

3. Storage and Handling Requirements:
1. Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
1.5 DELIVERY, STORAGE AND HANDLING

   (Cont'd)

   .2 Replace defective or damaged materials with new.

   .3 Protection:

   .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

   .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.6 COORDINATION WITH OTHER TRADES

   .1 Coordinate work with that of other trades. Manufacture and deliver to site all materials to be built into structures with sufficient time and accurate instructions for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

   .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

   .2 Steel pipe: to ASTM A53/A53M standard weight, black finish.

   .3 Welding materials: to CSA W59.

   .4 Welding electrodes: to CSA W48 Series.

   .5 Bolts and anchor bolts: to ASTM A307, Grade A.

   .6 Aluminum sheet: proprietary utility sheet.

   .7 Stainless steel tubing: to ASTM A269, Type 304, No 1. 4 finish commercial grade.

   .8 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours, pull out strength 7.9 MPa.

   .9 Hollow structural sections: to CAN3-G40.21, Grade 350W, Class H.

2.2 FABRICATION

   .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

   .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

   .3 Where possible, fit and shop assemble work, ready for erection.
2.2 FABRICATION
(Cont’d)

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush and hairline. Ease exposed edges to small uniform radius.

.6 Exposed mechanical fastenings: flush countersunk screws or bolts unobtrusively located, consistent with design of component, except where specifically noted otherwise.

.7 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

.1 Galvanizing (exterior use): hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: MPI- INT EXT 5.1A, MPI- INT EXT 5.1B in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a, CCD-048 GS-11.

.4 Zinc primer: zinc rich, ready mix to MPI-INT EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits.

.5 Prepare surfaces to be primed in accordance with SPCC-SP-3.

.6 Do not prime surfaces in direct contact with concrete, where field welding is required or where spray-applied fire-proofing is to be installed.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum.
2.5 SHOP PAINTING

(Cont'd)

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.6 PIPE RAILINGS

.1 Steel pipe: 38 mm x 38 mm square nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize exterior pipe railings after fabrication. Shop coat prime interior railings after fabrication.

2.7 ACCESS LADDERS

.1 Stringers: 127 mm x 6.7 mm thick steel c-channel.

.2 Steel rungs: 120 mm x 38 mm thick grip span or shurgrip treads, welded to stringers at height indicated on drawings. (Note: maximum 300 mm on centre.)

.3 Brackets: sizes and shapes as indicated on drawings complete with fixing anchors.

.4 Galvanize finish for exterior.

.5 Galvanize exterior ladders after fabrication.

2.8 CHANNEL FRAMES

.1 Fabricate frames from steel, sizes of channel and opening as indicated.

.2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.

.3 Finish: prime coat and painted.

.4 Refer to STRUCTURAL drawings and specifications.
PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer’s written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16 or Weld field connection.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of primer: maximum VOC limit 250 g/L.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding. Primer: maximum VOC limit 250 g/L.

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.
3.4 ACCESS LADDERS  
.1 Install access ladders in locations as indicated.
.2 Erect ladders 200 mm clear of wall on bracket supports.

3.5 CHANNEL FRAMES  
.1 Install steel channel frames to openings as indicated on STRUCTURAL drawings and specifications.

3.6 CLEANING  
.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION  
.1 Protect installed products and components from damage during construction.
.2 Repair damage to adjacent materials caused by metal fabrications installation.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS


1.2 REFERENCES

ASTM International
- ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

CSA International
- CSA O121-17, Douglas Fir Plywood.
- CSA O141-05(R2014), Softwood Lumber.
- CSA O151-17, Canadian Softwood Plywood.
- CSA O153-13, Poplar Plywood.
- CSA O325-16, Construction Sheathing.
- CAN/CSA-Z809-16, Sustainable Forest Management.


South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

Sustainable Forestry Initiative (SFI) - SFI-2010-2014 Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

Submit in accordance with Section 01 33 00 - Submittal Procedures.
1.4 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Protect materials from warping or other distortion by stacking in vertical position.

PART 2 - PRODUCTS

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 S2S is acceptable for non-visible elements.

.2 Board sizes: "standard" or better grade.

.3 Dimension sizes: "standard" light framing or better grade.

.4 Post and timbers sizes: "standard" or better grade.

2.2 PANEL MATERIALS

.1 Douglas fir plywood: to CSA O121, standard construction.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.3 Poplar Plywood: to CSA O153, standard construction.

.4 Plywood, OSB and wood based composite panels: to CSA O325.

2.3 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.
2.3 ACCESSORIES (Cont'd)  

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers to ASTM A307.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.4 FINISHES  

.1 Galvanizing: to ASTM A123/A123M and ASTM A653/A653M, use galvanized fasteners for exterior work and interior highly humid areas.

.2 Stainless steel: use stainless steel for speciality items where shown on drawings.

PART 3 - EXECUTION

3.1 PREPARATION  

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as follows:
  .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
  .2 Wood furring on outside surface of exterior masonry and concrete walls.

3.2 INSTALLATION  

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
3.2 INSTALLATION (Cont'd) .4 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized or steel fasteners as dictated by their location.

.5 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 ERECTION .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 27 00 - Air Barriers.

.2 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Membrane Roofing.

.3 Section 07 92 - Joint Sealants.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1.1 ASTM C208-12(2017)e1, Specification for Cellulosic Fiber Insulating Board.


.1.3 ASTM C612-14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.1.4 ASTM C726-17, Standard Specification for Mineral Fiber Roof Insulation Board.

.1.5 ASTM C728-17a, Standard Specification for Perlite Thermal Insulation Board.

.1.6 ASTM C1126-18, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.


.2 Canadian Gas Association (CGA)


.2.2 CAN/CGA-B149.2-15, Propane Storage and Handling Code.

.3 Underwriters’ Laboratories of Canada (ULC)

.3.1 CAN/ULC-S701.1:2017, Standard for Thermal Insulation Polystyrene Boards.

.3.2 CAN/ULC-S702-14, Standard for Mineral Fibre Thermal Insulation for Buildings.

.3.3 CAN/ULC-S704.1:2017, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).

.5 CGSB

.5.1 CGSB-71-GP-24M, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
   .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
   .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Convene pre-installation meeting one week prior to beginning work of this Section.
   .1 Verify project requirements.
   .2 Review installation and substrate conditions.
   .3 Co-ordinate with other building subtrades.
   .4 Review manufacturer's installation instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 INSULATION

.1 Extruded polystyrene foam insulation: to CAN/ULC-S701.1.
   .1 Type: 2.
   .2 Compressive strength: 16 psi.
   .3 Thickness: as indicated on drawings.
   .4 Size: 1220 mm x 2440 mm.
   .5 Edges: shiplapped.

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24M.
   .1 Product suitable to manufacturer's recommendations.
   .2 Ensure compatibility between insulation and adhesive.

2.3 ACCESSORIES

.1 As recommended by product manufacturer suited to this application.
PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 RIGID INSULATION INSTALLATION

.1 Apply approved adhesive to polystyrene in accordance with manufacturer's recommendations.

.2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
3.4 RIGID INSULATION INSTALLATION (Cont'd)

.3 In addition to adhesive, install mineral fibre insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, cut off fastener spindle 3 mm beyond disk.

.4 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.5 CLEANING 1

Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 42 43 - Composite Wall Panels.

.3 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Membrane Roofing.

.4 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES


.2 American Society for Testing and Inspection (ASTM)

.3 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
   .1 Submit manufacturer's printed product literature, specifications and data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
   .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
1.3 ACTION AND INFORMATIONAL SUBMITTALS

(Cont'd) Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control. Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

2. Deliver, store and handle materials in accordance with manufacturer's written instructions.

3. Avoid spillage: immediately notify Consultant if spillage occurs and start clean up procedures.

4. Clean spills and leave area as it was prior to spill.

1.5 AMBIENT CONDITIONS

1. Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

2. Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

3. Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.6 SEQUENCING

1. Sequence work in accordance with project schedule.

2. Sequence work to permit installation of materials in conjunction with related materials and seals.

1.7 WARRANTY

1. Provide three year warranty in accordance with General Conditions (GC) CCDC 2 GC 12.3.

2. Warranty: include coverage of installed sealant and sheet materials which:
   .1 Fail to achieve air tight and watertight seal.
   .2 Exhibit loss of adhesion or cohesion.
   .3 Does not cure.
PART 2 - PRODUCTS

2.1 MATERIALS

.1 Products: as manufactured by the Henry Bakor Company.
  .1  Self adhesive air / vapour barrier membrane - Blueskin SA and Blueskin T, 1.0 mm thickness.
  .2  Flashing system: Blueskin to be used at parapats, behind new metal panels (fascia) and soffits.
  .3  Through-wall flashing: Blueskin TWF, 1.0 mm thickness.
  .4  Air barrier sealant: to meet manufacturer's approval, ASTM E2357 (high performance caulk) and to be compatible with wood, aluminum, glass, steel and PVC materials. Acceptable product: Henry #925 BES Sealant, Polybitume, AirBloc21 or AirBloc 21FR.
  .5  Primers as recommended by manufacturer.

.2 Ensure new roofing vapour barrier is compatible with air barrier specified above. Where NOT compatible, provide transition flashings as required. Submit to Consultant for approval.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 GENERAL

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Consultant in writing.

.4 Do not start work until deficiencies have been corrected. Beginning of Work implies acceptance of conditions.
3.4 PREPARATION  
.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.5 INSTALLATION  
.1 Install materials in accordance with manufacturer's instructions.

.2 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.3 Ensure adequate lapping of roofing vapour barrier and membrane at applicable locations, in accordance with manufacturer's instructions.

3.6 CLEANING  
.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PROTECTION OF WORK  
.1 Protect finished work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13 - Board Insulation.

.2 Section 07 27 00 - Air Barriers.

.3 Section 07 46 13 - Preformed Metal Siding.

.4 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Membrane Roofing.

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

1.2 REFERENCES

.1 Aluminum Association (AA)

.2 American Society for Testing and Materials International (ASTM)
   .5 ASTM E283-04(2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.

.3 Green Seal Environmental Standards
   .1 Standard GC-03-93, Anti-Corrosive Paints.
   .2 Standard GS-11-97, Architectural Paints.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).

.5 South Coast Air Quality Management District (SCAQMD), California
   .1 SCAQMD Rule 1168-17, Adhesives and Sealants Applications.
1.3 DESIGN REQUIREMENTS

.1 Design metal cladding to allow for thermal movement of component materials caused by variation in ambient temperature range of 80 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Maximum deviation from vertical and horizontal alignment of erected panels: 1 to 1000.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
   .1 Submit manufacturer's printed product literature for cladding system materials, specifications and data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
   .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Shop Drawings:
   .1 Shop drawings: submit drawings in accordance with Section 01 33 00 - Submittal Procedures.
   .2 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints and gaskets, thermal movement provision, materials and finish, compliance with design criteria and requirements of related work.

.4 Samples: submit duplicate 100 x 100 mm samples of wall (fascia) and soffit system, representative of materials, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control. Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALIFICATIONS

.1 Manufacturer: company specializing in producing composite wall panels with five years documented experience with sufficient capacity to produce and deliver required units without causing delay in work.

.2 Installer: person specializing in composite wall panel installations with five years documented experience approved by manufacturer.

.3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 - Quality Control and to requirements supplemented as follows:
1.5 QUALIFICATIONS

(Cont’d)

.1 Provide mock-up for evaluation of surface finishes and workmanship.
.2 Provide initial production units for job-site assembly with other materials for review approval.
.3 Co-ordinate type and location of mock-ups with project requirements.
.4 Accepted units will be used as standard for acceptance of production units.
.5 Remove and replace units which are not accepted.
.6 Do not proceed with remaining work until workmanship, colour, and finish are reviewed and accepted by Consultant.
.7 Refinish mock-up area as required to produce acceptable work.
.8 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

(Cont’d)

.1 Approved mock-up may remain as part of finished work if deemed acceptable by Consultant.
.2 Remove mock-up and dispose of materials when no longer required and when directed by Consultant.

.4 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section with contractor's representative and Consultant in accordance project schedule to:

.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and protect material in accordance with panel manufacturer's recommendations.

.3 Do not expose panels with strippable film to direct sunlight or extreme heat.

1.7 WARRANTY

.1 Panel Finish Warranty: furnish panel manufacturer's written warranty covering failure of factory-applied exterior finish on composite metal panels within 20 years after the date of substantial completion. Warrant finish for chalk not in excess of 8 NBS units when tested in accordance with ASTM D 4214.
1.7 WARRANTY
(Cont'd)

Wall System Warranty: furnish fabricator / installer's warranty against defects or deficiencies for a period of one year from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Acceptable manufacturer: Sobotec Ltd., 67 Burford Road, Hamilton, Ontario, phone 905 578 1278, fax 905 578 1446, contact sales@sobotec.com.

Approved alternate is Kanalco Ltd., 345 Lake Road, Bowmanville, On, phone 1 800 268-8139, fax 1 888 779-9914.

Requests for substitutions will NOT be considered.

2.2 WALL PANEL SYSTEM

Wall panel system: Sobotec Dry Joint Filler Snap-In Reveal System SL-2000P with 13.0 mm wide reveal joints using proprietary aluminum.

System characteristics: design, fabricate and erect pressure equalized wall panel system the comply with the following requirements.

Panel removal: design system to allow removal of individual panels within wall system. For replacement purpose only.

Water penetration: prevent rain penetration throughwall system, design system based on "Rain Screen Principle", incorporate means of draining water to the exterior.

Wind resistance: design wall system to resist wind loads, positive and negative, expected in this geographical region without causing rattling, vibration or excessive deflection of panels, overstressing of fasteners, clips, and other detrimental effects on the system.

Structural and thermal movement: accommodate movement of supporting structural framing and movement caused by thermal expansion and contraction of system component parts without causing blowing, buckling, delamination, oil canning, failure of joint seals, excessive stress on fasteners of any other detrimental effects.

Fabrication:

Flatness tolerance: panel surfaces free from warp or buckle with no rises and falls across the panel (local bumps and depressions) and maximum 1.6 mm bow or warp in concave or convex direction, measured perpendicular to normal plane.

Panel lines, breaks and angles: sharp and true.
2.2 WALL PANEL SYSTEM (Cont'd)

Erection tolerance: maximum of 6 mm in 6 m deviation from vertical and horizontal alignment of erected panels.

System performance: provide wall panel system with the following tested performance.

1. Air leakage: not more than 0.006 L/s / m² of wall area when tested at 0.075 kPa in accordance with ASTM E 283.
2. Water penetration: no water infiltration under static pressure when tested in accordance with ASTM E 331 at differential of 10% of inward acting design load, 0.299 kPa minimum, after 15 minutes.

Water penetration is defined as the appearance of uncontrolled water in the wall.

Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.

Structural: provide system that has been tested in accordance with ASTM E330, with appropriate design pressure, and has been certified to be without permanent deformation or failure of structural members.

2.3 MATERIALS

Wall panels: aluminum composite material (ACM) consisting of two aluminum face sheets and core of extruded thermoplastic formed in continuous process without use of glues or adhesives between dissimilar materials.

2. Face sheets: aluminum alloy 3003, 0.51 mm thick.
3. Bond integrity: no failure of bond between core and faces and no cohesive failure of core when tested in accordance with ASTM D 1781 at minimum of 115 N mm/mm.
4. Panel thickness: 4 mm.
5. Panel weight: 7.62 kg/m².
6. Panel flatness: maximum bow of 0.8% of panel dimension (width or length).
7. Finish: Clear Anodized Aluminium #17, AA-M10C21A31 Architectural Class II (0.4 mils min.)

Fittings for attaching panels to sub-structure: proprietary, custom made aluminum extrusions and clips in fabricator's standard profiles as required for complete installation, provide continuous extrusions full length around panel perimeter for panel reinforcement and alignment. Intermittent clips not acceptable.

Fasteners: as recommended by panel manufacturer, concealed and non-corrosive.

Air / vapour barrier: refer to Section 07 27 00 - Air Barriers.
PART 3 - EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 EXAMINATION .1 Before installation examine alignment of substrate and notify Consultant in writing if substrate does not comply with requirements of panel installer.

3.3 INSTALLATION .1 Install composite panels in accordance with manufacturer's written instructions and shop drawings. Allow for thermal movement.

.2 Maintain following installation tolerances:
.1 Maximum variation from plane or location shown on shop drawings: 10 mm/10 m of length and up to 20 mm/100 m.
.2 Maximum deviation for vertical member: 3 mm in an 8.5 m run.
.3 Maximum deviation for a horizontal member: 3 mm in an 8.5 m run
.4 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

.3 Remove strippable coating from panels as they are erected.

3.4 CLEANING .1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13 - Board Insulation.

.2 Section 07 27 00 - Air Barriers.

.3 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Membrane Roofing.

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

.5 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
   .1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 ASTM International
   .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   .3 ASTM D2369-10(2015)e1, Test Method for Volatile Content of Coatings.
   .4 ASTM D2244-16, Standard Practice for Calculations of Color Tolerances and Color Differences From Instrumentally Measured Color Coordinates.
   .6 ASTM D 5116-17, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 CSA International
   .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
   .2 CSA S136-16, For the Design of Cold Formed Steel Structure Members.

.4 Environmental Choice Program (ECP)
   .1 CCD-045-95, Sealants and Caulking Compounds.

.5 Green Seal Environmental Standards (GS)
   .1 GS-36-11, Standard for Commercial Adhesives.
1.2 REFERENCES (Cont'd) .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI, Source Specific Standards .1 SCAQMD Rule 1168-17, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit manufacturer's instructions, printed product literature and data sheets for metal siding and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings: indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, metal furring, and related work.

.4 Samples: submit duplicate 300 mm x 300 mm samples of siding material, of colour and profile specified.

1.4 QUALITY ASSURANCE .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Manufacturer of wall cladding and installer shall demonstrate at least five years experience in projects similar in scope.

.3 This Section establishes the standard of quality required for the complete metal wall cladding system. Proposed substitutions must meet this standard, and will be considered as follows: .1 A written request for approval of a substitution is received at least ten days prior to Tender Closing. .2 The request includes a complete item-by-item description comparing the proposed substitution to the specified system, together with manufacturer's literature, samples, test data, engineering standards and performance evaluation indicating comparable standards to those specified.

1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)  .3

Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 MAINTENANCE DATA  .1

Provide maintenance data for cleaning and maintenance of panel finishes for incorporation into project manuals.

1.7 GUARANTEE AND WARRANTY  .1

For work in this Section, warranty by installer against defects or deficiencies in materials or workmanship shall be for a period of one year from date of substantial completion.

.2 Provide a manufacturer's written warranty covering failure of factory-applied exterior finish within the warranty period.

.3 Warrant that the Product will not chip, crack, peel or otherwise lose adhesion for a period of 40 years following the original date of purchase of the Product. Also warrant to the Owner that when the Product is used within Canada under normal conditions, in both vertical and non-vertical applications, that for a period of 30 years from installation or 30.5 years following the original date of purchase of the Product, the degree of colour fade and surface chalk of the Product shall be in accordance with the Performance Criteria (as described below).

1.8 PERFORMANCE CRITERIA  .1

All WeatherX Colours, Sidewall Panels (for 30 years from installation or 30.5 years from the date of purchase):

.1 Will not chalk in excess of #8 rating as determined by ASTM D4214, Method D659.

.2 Will not change colour more than 5 Hunter \AE units as determined by ASTM Method D2244. Colour change shall be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed painted surface. It is understood that fading or colour changes may not be uniform if the surfaces are not equally exposed to the sun and elements.
PART 2 - PRODUCTS

2.1 MANUFACTURER .1 Acceptable manufacturer: VicWest.

2.2 METAL CLADDING .1 Sub-girts: minimum 1.21 mm thick formed galvanized steel, ASTM A653/A653M, Grade 230 with Z275 zinc coating. Full depth of wall cladding system, factory notched and formed.

.2 Insulation: refer to Section 07 21 13 - Board Insulation.

.3 Steel cladding:
   .1 Profile: 7/8" Corrugated.
   .2 Fabricated from Z275 galvanized sheet steel conforming to A653/A653M, Grade 230, having a nominal core thickness of 0.76 mm (22 gauge).

.4 Fasteners: exposed in accordance with manufacturer's recommendations.

.5 Panel finishes: cladding coating to be prepainted with WeatherX Coating, Siliconized Polyester - SMP.

.6 Colour: prefinished cladding colour to be 56072 CHARCOAL WeatherX Coating on exterior exposed surface of the finished profile, selected from manufacturer's STANDARD colour range.

2.3 ACCESSORIES .1 Flashing: in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim. Materials to match cladding in exposed locations, galvanized material in concealed locations. Custom fabricated to suit architectural details, as required. Use preformed corner pieces only. Double back exposed edges.

.2 Closures: metal closures to suit profiles selected, to manufacturer's recommendations.

.3 Sealants: refer to Section 07 92 00 - Joint Sealants.
   .1 Concealed: tape or compound, non-skinning, non-drying, butyl rubber.
   .2 Exposed acrylic co-polymer or one part silicone.
PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install cladding in accordance with manufacturer's written instructions.

.2 Install continuous starter strips, inside and outside corners, edgings, drip and cap, as indicated.

.3 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.4 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.5 Attach components in manner not restricting thermal movement.

.6 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by preformed metal siding installation.
1 GENERAL

1.1 SECTION INCLUDES

.1 Modified bituminous membrane roofing, hot applied method.
.2 Refer to SCDSB Hot Work Procedures (attached, 6 pages) at the end of this Section. These procedures are required for this project.

1.2 RELATED SECTIONS

.1 Mechanical and Electrical Drawings and Specifications
.2 Structural Drawings and Specifications
.3 Section 06 10 00 – Rough Carpentry
.4 Section 07 62 00 – Sheet Metal Flashing and Trim
.5 Section 07 92 00 – Joint Sealants

1.3 REFERENCES

General: The most recent adopted versions of the following references apply to the Work of this Section.


.2 Canadian Roofing Contractors Association (CRCA)

.3 Canadian Standards Association (CSA International)
   .2 CSA 0151-M: Canadian Softwood Plywood
   .3 CAN/CSA 0141-05 (R2014): Softwood Lumber

.4 Health Canada/ Workplace Hazardous Materials Information System (WHMIS)
   .1 Material Safety Data Sheets (SDS)

.5 Underwriters Laboratories of Canada (ULC)
   .2 CAN/ULC-S706-09: Standard for Wood Fibre Thermal Insulation for Buildings.
1.4 PERFORMANCE REQUIREMENTS

.1 Roof Type 1: Work Area #1 (Rapidex Roof Deck): Roofing System: Two-ply hot applied modified bituminous membrane roofing system with smooth base sheet membrane and granulated cap sheet set in rubberized asphalt adhesive, overlay board, tapered insulation, rigid board insulation and vapour barrier.

   NOTE: Refer to drawings for extent and locations of Rapidex roof deck. Do not impose any loads on these roof areas. Exercise extreme caution while working on these roof areas and all parties are to be informed of weight restrictions. **New roof system is not to exceed design weight of 7.8 lbs/sq.ft.**

.2 Roof Type 2: Work Area #2 (Steel Roof Deck): Roofing System: Two-ply hot applied modified bituminous membrane roofing system with smooth base sheet membrane and granulated cap sheet set in rubberized asphalt adhesive, overlay board, tapered insulation, rigid board insulation, vapour barrier and thermal barrier overlay board.

.4 Provide Products that are compatible with one another under field conditions, as demonstrated by roofing manufacturer.

.5 Provide watertight roofing system capable of resisting specified wind uplift pressures for corner and field criteria (for project location), thermally induced movement and exposure to weather without failing during the specified warranty period.

1.5 SUBMITTALS

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

.2 Product Data: for each major component, including membrane, thermal barrier underlay board, vapour retarder, rigid board insulation, tapered insulation, fasteners, pavers, and adhesives. Highlight critical criteria for proper installation.

.3 Submit Shop Drawings for prefabricated work and details as specified in Section 01 33 00 – Submittal Procedures.

.4 Shop Drawings: Include plans, sections, details in accordance with performance requirements, and for attachment to other portions of the Work. Include roof paver layout.

.5 Shop Drawings for Sloped Insulation: Indicate degree of slope and layout of sloping insulation on roof surfaces. Ensure positive drainage to roof drains.

1.6 REPORTS

.1 Manufacturer Field Inspection Reports: manufacturer's written acceptance of roofing installation based on regular inspections.
1.7 QUALITY ASSURANCE

.1 Manufacturer: qualified manufacturer having roofing systems listed by UL and approved for use by Factory Mutual.

.2 Installer: a company and persons specializing in the application of cold-applied roofing, with minimum 5 years documented experience licensed or approved to apply roofing system by manufacturer. In addition, the roofing subcontractor must be on the Owner’s prequalified roofing subcontractor list supplied in the Instructions To Bidders.

.3 Conform to CRCA Roofing Specifications and roofing membrane manufacturer's instructions.

1.8 PRE-INSTALLATION MEETINGS

.1 Conduct pre-installation meeting with Consultant and Owner one week prior to work commencing.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store Products undamaged in original containers with manufacturer's labels and seals intact.

.2 Store Products in designated areas elevated off the ground and protected from ultra-violet radiation, inclement weather and construction activities.

.3 Store solvent-based liquids away from excessive heat and open flame.

.4 Store adhesives and sealants at temperature above 5 degrees Celsius.

.5 Store membrane rolls on end, dry, and protected from moisture and damage. Cover rolls, insulation and other moisture-sensitive Products with tarpaulins.

.6 Store Products on roof deck in a manner to prevent overloading the structure and properly secured to prevent movement due to wind or other forces. Prevent permanent deformation of deck.

1.10 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply any roofing materials during inclement weather.

.2 Comply with manufacturer's recommendations for minimum and maximum temperatures and humidity during application.

.3 Do not install Products when temperatures are below -18 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 the General Conditions of the Contract.

.2 Installer’s Extended Warranty: standard OIRCA 2-year warranty, commencing from the date of Substantial Performance of the Work.

.3 Manufacturer’s Extended Warranty: a written guarantee that the manufacturer will replace, at no cost to the Owner, any portion of the roofing membrane which experiences actual leaks resulting from defects in the manufacture of the membrane for a period of 20 years, commencing from the date of Substantial Performance of the Work.

1.12 APPROVED APPLICATORS

.1 Refer to SCDSB Instructions To Bidders for Prequalified Roofing Contractors.

1.13 FIRE PROTECTION

.1 Prior to the start of work conduct a site inspection to ensure the site’s safety in order to minimize fire risks and hazards.

.2 Respect safety measures recommended by related local authorities.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Manufacturers of hot-applied modified bitumen and built-up asphalt roofing systems having products considered acceptable for use: Tremco, Garland, Siplast

2.2 MATERIALS

.1 Primer: non-fibrated, asbestos free, water-based, low-VOC formulation; meets the following requirements:

   .1 Asbestos Content, EPA 600/R13/116: None.
   .2 Non-Volatile Content, minimum, ASTM D 2823: 30 percent.
   .3 Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 2 g/L.

.2 Thermal Barrier Underlay Board: (Work Area 2 Steel Deck) 13 mm thick glass mat faced gypsum panel with water-resistant core, and meeting the following criteria:

   .1 Combustibility: Noncombustible to ASTM E136.
   .2 Surface Burning Characteristics: to ASTM E84, maximum flame spread of 0, smoke developed of 0.
   .3 Manufacturer and Product Name: Dens-Deck by G-P Gypsum.
.3 Roof Vapour Retarder: 2 Plies NO. 15 asphalt saturated perforated, organic felts to CSA-A123.3M. adhered in Type III Asphalt.

.4 Roof Insulation: Polyisocyanurate rigid board; to CAN/ULC-S704, Type 3, Class 2, closed cell type:
  .1 Compressive Strength (ASTM D1621): 140 kPa.
  .2 Dimensional Stability (ASTM D2126): < 2 percent linear change.
  .3 Water Absorption (ASTM C209): < 1 percent by volume.
  .4 Edges: square.
  .5 Faces: non-asphaltic, fibre-reinforced felt facers both sides.
  .6 Combustibility: meets CAN/ULC-S107 and CAN/ULC-S126
  .7 Thickness: 102mm + 64mm as detailed on architectural drawings.

.5 Overlay Board: 12 mm thick asphalt-coated fibreboard, to CAN/ULC-S706, Type I, Grade 1.

.6 Tapered Insulation: Polyisocyanurate rigid board; to CAN/ULC-S704, Type 3, Class 2, closed cell type: As manufactured by Posi-Slope or Accuplane, as indicated on Drawings.

.7 Modified Bitumen Base Sheet and Base Flashing Membrane: 2.2 mm thick polyester reinforced asphalt-coated sheet to ASTM D6164, Type I, Grade S; Meeting the following requirements:
  .1 Tensile Strength, minimum, ASTM D 5147: machine direction, 18 kN/m; cross machine direction, 13 kN/m;
  .2 Elongation, ASTM D 5147: machine direction, 60%; cross machine direction, 70%.
  .3 Low Temp. Flex, ASTM D 5147, -20C.

.8 Modified Bitumen Cap Sheet and Cap Flashing Membrane: 3.7 mm thick polyester /fiberglass reinforced SBS/RET/TPU modified asphalt-coated sheet to ASTM D6162, Type III, Grade G; Meeting the following requirements:
  .1 Tensile Strength, minimum, ASTM D 5147@-18C: machine direction, 71 kN/m; cross machine direction, 64 kN/m;
  .2 Tear Strength, minimum, ASTM D 5147@25C: machine direction, 2.6 KN; cross machine direction, 2.5 KN
  .2 Elongation, ASTM D 5147@25C: machine direction, 12%; cross machine direction, 8%.
  .3 Low Temp. Flex, ASTM D 5147, -35C.

.9 Adhesive for Membrane and Flashing Plies: Polymer-Modified Roofing Asphalt: SEBS-modified, hot-melt, asphalt adhesive, with the following physical properties.
.1 Softening Point, min/max, ASTM D 36: 90-96 deg. C.
.2 Flash point, minimum, ASTM D 92: 287 deg. C.
.3 Elongation at 25 deg. C, minimum, ASTM D 412: 800 percent.
.4 Low Temp. Flex, CGSB 37.50-M89, pass at -8 degrees C.

.10 Adhesive for Insulation Boards, Tapered Insulation, Overlay Boards, Vapour Barrier: Type III Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems to CAN/CSA A123.4-04.

2.3 ACCESSORIES

.1 Mechanical Fasteners: Flat-head, countersunk, self-tapping screws; size, type and length in accordance with FMG; corrosion resistant coating in accordance with FM 4470, with locking metal plates.

.2 Stack Flashings: Prefabricated stack jack; sizes to suit applications

.3 Roof Drains: Refer to Mechanical Specifications.

.4 Metal Flashing: as specified in Section 07 62 00 – Sheet Metal Flashing and Trim

.5 Starter Strips: Starter strips to be manufactured from the same type of material used for cap and counter flashings and shall be 24 gauge galvanized steel. Starter strips are to be continuous. Exposed starter strips to match prefinished sheet metal in colour.

.6 Cant Strips: purpose made asphalt impregnated wood fibreboard, various sizes to suit roof slopes and existing conditions.

.7 Stripping Membrane: Vinyl-coated fiberglass mesh.

.8 Stripping Ply Adhesive: One-part rubberized elastomer.

.9 Stripping Ply Mastic: Asphalt based, fibrated roof mastic.

.10 Gas Pipe Supports: Refer to Mechanical.

.11 Sealant: as specified in Section 07 92 00 – Joint Sealants

.12 Termination Bar: 3 mm thick aluminum bar, 25 mm wide profile, pre-drilled for mechanical attachment.

.13 Copper: 0.8 mm cold rolled copper to ASTM B370-81.

.14 Wood: "Construction" grade light framing and blocking in accordance with the National Lumber Grades Authority Standard Grading Rules 1987. Grade #2 or better. Wood to be pressure treated in accordance with CSA 080.1 – M89.

.15 Wood Preservative: Copper napthenante or pentachlorophenol base. Water repellent wood preservative to CSA 080 – M89
.16 Nails, spikes, staples: to CSA B111. Hot dipped galvanized.

.17 Fasteners:

.1 Wood to wood: Minimum #12 corrosion resistant screw of sufficient length to penetrate lower piece 33 mm.

.2 Wood to steel deck: Minimum #12 corrosion resistant screw of sufficient length to penetrate deck 19 mm.

.3 Wood to masonry or concrete: Screws, expansion shields or wall anchors, corrosion resistant of sufficient length to penetrate substrate to a depth recommended by the manufacturer.

2.4 WALKWAYS

.1 Install one row of new 460mm x 460mm diamond textured concrete pavers as indicated on architectural drawings. Pavers to be supported on 38mm thick extruded polystyrene insulation. Provide minimum 100mm gap between each unit paver to allow for water drainage.

3 EXECUTION

3.1 EXAMINATION

.1 Inspect existing conditions to ensure they are suitable for roofing work to begin. Do not proceed until unacceptable conditions are corrected.

.2 Ensure substrate is solid, clean, dry and free of any contaminants prior to commencing any roofing work.

.3 Ensure Products are dry prior to installation. Replace damaged Products.

3.2 PREPARATION

.1 Protect existing roofing from damage with minimum 13 mm thick plywood runways.

.2 Prime metal and concrete surfaces designated to be covered with asphaltic Products.

.3 Apply primer at an average rate of 4.3 m²/litre. Allow to cure.

.4 Ensure primer does not enter building through cracks and other openings.

3.3 THERMAL BARRIER UNDERLAY BOARD (Work Area 2, Steel Deck)

.1 Mechanically attach thermal barrier underlay board to roof deck with screws and plates using the following density: one fastener per 3ft² 0.27 m² in the field of the roof; one fastener per 2ft² 0.2 m² at the perimeter of the roof; one fastener per 1.5ft² 0.14 m² in the corners of the roof. Roof perimeters are defined by the smaller of either 10% of the least building dimension or 40% of the building height but never less then 900mm.
Corners are the squares defined by the dimension of the perimeter. Stagger boards 300 mm. Drive fasteners flush to top surface.

.2 Install thermal barrier underlay boards with long axis perpendicular to ribs, with end joints fully supported.

.3 Firmly butt each board to surrounding boards. Do not jam or deform boards.

.4 Cut and fit boards where roof deck intersects vertical surfaces.

.5 Provide filler boards every 450 mm in both directions and secure with minimum two fasteners per board.

.6 Tape joints of thermal barrier underlay board with 50 mm wide tape.

3.4 VAPOUR RETARDER

.1 Adhere two plies NO. 15 asphalt saturated organic felts adhered in Type III Asphalt over prepared substrate with approved adhesive at a rate of 1.22 kg/ m²

.2 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.

.3 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.

3.5 INSULATION AND OVERLAY BOARD

.1 Install insulation boards to maintain continuity of thermal envelope.

.2 Adhere base layer of roof insulation to vapour retarder with approved adhesive at a rate of 1.22 kg/ m²

.3 Adhere additional layers of insulation as required to previous layers of insulation with approved adhesive at a rate of 1.22 kg/ m²

.4 Adhere tapered roof insulation where indicated and in accordance with approved Shop Drawings.

.5 Fit insulation tight to roof penetrations.

.6 Firmly butt insulation boards. Do not jam or deform boards.

.7 Stagger joints minimum 300 mm.

.8 Stagger overlay board seams with insulation board seams.

3.6 CANT STRIPS

.1 Install cant strips at intersections of roofing and vertical surfaces.
.2 Embed in a continuous bed of approved adhesive applied to overlay boards.

.3 Lay true to line, level and with flush butt joints and accurately mitred corners.

3.7  BASE SHEET

.1 Install base sheet parallel to roof edge in line with centre of drain, starting at roof low point. Conform to manufacturer's recommended method.

.2 Lap sheet membrane sides 100 mm and ends 150 mm. Stagger end laps 1.0 metre minimum. Overlap previous day's work 600 mm.

.3 Install membrane so that it shall be firmly and uniformly set, without voids. Thoroughly and effectively broom or roll each membrane application to ensure full adhesion.

.4 Embed base sheet in approved adhesive, applied at a minimum rate of 1.2 L/m², solidly coated for full width. Apply adhesive no more than 3.0 metres ahead of each roll being embedded.

.5 Ensure complete and continuous seal and contact between bitumen and sheet membranes, including ends, edges and laps without wrinkles, fish mouths or blisters.

.6 Do not step or walk on membranes during or immediately after application until adhesive has set.

.7 Terminate base sheet membrane 40 mm above the top of the cant strip.

.8 Cut out fishmouths and side laps that are not continuously sealed and patch to a watertight condition. Replace sheet membranes that are not fully and continuously bonded.

3.8  CAP SHEET

.1 Install cap sheet in similar fashion as base sheet, with seams offset from base sheet membrane by one-half roll width. Ensure water flows over or parallel to, but never against exposed edges. Conform to manufacturer's recommended method for laying and mopping down membranes.

.2 Lap sheet membrane sides 75 mm and ends 150 mm. Stagger end laps 300 mm minimum. Overlap previous day's work 600 mm.

.3 Install membrane so that it shall be firmly and uniformly set, without voids. Thoroughly and effectively broom or roll each membrane application to ensure full adhesion.

.4 Embed cap sheet in approved adhesive, applied at a minimum rate of 1.2 L/m², solidly coated for full width. Apply adhesive no more than 3.0 metres ahead of each roll being embedded.

.5 Ensure complete and continuous seal and contact between bitumen and sheet membranes, including ends, edges and laps without wrinkles, fish mouths or blisters.
.6 Do not step or walk on membranes during or immediately after application until bitumen has set.

.7 Terminate cap sheet membrane even with base of cant strip.

.8 Cut out fishmouths and side laps that are not continuously sealed and patch to a watertight condition. Replace sheet membranes that are not fully and continuously bonded.

3.9 MODIFIED BITUMINOUS MEMBRANE FLASHINGS

.1 Provide membrane flashings in accordance with manufacturer's written installation guidelines.

.2 Install flashings to ensure the roof is watertight at the end of each Working Day.

.3 Fully adhere two-plies of flashing membrane with flashing adhesive. Complete the application by welding the end laps and side laps using an electric hot-air welder and a membrane roller.

.4 Extend base ply minimum 100 mm over roof membrane. Extend cap ply 50 mm beyond edge of base ply flashing.

.5 Extend flashing membranes minimum 200 mm up vertical surfaces.

.6 Secure flashings at 200 mm OC. Secure vertical flashings through termination bar.

.7 Where flashing membranes will be adhered to a granulated sheet, embed granules with a hot trowel and allow to cool prior to applying flashing membranes.

3.10 FIELD QUALITY CONTROL

.1 Contractor Inspection: Prior to application of aggregate surfacing, inspect completed membrane and flashing for punctures, tears, and discontinuously sealed seams.

.2 Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions, and seal seams.

.3 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect the roofing application and confirm that the roofing system installation is in strict accordance with manufacturer's recommendations.

3.11 CLEANING

.1 Clean drains, gutters and downspouts of debris, ensuring free drainage.

.2 Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.
3.12 PROTECTION

.1 Adequately protect products and work from damage by weather, traffic and other causes.

.2 At the end of each Working Day, seal exposed edges of roofing membrane to be watertight.

.3 Protect adjacent Work from damage. Repair damage.

END OF SECTION
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Definitions
Hot work - is any temporary operation involving open flames or producing heat and/or sparks. It includes but is not limited to: brazing, cutting, grinding, soldering, thawing pipe, torch applied roofing and welding.

Fire watch is a visual inspection of the work area for smouldering or flaming ignitions during and after hot work.

Objective
The objective of a hot work permit system is to ensure:
- Work is performed by competent persons
- Hazards are identified, removed, isolated or protected as required
- Appropriate firefighting equipment is on hand
- Risk to employees, students and property is minimized

Safety Considerations
1. This procedure applies to all Simcoe County District School Board employees and any contractors retained by the board to perform hot work as defined above.
2. Hot Work will be avoided whenever possible; if there is a safer way to complete the job this will be the first choice.
3. When possible hot work should be moved outside away from buildings and combustibles.
4. EXCLUSION - This procedure does not apply to rooms specifically constructed for these tasks such as a welding technology room.

Board Responsibilities
1. To establish a hot work procedure.
2. To provide site locations, maintenance personnel and regular external contractors with hot work permits.
3. To provide training for staff and personnel on the use of hot work procedures.

Supervisor Responsibilities
1. To ensure contractors and employees are aware of procedure and equipped with permits.
2. To contact persons who have conducted hot work to obtain hot work permits that have not been remitted.

**Person Performing Hot Work Responsibilities**

1. Complete the job information and checklist on the hot work permit. (Appendix A)
2. To notify the chief custodian/group leader, office and security monitoring company to advise that hot work will be performed.
3. Ensure checklist items are completed:
   - Hot work equipment is in good repair
   - Flammable liquids, dust, lint and oil deposits removed
   - Explosive atmosphere in area eliminated and ventilated
   - Floors cleaned of combustibles
   - Combustible floors covered with fire resistive sheets
   - Remove other combustibles or block with fire resistive material
   - Cover all wall and floor openings
   - Ensure there is a fire extinguisher at the work site
   - Construction of work surface is non combustible
   - No danger exists from conduction of heat into another room or area
4. Ensure fire watch/hot work area monitoring is completed:
   - Fire watch will be provided during and continuously for 30 minutes after work is completed
   - Fire watch is supplied with suitable extinguishers
   - Fire watch is trained in the use of this equipment and in sounding the alarm
   - Fire watch may be required for areas above and below
   - Hot work area inspected 60 minutes after work is completed
5. Ensure other precautions are taken:
   - Confined space entry noted in comments, if applicable
   - Asbestos log reviewed
   - Area is protected by heat/smoke detectors
   - Ventilation is adequate to remove smoke/vapours
   - Lock out/Tag out required
6. Post the permit at the work site.
7. Complete the fire watch for 30 minutes after work is completed - sign form.
8. Notify chief custodian/group leader, office and security monitoring company that work is complete.
9. Ensure someone is available to complete 60 minute inspection;
   Chief custodian, group leader, or regional operations supervisor
10. If no one is available, complete inspection 60 minutes after work is completed.
11. Sign form advising you have completed the above tasks.
12. Return form to maintenance dispatch or attach to invoice if external contractor.

**Maintenance Dispatch Requirements**

1. To retain copies of returned hot work permits.
2. To advise supervisor if permits are not returned.
Large Project Requirements

For projects lasting more than a week, and involving multiple hot work tasks, please use "Hot Work Large Project" form. Contractor is responsible to return these to design and construction supervisor.

Revised: August 2015
**HOT WORK PERMIT**

A Hot Work Permit is required for any temporary operation involving open flames or producing heat and/or sparks. It must be completed by the employee or contractor performing the work and should be at the site of the work. Hot Work includes but is not limited to: Brazeing, Cutting, Grinding, Soldering, Thawing, Pipe, Torch Applied Roofing.

If precautions below cannot be met Hot Work is NOT permitted.

<table>
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<tr>
<th>DATE</th>
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<tr>
<td>LOCATION/BUILDING &amp; ROOM</td>
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<tr>
<td>NATURE OF JOB</td>
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<td>PERMIT ISSUED</td>
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<td>PERMIT EXPIRES</td>
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**CHECKLIST**

- Notify chief custodian/group leader, office and security monitoring company that hot work will be performed
- Hot work equipment is in good repair
- Flammable liquids, dust, fire and oil deposits removed
- Explosive atmosphere in area eliminated and ventilated
- Floors cleaned of combustibles
- Combustible floors covered with fire resistant sheet
- Remove other combustibles or block with fire resistant material
- Cover all wall and floor openings
- Is there a fire extinguisher at the work site
- Construction of work surface is noncombustible
- Combustible areas are covered with fire resistant tarps
- No danger exists from conduction of heat into another room or area

**FIRE WATCH/HOT WORK AREA MONITORING**

- Fire watch will be provided during and continuously for 30 minutes after work is completed
- Fire watch is supplied with suitable extinguishers
- Fire watch is trained in the use of this equipment and in sounding the alarm
- Fire watch may be required for areas above and below
- Notify chief custodian/group leader and office that hot work is complete and ensure that someone is available to perform the 60 minute visual inspection. (If no one available person performing work must do inspection)
- Notify security monitoring company that hot work is complete
- Hot work area inspected 60 minutes after work is completed

**OTHER PRECAUTIONS TAKEN**

- Confined space entry noted in comments, if applicable
- Asbestos log reviewed
- Area is protected by heat/smoke detectors
- Ventilation is adequate to remove smoke/vapours
- Lock out/Tag out required

**INSTRUCTIONS**

1. Complete job information
2. Pest at work site
3. Complete 30 minute fire watch
4. Inspect area 60 min after work is completed
5. Sign form
6. Return to maintenance dispatch or attach to invoice if external contractor
# HOT WORK PERMIT
## LARGE PROJECTS

A Hot Work Permit is required for any temporary operation involving open flames or producing heat and/or sparks. It must be completed by the employee or contractor performing the work and should be at the site of the work. Hot Work includes but is not limited to: Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing.

**If precautions below cannot be met Hot Work is NOT permitted.**

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**This Permit is Valid for 7 Days**

I VERIFY THAT A 30 MINUTE FIRE WATCH HAS BEEN COMPLETED AND THE HOT WORK AREA HAS BEEN INSPECTED AGAIN 30 MINUTES AFTER THE COMPLETION OF THE WATCH. THE PRECAUTIONS INDICATED ON THE RIGHT HAVE BEEN TAKEN TO PREVENT FIRE.

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<th>Name of Supervisor/Contractor</th>
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<td>Signature of Supervisor/Contractor</td>
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**Checklist**
- Hot work equipment is in good repair
- Flammable liquids, dust, lint and oil deposits removed
- Explosive atmosphere in area eliminated and ventilated
- Floors cleaned of combustibles
- Combustible floors covered with fire resistive sheets
- Remove other combustibles or block with fire resistive material
- Cover all wall and floor openings
- Is there a fire extinguisher at the work site
- Construction of work surface is non-combustible
- Combustible areas are covered with fire resistant tarps
- No danger exists from conduction of heat into another room or area

**Fire Watch/Hot Work Area Monitoring**
- Fire watch will be provided during and continuously for 30 minutes after work is completed
- Fire watch is supplied with suitable extinguishers
- Fire watch is trained in the use of this equipment and in sounding the alarm
- Fire watch may be required for areas above and below
- Hot work area inspected 60 minutes after work is completed

**Other Precautions Taken**
- Confined space entry noted in comments, if applicable
- Asbestos log reviewed
- Area is protected by heat/smoke detectors
- Ventilation is adequate to remove smoke/vapours
- Lock out/Tag out required

**Instructions**
1. Complete job information
2. Complete 30 minute fire watch for every hot work operation
3. Inspect area 60 minutes after work complete
4. Sign form on back when each process completed
5. Return to maintenance dispatch or attach to invoice if external contractor-1 form per week
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SIGNATURE
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry

.2 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Roofing.

1.2 REFERENCES


.2 American Society for Testing and Materials International (ASTM)
   .3 ASTM A653/A653M-2018, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   .6 ASTM B370-12, Standard Specification for Copper Sheet and Strip for Building Construction.

.3 Canadian Roofing Contractors Association (CRCA)

.4 Canadian Standards Association (CSA International)
   .2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.5 Green Seal Environmental Standards
   .1 Standard GS-03-93, Anti-Corrosive Paints.
   .2 Standard GS-11-97, Architectural Paints.
   .3 Standard GS-36-00, Commercial Adhesives.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).
1.2 REFERENCES
(Cont'd) .7 South Coast Air Quality Management District (SCAQMD), California
.1 SCAQMD Rule #1113-16, Architectural Coatings.
.2 SCAQMD Rule #1168-17, Adhesives and Sealants.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
   .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
   .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29 - Health and Safety Requirements.
.3 Shop Drawings: shop drawings: submit drawings in accordance with Section 01 33 00 - Submittal Procedures.
.4 Samples: submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.

1.4 QUALITY
ASSURANCE
.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section with contractor's representative and Consultant in accordance project schedule to:
   .1 Verify project requirements.
   .2 Review installation and substrate conditions.
   .3 Co-ordination with other building subtrades.
   .4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY,
STORAGE AND
HANDLING
.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

PART 2 - PRODUCTS

2.1 SHEET METAL
MATERIALS
.1 Zinc coated steel sheet: 0.018 mm thickness, 26 gauge commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating.
2.1 SHEET METAL MATERIALS

.2 Flashing and trim as manufactured by VicWest Weather X Series.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied Silicone Modified Polyester Paint System.
   .1 Class F2S, factory finished two sides.
   .2 Colour shall be 56072 CHARCOAL from Standard Range.
 .2 Samples: submit duplicate 50 mm x 50 mm samples of prefinished steel sheets from Standard Range.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.
 .2 Plastic cement: to CAN/CGSB 37.5.
 .3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32 asphalt laminated 3.6 to 4.5 kg kraft paper No. 15 perforated asphalt felt to CSA A123.3.
 .4 Sealants: refer to Section 07 92 00 - Joint Sealants.
 .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
 .6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
 .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
 .8 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
 .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with applicable standards.
 .3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
2.4 FABRICATION

(Cont'd)

.4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.018 mm thick, 26 gauge prefinished steel.

2.6 REGLETS AND CAP FLASHINGS

.1 Form recessed reglets of 0.018 mm thick, 26 gauge sheet metal to be built-in masonry work for base flashings in accordance with CRCA FL series details.

.1 Provide slotted fixing holes and steel/plastic washer fasteners.

.2 Cover face and ends with plastic tape.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details, Aluminum Association (AA).

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.
3.2 INSTALLATION

(Cont'd)

.6 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

.7 Caulk flashing at reglet cap flashing with sealant.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 52 16.13 - Hot-Applied Smooth Bituminous Membrane Roofing.

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

1.2 REFERENCES

.1 ASTM International
   .4 ASTM C919-18, Standard Practice for Use of Sealants in Acoustical Applications.


.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
1.3 ACTION AND INFORMATIONAL SUBMITTALS

(Cont'd)

.2 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Manufacturer's product to describe:
     .1 Caulking compound.
     .2 Primers.
     .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  .3 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements.

.3 Samples:
  .1 Submit two samples of each type of material and colour.
  .2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions: submit instructions to include installation instructions for each product used.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect joint sealants from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.
1.6 SITE CONDITIONS

.1 Ambient Conditions:
   .1 Proceed with installation of joint sealants only when:
     .1 Ambient and substrate temperature conditions are
     within limits permitted by joint sealant manufacturer or are
     above 4.4 degrees C.
     .2 Joint substrates are dry.
     .3 Conform to manufacturer's recommended
     temperatures, relative humidity, and substrate moisture
     content for application and curing of sealants including
     special conditions governing use.

   .2 Joint-Width Conditions: proceed with installation of joint
   sealants only where joint widths are more than those allowed by joint sealant
   manufacturer for applications indicated.

   .3 Joint-Substrate Conditions: proceed with installation of joint
   sealants only after contaminants capable of interfering with
   adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials
   Information System (WHMIS) regarding use, handling, storage, and
   disposal of hazardous materials; and regarding labelling and
   provision of Material Safety Data Sheets (MSDS) acceptable to
   Health Canada.

1.8 WARRANTY

.1 Provide a 5 year weatherseal warranty for DC sealants installations.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic
   chemicals or is not certified as mould resistant in air handling units.

   .2 When low toxicity caulks are not possible, confine usage to areas
     which off gas to exterior, are contained behind air barriers, or are
     applied several months before occupancy to maximize off gas time.

   .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATION

.1 Use materials as received from manufacturer, without additives or
   adulterations. Use one manufacturer's product for each product
   specified. Colours selected from standard range.
2.2 SEALANT MATERIAL DESIGNATION

(Cont'd)

.2 Silicone Sealant, Medium Modulus, TYPE A: one-part, non-sag type in standard colours selected, meeting requirements of ASTM C920 with movement capacity of ± 50%.
   .1 Dow Corning DC 790 Silicone Building Sealant.
   .2 Pecora 895.

.3 Silicone Sealant, Low Modulus, TYPE B: one-part, non-sag type in standard colours selected, meeting requirements of ASTM C920 with movement capability of +100%, -50% in joint configuration.
   .1 Dow Corning DC795 Silicone Building Sealant.
   .2 Pecora 890.

.4 Silicone Sealant, Ultra Low Modulus, TYPE C: one-part or two-part, self-leveling type, in standard colours selected, meeting requirements of ASTM C-920 with movement capability of +100%, -50% in joint configuration.
   .1 Dow Corning FC Parking Structure Sealant.
   .2 Dow Corning SL Parking Structure Sealant.

.5 Silicone Sealant, TYPE D: one-part mildew-resistant silicone, FDA Regulation 21 CFR 177.2600 in standard colours selected.
   .1 Dow Corning 786 Mildew Resistant Silicone Sealant.
   .2 Tremsil 600 Silicone Sealant by Tremco Ltd.

.6 Preformed Compressible and Non-compressible back up material:
   .1 Polyethylene, urethane, neoprene or vinyl foam.
   .2 Extruded closed cell foam backer rod.
   .3 Size: oversize 30% to 50%.
   .4 Neoprene or butyl rubber: round solid rod, Shore A, hardness 70.
   .5 High density foam: extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A, hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
   .6 Bond breaker tape: polyethylene breaker tape which will not bond to sealant, as approved by manufacturer.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): sealant TYPE A.

.2 Expansion and control joints in exterior surfaces of poured-in-place concrete walls: sealant TYPE C.

.3 Control and expansion joints in exterior surfaces of unit masonry walls: sealant TYPE C.
2.3 SEALANT SELECTION

(Cont'd)

.4 Seal interior perimeters of exterior openings as detailed on drawings: sealant TYPE A.

.5 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: sealant TYPE B.

.6 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): sealant TYPE B.

.7 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: sealant TYPE B.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
3.2 SURFACE PREPARATION

(Cont'd)

3.2.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

3.2.4 Ensure joint surfaces are dry and frost free.

3.2.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

3.3.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

3.3.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

3.4.1 Apply bond breaker tape where required to manufacturer's instructions.

3.4.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

3.5.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

3.6.1 Sealant:

3.6.1.1 Apply sealant in accordance with manufacturer's written instructions.

3.6.1.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

3.6.1.3 Apply sealant in continuous beads.

3.6.1.4 Apply sealant using gun with proper size nozzle.

3.6.1.5 Use sufficient pressure to fill voids and joints solid.

3.6.1.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

3.6.1.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

3.6.1.8 Remove excess compound promptly as work progresses and upon completion.

3.6.2 Curing:

3.6.2.1 Cure sealants in accordance with sealant manufacturer's instructions.

3.6.2.2 Do not cover up sealants until proper curing has taken place.
3.7 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.
.2 Clean adjacent surfaces immediately.
.3 Remove excess and droppings, using recommended cleaners as work progresses.
.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.8 PROTECTION .1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.
Division 20  Common Requirements for Mechanical

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Common Contract Requirements for Mechanical

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Common Work Results for Mechanical

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Testing, Adjusting, and Balancing

20 06 11  Testing, Adjusting, and Balancing (TAB) of Mechanical Systems 6

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Division 22  Plumbing

Plumbing Insulation

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22 14 15  Storm Drainage Piping – Cast Iron and Copper 4
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Division 23  Heating, Ventilating, and Air Conditioning (HVAC)

Common Work Results for HVAC

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Facility Fuel Piping

23 11 23  Facility Natural-Gas Piping 4

Hydronic Piping and Pumps

23 21 13  Hydronic Piping (Welded) 8
Refrigerant Piping
23 23 13 Refrigerant Piping and Specialties 6

HVAC Water Treatment
23 25 13 Water Treatment for Closed Loop Hydronic Systems 4

HVAC Ducts and Casings
23 31 13 Metal Ducts 8

Air Duct Accessories
23 33 13 Duct Accessories 4
23 33 13.13 Volume Control Dampers 4
23 33 53 Duct Liners 4

HVAC Fans
23 34 23 Packaged Exhausters 4

Air Outlets and Inlets
23 37 13 Diffusers, Registers, and Grilles 2

Breeching, Chimneys, and Stacks
23 51 33 Insulated Sectional Chimneys 4

Packaged Outdoor HVAC Equipment
23 74 43 Packaged Rooftop HVAC Units 8

Division 25 Integrated Automation

Building Automation System
25 20 11 Building Automation System 36

END OF SECTION
LIST OF DRAWINGS

Mechanical and Electrical – DEI & Associates Inc.
ME-01 Legend, Schedule, Key Plan and Details
ME-02 Roof Plan Demolition
ME-03 Roof Plan Renovation
ME-04 Details
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  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.

.5 Submit a copy of all final certificates in the maintenance manuals.
1.4 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 diagramatically, 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 co-ordinated 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.

1.5 INTERFERENCE AND CO-ORDINATION 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 co-ordinated.
.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 release AutoCAD 2007) in addition to hard copies.

1.6 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.

1.7 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 allotted 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.

1.8 EXAMINATION

.1 Site Inspection

.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.

1.9 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.

1.10 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. $2000.00)
- Above grade rough-in plumbing and drainage
- Roof drainage system
- Ductwork
- Fire stopping
- HVAC Units
- Propane Piping
- Heating Piping
- Piping Insulation
- Duct insulation
- Fans & Equipment
- Water Treatment
- Building Automation Systems
- Testing, Adjusting and Balancing
- Mechanical contractor closeout requirements (min. of $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.

1.11 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 30 days after award of Contract.

.2 Provide a complete list of shop drawings to be submitted prior to first submission.

.3 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 the appropriate authorization.

.4 Shop drawings can be submitted either by hard (paper) copy submission or by an electronic submission as per the following directions.

.1 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information.

.2 List on catalog covers page numbers of submitted items.

.3 Underline applicable data.

.4 Hard copy submissions:

.1 Submit 6 copies of data in 6 individual binders and index in same order and name as they appear in Specification. Prior to submission these shop drawings must be reviewed by the contractor and bear the “company stamp” of the contractor. If not stamped, the drawings will not be reviewed.
.5 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.

.10 All shop drawings are to be submitted to this consultant and the commissioning agent. Comments from the commissioning agent will be forwarded to the contractor through this consultant.

.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 3 copies of “reviewed” shop drawings and compile into maintenance manuals.

.5 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.

.6 Partial submittals will not be accepted.
.7 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.

.9 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.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:
   .1 Mounting arrangements.
   .2 Operating and maintenance clearances. e.g. access door swing spaces.

.12 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.

1.12 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 Copies of the operation maintenance manuals are to be forwarded to the commissioning agent for review. Comments by the commissioning agent will be forwarded to the contractor by this consultant.

.4 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.
.5 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.

.6 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.

.7 Miscellaneous data to include:
  .1 Letter of contractors 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.

.8 Approvals:
  .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.
  .2 Make changes as required and re-submit as directed by Consultant.
  .3 Provide three (3) 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 Record drawings.

.9 Additional data:
  .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.13 RECORD 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 Record drawings:
  .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of record drawings.
  .2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  .3 TAB to be performed using record drawings.
  .4 Submit hard copy to Consultant for approval. When returned, make corrections as directed.
  .5 Once approved, submit completed reproducible paper record drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

1.14 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 Warranty period shall start from date of substantial completion.

1.15 SUBSTANTIAL PERFORMANCE
  .1 Complete the following to the satisfaction of the consultant prior to request for submission of substantial performance.
    .1 Record Drawings.
    .2 Maintenance Manuals
    .3 System Start up
    .4 TAB Reports
    .5 Instructions to Owners
    .6 Final Certificates (required prior to consultant’s release of conformance letter).
      .1 TSSA Gas Pressure Test
1.16 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 TSSA Gas Pressure Test
  .2 Commissioning agent verifications.

1.17 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/suppliers invoice if requested.

1.18 DELIVERY STORAGE & HANDLING

.1 Follow Manufacturer’s directions in delivery, storage, and protection, of equipment and materials.

.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.

1.19 ASBESTOS

.1 If asbestos is 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 asbestos due to the nature of the work that they perform, have received training that enables them to recognize asbestos and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with asbestos occur during the course of their work.

.4 It is the responsibility of the contractor to review the asbestos book in the building prior to starting any work.

.5 Existing occupied buildings (depending upon their age) may contain asbestos 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 asbestos and shall not be disturbed.

.6 A survey of each building documenting the location and condition of asbestos-containing materials is available for your mandatory review prior to commencing any work on premises.
1.20 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.

1.21 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 refrigeration, fuel piping, 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.

1.22 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 hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
   .3 Test propane 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, consultant, contractor, building automation systems (BAS) contractor, and manufacturer’s representative. Each person shall witness and sign off each piece of equipment.
.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, record 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 Thermostats: Barrier Free (operable) 1200 mm (3'-11")
       Non Barrier Free 1500 mm (5'-0")

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 Control 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. Refer to 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.
   
   .4 All starters for mechanical equipment to be provided by and wired by Electrical Division unless otherwise noted.

1.11 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, Totally Enclosed Fan Cooled (TEFC) induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.12 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 for all belt driven motors.

1.13 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
Trikon Systems

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 / Roof
   .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.

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 cementious 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, manufacturers 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 Manufacturer: Minnesota Mining and Manufacturing

.16 Acceptable Alternate Manufacturers to approval of local authority:
   - Fryesleeve Industries Inc.
   - General Electric Pensiil 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 Prime and touch up marred finished paintwork to match original.

.4 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 for each pump.
   .2 One casing joint gasket for each size pump.
   .3 One head gasket set for each heat exchanger.
   .4 One set of belts for each type or each size of machinery.
   .5 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 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable materials:
Banco Plus II by Banco Access or approved alternate.

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 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units as required and/or as indicated by Consultant 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.

1.27 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.28 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.

1.29 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.

1.30 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.
1.31 OWNER SUPPLIED EQUIPMENT
.1 Connect to equipment supplied by the owner and make operable.

1.32 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 DVD.
.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 3 copies of DVD.
.4 Identify video routing on Record drawings.

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.

1.35 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 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, teflon or graphite impregnated asbestos.
.9 Thermal plastic packing: teflon or graphite impregnated asbestos 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.

SPEC NOTE: Re 2.2.6. Use monel or inconel when fluorides or caustics are present in the fluid.

.15 Bellows:
   .1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.16 Reinforcing or control rings:
   .1 2 piece nickel iron.

.17 Ends:
   .1 Slip-on flanges to match pipe.

.18 Liner:
   .1 Austenitic stainless steel in direction of flow.

.19 Shroud:
   .1 Carbon steel, painted.

2.2 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.
2.3 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.

2.4 EXPANSION COMPENSATORS (EXP)

.1 Packless guided construction complete with multi ply stainless steel bellows.
.2 Operating temperature (750°F).
.3 Provide model H3 for steel pipe and model HB for copper pipe.
.4 Material to match piping system.
.5 Acceptable materials:
   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
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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 clocks.
      .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 in 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)

   .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 not 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.

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 ROOF MOUNTED EQUIPMENT

.1 Install as per manufacturers’ 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.

2.11 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.
2.12 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.

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:

<table>
<thead>
<tr>
<th>Size: NPS</th>
<th>Maximum Spacing</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel</td>
<td>Copper</td>
</tr>
<tr>
<td>up to 32 mm (1 1/4&quot;)</td>
<td>2.1 m (7')</td>
<td>1.8 m (6')</td>
</tr>
<tr>
<td>40 mm (1 1/2&quot;)</td>
<td>2.7 m (9')</td>
<td>2.4 m (8')</td>
</tr>
<tr>
<td>50 mm (2&quot;)</td>
<td>3.0 m (10')</td>
<td>2.7 m (9')</td>
</tr>
<tr>
<td>65 mm (2 1/2&quot;)</td>
<td>3.6 m (12')</td>
<td>3.0 m (10')</td>
</tr>
<tr>
<td>80 mm (3&quot;)</td>
<td>3.6 m (12')</td>
<td>3.0 m (10')</td>
</tr>
<tr>
<td>90 mm (3 1/2&quot;)</td>
<td>3.9 m (13')</td>
<td>3.3 m (11')</td>
</tr>
<tr>
<td>100 mm (4&quot;)</td>
<td>4.2 m (14')</td>
<td>3.6 m (12')</td>
</tr>
<tr>
<td>125 mm (5&quot;)</td>
<td>4.8 m (16')</td>
<td></td>
</tr>
<tr>
<td>150 mm (6&quot;)</td>
<td>5.1 m (17')</td>
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</tr>
<tr>
<td>200 mm (8&quot;)</td>
<td>5.7 m (19')</td>
<td></td>
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<tr>
<td>250 mm (10&quot;)</td>
<td>6.6 m (22')</td>
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<tr>
<td>300 mm (12&quot;)</td>
<td>6.9 m (23')</td>
<td></td>
</tr>
</tbody>
</table>

.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  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 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.

2.10 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

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.

.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.

1.2 WLU NAMING STANDARDS

.1 Refer to specification section 20 05 54 for WLU naming standards.

1.3 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.

1.4 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 laminoid 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:

<table>
<thead>
<tr>
<th>Size</th>
<th>No. of Lines</th>
<th>Height of Line m (&quot;)</th>
<th>Height of Letters m (&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes</td>
<td>mm (&quot;)</td>
<td>mm (&quot;)</td>
<td>mm (&quot;)</td>
</tr>
<tr>
<td>1</td>
<td>10 x 50 (3/8&quot; x 2&quot;)</td>
<td>1 (3/64&quot;)</td>
<td>3 (1/8&quot;)</td>
</tr>
<tr>
<td>2</td>
<td>15 x 75 (1/2&quot; x 3&quot;)</td>
<td>1 (3/64&quot;)</td>
<td>6 (1/4&quot;)</td>
</tr>
<tr>
<td>3</td>
<td>15 x 75 (1/2&quot; x 3&quot;)</td>
<td>2 (5/64&quot;)</td>
<td>3 (1/8&quot;)</td>
</tr>
<tr>
<td>4</td>
<td>20 x 100 (3/4&quot; x 4&quot;)</td>
<td>1 (3/64&quot;)</td>
<td>10 (3/8&quot;)</td>
</tr>
<tr>
<td>5</td>
<td>20 x 100 (3/4&quot; x 4&quot;)</td>
<td>2 (6/64&quot;)</td>
<td>6 (1/4&quot;)</td>
</tr>
<tr>
<td>6</td>
<td>20 x 200 (3/4&quot; x 8&quot;)</td>
<td>1 (3/64&quot;)</td>
<td>10 (3/8&quot;)</td>
</tr>
<tr>
<td>7</td>
<td>25 x 125 (1&quot; x 5&quot;)</td>
<td>2 (5/64&quot;)</td>
<td>10 (3/8&quot;)</td>
</tr>
<tr>
<td>8</td>
<td>32 x 200 (1¼&quot; x 8&quot;)</td>
<td>1 (3/64&quot;)</td>
<td>20 (3/4&quot;)</td>
</tr>
</tbody>
</table>

   .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

   .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 PIPING SYSTEMS GOVERNED BY CODE

   .1 Identification:
      .1 Natural gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
      .2 Sprinklers: To NFPA 13.
2.5 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 sizes:

.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 follow Mechanical Room piping colour chart (Refer to chart at end of section for colours)

<table>
<thead>
<tr>
<th>Background colour</th>
<th>Legend</th>
<th>Arrows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>Green</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>Red</td>
<td>White</td>
<td>Black</td>
</tr>
</tbody>
</table>

.7 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.
.8 Background colour marking and legends for piping systems:

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>MARKING</th>
<th>LEGEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycol heating supply</td>
<td>Yellow</td>
<td>GLYCOL HEATING SUPPLY</td>
</tr>
<tr>
<td>Glycol heating return</td>
<td>Yellow</td>
<td>GLYCOL HEATING RETURN</td>
</tr>
<tr>
<td>Domestic hot water supply</td>
<td>Green</td>
<td>DOM. HW SUPPLY</td>
</tr>
<tr>
<td>Dom. HW recirculation</td>
<td>Green</td>
<td>DOM. HW CIRC</td>
</tr>
<tr>
<td>Domestic cold water supply</td>
<td>Green</td>
<td>DOM. CWS</td>
</tr>
<tr>
<td>Plumbing vent</td>
<td>Green</td>
<td>SAN. VENT</td>
</tr>
<tr>
<td>Storm water</td>
<td>Green</td>
<td>STORM</td>
</tr>
<tr>
<td>Sanitary</td>
<td>Green</td>
<td>SAN</td>
</tr>
<tr>
<td>Propane</td>
<td>Yellow</td>
<td>PROPANE</td>
</tr>
<tr>
<td>Gas regulator vents</td>
<td>to Codes</td>
<td></td>
</tr>
<tr>
<td>Conduit for low voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control wiring</td>
<td>White</td>
<td>CONTROL WIRING__VOLTS</td>
</tr>
</tbody>
</table>

2.6 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.

2.7 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.

2.8 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 contractor.

2.9 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.

### Mechanical Room Piping Colour Chart

<table>
<thead>
<tr>
<th>Label Name</th>
<th>Band Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water</td>
<td>Green</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Green &amp; Blue</td>
</tr>
<tr>
<td>Hot Water Heating (Rust Inhibitor)</td>
<td>Orange</td>
</tr>
<tr>
<td>Hot Water Heating Fluid (Poly Glycol)</td>
<td>Orange &amp; Purple</td>
</tr>
<tr>
<td>Hot Water Heating Fluid (Ethylene Glycol)</td>
<td>Orange &amp; Brown</td>
</tr>
<tr>
<td>Hot Water Heating Fluid (Eco Glycol)</td>
<td>Orange &amp; Green</td>
</tr>
<tr>
<td>Steam</td>
<td>Grey</td>
</tr>
<tr>
<td>Condensate Return</td>
<td>Grey &amp; Black</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>Blue</td>
</tr>
<tr>
<td>No 2 Fuel Oil</td>
<td>Brown</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Yellow</td>
</tr>
<tr>
<td>Fire Protection</td>
<td>Red</td>
</tr>
</tbody>
</table>

END OF SECTION
Part 1
General

1.1 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.

1.2 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:

.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 Dynamic Flow Balancing Ltd.
1200 Speers Road, Unit 36
Oakville, Ontario
L6L 4V6
(905) 338-0808

.5 VPG Associates
2062 King Road
King City, Ontario
L7B 1K9
(905) 833-4334
1.3 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.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 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.

1.6 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.
1.7 **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.

1.8 **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.

1.9 **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.
1.10 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%.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 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.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 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.

1.15 TAB REPORT

.1 Format to be in accordance with NEBB, AABC, or SMACNA.
.2 TAB report to show all results in SI or imperial units as indicated on plans and to include:

.1 Project record drawings.
.2 System schematics.
.3 Submit 3 copies of TAB Report to consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 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.
1.17 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.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.19 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, 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, 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.

1.20 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.

1.21 TWO-SPEED HVAC UNITS

.1 This contractor shall re-balance the two-speed rooftop HVAC units and associated dampers.

1.22 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 specified in Section 23 31 13.

1.23 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 Provide duct testing as specified.

.4 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 Record 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
- Commission Consultant performance testing
- Commissioning meetings
- Operating and maintenance manuals
- Training
- Systems Demonstration and turnover
- Testing forms
- Warranties

3.2  SHOP DRAWINGS AND RECORD DRAWINGS

.1 Conform to General Requirements Section for shop drawings and record 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:
- Roof Mounted Condensing Units
- Boilers and Pumps
- Air Handling Units
- VAV Terminal Units
- 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:

<table>
<thead>
<tr>
<th>System</th>
<th>Minimum Training Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Mechanical System</td>
<td>4 hours</td>
</tr>
</tbody>
</table>

.7 The minimum training for the BAS shall be as specified in Section 25 40 14. 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 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
       - 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.

3.14 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.

3.15 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.

3.16 CLOSEOUT PROCESS ALLOCATION
   .1 The mechanical contractor closeout process shall be allocated a minimum value equal to $5,000.00.
   .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/CGBS-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)
  .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.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): National 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.

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 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.

**Part 2 Products**

2.1 **FIRE AND SMOKE RATING**

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 **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 C 335.

.3 Type A-1: Rigid moulded mineral fibre 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.

.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 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

Fibreglass Canada
Knauf
Manson
Pittsburg Corning
2.3 INSULATION SECUREMENT
   .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
   .2 Contact adhesive: Quick setting.
   .3 Canvas adhesive: Washable.

2.4 CEMENT
   .1 Thermal insulating and finishing cement:
     .1 To ASTM C553.
     .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE
   .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH
   .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS
   .1 Polyvinyl Chloride (PVC):
     .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
     .2 Colours: white.
     .3 Minimum service temperatures: -20°C (-4°F).
     .4 Maximum service temperature: 65°C (150°F).
     .5 Moisture vapour transmission: 0.02 perm.
     .6 Fastenings:
       .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
       .2 Tacks.
       .3 Pressure sensitive vinyl tape of matching colour.

2.8 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 National 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.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
.3 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.

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Pipe sizes through (NPS) and insulation thickness mm (”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Piping</td>
<td>A-1</td>
<td>25 (1”)  25 (1”)  25 (1”)  25 (1”)  25 (1”)  25 (1”)</td>
</tr>
<tr>
<td>Domestic Water Piping</td>
<td>A-1</td>
<td>25 (1”)  25 (1”)  40 (1½”)  40 (1½”)  40 (1½”)</td>
</tr>
<tr>
<td>Roof Drain sumps</td>
<td>A-2</td>
<td>25 (1”)  25 (1”)  25 (1”)  25 (1”)  25 (1”)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Pipe sizes through (NPS) and insulation thickness mm (”)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>to 32 (1¼”)  50 (2”)  105 (4”)  200 (8”)</td>
</tr>
</tbody>
</table>

.5 Finishes: Conform to the following table:

<table>
<thead>
<tr>
<th>Application</th>
<th>Piping</th>
<th>Valves &amp; Fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed indoors</td>
<td>PVC</td>
<td>PVC</td>
</tr>
<tr>
<td>Exposed in mech. rooms</td>
<td>PVC</td>
<td>PVC</td>
</tr>
<tr>
<td>Concealed indoors</td>
<td>N/A</td>
<td>PVC</td>
</tr>
</tbody>
</table>

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.
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.

1.2 SHOP DRAWINGS

.1 Submit shop drawing data in accordance with general requirements.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2  Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
  .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
  .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 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.
2.3 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.

2.4 VALVES
   .1 All valves shall be of commercial grade and of same manufacturer.
   .2 Acceptable materials:
       Milwaukee
       Crane
       Neuman Hattersley
       Kitz

2.5 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.

2.6 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.
2.7 **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.

2.8 **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.

2.9 **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

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**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 record 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 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  BURIED SANITARY PIPING

.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.

2.2  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.

2.3  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).
2.4 **VENT FLASHINGS**

.1 Thaler or equal 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.

.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.

.11 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.

.3 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.4 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.
.5 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.

.6 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 Do not terminate vents within 3600 mm of any building intake and/or exhaust opening.
   .4 Provide copper vent piping through roof as per detail.

.7 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.

.8 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/m² (5 lb/ft²) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.

.9 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 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   BURIED SANITARY PIPING

.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.

2.2   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.

2.3   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).

.2 Above grade sanitary and vent piping:

.1 Where piping pierces a fire separation an approved fire stop system to

the approval of authority having jurisdiction shall be used.
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.
  .11 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.

.3 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.4 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.
.5 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.

.6 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.
   .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  ROOF DRAINS
   .1 Type RD-1: standard roof drain with cast iron body with aluminum dome, under-deck clamp to suit roof construction, roof sump receiver, flashing clamp ring with integral gravel stop.
      .1 Acceptable materials: Zurn ZA-121-ERC
                     Mifab R1200-BW
                     Ancon RD-100-BEDK (80)
                     Smith
                     Contour C1000DMP
.2 Type RD-2: controlled flow; cast iron body, under deck clamp and sump receiver to suit roof construction, flashing clamp ring with integral gravel stop, bearing pan, flow control weir assembly, aluminum dome.

.1 Acceptable material:
Zurn ZACF121RC
Mifab R1200-F
Ancon RD-100-ABDK (80)
Smith
Contour C1000DMPX

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
Ancon CO-480-RD-3
Contour C3700RAC

.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
Ancon CO-200-RX-1-6
Contour C3000RXNB

.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
Ancon CO-200-U-1-6
Contour C3000RZNB

.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
Ancon CO-200-TS-1-6
Contour C3000SYNB
.4 Cover for ceramic tile floors: 15 (¾") 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
  Ancon CO-200-S-1-6
  Contour C3000SNB

.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 Roof drains:
   .1 Verify installation at low points in roof.
   .2 Verify security and removability of dome.
   .3 Adjust weirs to suit actual roof slope and meet requirements of design.
   .4 Verify provision for movement of roof and integrity of roof drain piping system.
.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.

.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
1.1 General

1.2 REFERENCES

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.


.11 AWS C1.1, Recommended Practices for Resistance Welding.

.12 AWS W1, Welding Inspection.

.13 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

1.3 WELDERS QUALIFICATIONS

1. 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.

1.4 INSPECTORS QUALIFICATIONS

1. INSPECTORS QUALIFICATIONS

.1 Inspectors to be qualified to CSA W178.2.

1.5 WELDING PROCEDURES

1. 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.


5. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
   1. ASHRAE Standard 90.1.

6. Manufacturer’s Trade Associations.

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.

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 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.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 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 C 335.

.3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 Type C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.
Manufacturers:

1. All materials must be supplied by the same manufacturer.

Acceptable Materials:

1. Johns Manville
2. Fibreglass Canada
3. Knauf
4. Manson
5. Roxul

2.3 JACKETS

1. Canvas:
   1. 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
   2. Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

1. Vapour retarder lap adhesive:
   1. Water based, fire retardant type, compatible with insulation.

2. Indoor Vapour Retarder Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation.


4. ULC Listed Canvas Jacket:
   1. 220 g/m² (0.0451 lb/ft²) 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 Duro Dyne 1A-22 or equal.


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. Vinyl emulsion type acrylic, compatible with insulation.
   2. Reinforcing fabric: Fibrous glass, untreated 305 g/m² (0.062 lb/ft²).

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 TIAC National 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.

3.3  DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thickness’ conform to following table:

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular supply air ducts</td>
<td>C-1</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>Round supply air ducts</td>
<td>C-2</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>Supply, return and exhaust ducts exposed (visible) in space being served</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Interior acoustically lined ducts</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

.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.

.3 Finishes: Conform to following table:

<table>
<thead>
<tr>
<th>Application</th>
<th>Rectangular</th>
<th>Round</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor, concealed</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Indoor, exposed</td>
<td>Canvas</td>
<td>Canvas</td>
</tr>
</tbody>
</table>
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)
  .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.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): National 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.

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 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.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 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 C 335.

.3 Type A-1: Rigid moulded mineral fibre 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.

.4 Type A-3: Flexible unicellular tubular elastomer.

.1 Insulation to ASTM C553 with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.
.5 Materials:
  .1 All materials must be supplied by the same manufacturer.
  .2 Acceptable Materials:
    Fibreglass Canada
    Knauf
    Manson
    Pittsburg Corning

2.3 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 (26 gauge) thick.

2.4 CEMENT
  .1 Thermal insulating and finishing cement:
    .1 To ASTM C553.
    .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE
  .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH
  .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH
  .1 Vinyl emulsion type acrylic, compatible with insulation.
  .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m² (0.062 lb/ft²).

2.8 JACKETS
  .1 Polyvinyl Chloride (PVC):
    .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed
        shapes as required.
    .2 Colours: white.
    .3 Minimum service temperatures: -20°C (-4°F).
    .4 Maximum service temperature: 65°C (150°F).
.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:
   .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
   .2 Tacks.
   .3 Pressure sensitive vinyl tape of matching colour.

.2 Aluminum:
   .1 To ASTM B 209M.
   .2 Thickness: 0.50 mm (26 gauge) sheet.
   .3 Finish: Smooth.
   .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
   .5 Fittings: 0.50 mm (26 gauge) thick die-shaped fitting covers with factory-attached protective liner.
   .6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (26 gauge) thick at 300 mm (12") spacing.

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 National 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 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm (3").
3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.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 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.

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Pipe sizes through (NPS) and insulation thickness mm (&quot;&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>to 25 (1&quot;) 32 (1¼&quot;) 40 (1½&quot;) 50 (2&quot;) 105 (4&quot;) 200 (8&quot;)</td>
</tr>
<tr>
<td>Refrigerant piping</td>
<td>A-3</td>
<td>25 (1&quot;) 25 (1&quot;) 25 (1&quot;) 25 (1&quot;) 25 (1&quot;)</td>
</tr>
<tr>
<td>Glycol Water Heating</td>
<td>A-1</td>
<td>40 (1½&quot;) 50 (2&quot;) 50 (2&quot;) 50 (2&quot;) 50 (2&quot;)</td>
</tr>
</tbody>
</table>

.5 Finishes: Conform to the following table:

<table>
<thead>
<tr>
<th>Application</th>
<th>Piping</th>
<th>Valves &amp; Fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed indoors</td>
<td>PVC</td>
<td>PVC</td>
</tr>
<tr>
<td>Exposed in mech. rooms</td>
<td>PVC</td>
<td>PVC</td>
</tr>
<tr>
<td>Concealed indoors</td>
<td>N/A</td>
<td>PVC</td>
</tr>
<tr>
<td>Exterior refrigerant piping</td>
<td>Aluminum</td>
<td>Aluminum</td>
</tr>
</tbody>
</table>

.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.


.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).


.7 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded 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  PIPE

.1 Steel pipe: to ASTM A53/A53M, 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.

.4 Flexible gas pipe: ASTM A240 CSA/ULC approved corrugated 304 stainless steel piping to ASTM A240 with UV resistant polyethylene jacket to ASTM E84. Fittings to ASTM B16 Type 360 Brass. Provide end fittings to suit connections.
2.2 JOINTING MATERIAL

- Screwed fittings: pulverized lead paste.
- Welded fittings: to CSA W47.1.
- Flange gaskets: nonmetallic flat.
- Soldered: to ASTM B32, tin antimony 95/5.
- Screwed brass fittings: Teflon Tape.

2.3 FITTINGS

- Steel pipe fittings, screwed, flanged or welded:
  - Malleable iron: screwed, banded, Class 150.
  - Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.
  - Welding: butt-welding fittings.
  - Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - Bolts and nuts: to ANSI B18.2.1.
  - Nipples: schedule 40, to ASTM A53/A53M.

- Copper pipe fittings, screwed, flanged or soldered:
  - Cast copper fittings: to ANSI B16.18.

- Brass fittings: To ASTM B16.

2.4 BALL VALVES

- NPS 50 mm (2") and under:
  - Body and cap: cast high tensile bronze to ASTM B62.
  - Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
  - Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders.
  - Stem: tamperproof ball drive.
  - Stem packing nut: external to body.
  - Ball and seat: replaceable stainless steel solid ball and teflon seats.
  - Stem seal: TFE with external packing nut.
  - Operator: removable lever handle.

2.5 LUBRICATED PLUG VALVES

- All sizes
  - Provincial Code approved, lubricated plug type.
  - Body: cast iron to ASTM A 126 Class B semi-steel.
  - Rating: Class 125 psig.
  - Plug: tapered, with regular pattern port – 90 from full open to fully closed.
  - Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.
  - 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

2.6 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.

2.7 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

2.8 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 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.

3.3 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.

3.4 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

3.5 GAS FIRED EQUIPMENT START-UP

.1 Start-up of all new gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

3.6 PIPING ON ROOF

.1 Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:
   \[ \leq 40 \text{ mm (1½") } 2.4 \text{ M (8' - 0") O.C.} \]
   \[ \geq 500 \text{ mm (2") } 3.0 \text{ M (10' - 0") O.C.} \]

.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.
Part 1  General

1.1  RELATED SECTIONS

.1  HVAC Water Treatment Section.

1.2  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.

.4  American Society for Testing and Materials (ASTM).


.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.

1.3  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

1.4  CLOSEOUT SUBMITTALS

.1  Provide maintenance data for incorporation into manual specified in general requirements.
Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
   .1 NPS 150 mm (6") and smaller: Schedule 40.
   .2 Final connection to copper heating elements.
   .1 Type “L” copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.2 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.

2.3 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.

2.4 VALVES MANUFACTURERS

.1 All valves shall be of commercial grade and of same manufacturer.
.2 Acceptable Manufacturers:
   .1 Newman Hattersley Canada Ltd.
   .2 Jenkins/Crane
   .3 Milwaukee
   .4 Toyo
   .5 Kitz
2.5 **VALVES**

.1 Connections:
   .1 NPS 50 mm (2") and smaller: screwed ends.
   .2 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. Jenkins 810J.
      .2 Elsewhere: Class 125, non-rising stem, solid wedge disc. Jenkins 310J.
   .2 NPS 65 mm (2 1/2") and over:
      .1 Mechanical Rooms:
         .1 Rising stem, solid wedge disc, bronze trim. Jenkins 454J.
         .1 Operators: handwheel.
         .2 Non-rising stem, solid wedge disc, bronze trim. Jenkins 452J.
         .1 Operators: handwheel.

.3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
   .1 NPS 65 mm (2 1/2") and over: Flanged ends. Jenkins FIG 2232 ELJ.

.4 Globe valves: Application: Throttling, flow control, emergency bypass:
   .1 NPS 50 mm (2") and under:
      .1 With PFTE disc, as specified. Jenkins 106BJ. Bronze.
   .2 NPS 65 mm (2 1/2") and over:
      .1 With solid bronze disc, bronze trim, cast iron body. Jenkins 2342.

.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. Jenkins 587J.

.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 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.
.9 Jenkins 201SJ.

2.6 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

2.7 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 (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

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

.1 Install flow measuring stations and flow balancing valves as indicated and as follows:

.1 On return side of all heating devices (conectors, 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.

.2 Install to manufacturers requirements.

.3 Valve size shall be one trade size smaller than piping.

.4 Refer to Testing Adjusting and Balancing Section for applicable procedures.
3.5 **FILLING OF SYSTEM**

1. Refill system with clean water adding water treatment & glycol as specified.
2. Co-ordinate filling of system with HVAC water treatment contractor.
3. Drain and vent all new and existing piping, radiation, etc for a complete operable system.

3.6 **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.

3.7 **FLUSHING AND CLEANING**

1. 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.

2. 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.

3. 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.

4. Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.

5. Flush and clean new piping system in presence of Consultant.

6. Flush after pressure test for a minimum of 4 hrs.

7. Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.

8. 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.
During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

Drainage to include drain valves, dirt pockets, strainers, every low point in system.

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.

Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.

Repeat system drain and flush as often as necessary to have a clean system.

Disposal of cleaning solutions to be approved by authority having jurisdiction.

Isolate new piping system from existing system as required for system cleaning.

After hydronic system is cleaned, refill with clean water, chemical and glycol as per chemical supplier treatment.

**EXISTING SYSTEM DRAINAGE**

Drain existing hot hydronic system as required to facilitate system renovations.

Disposal of existing system shall be to the requirements of the local and/or provincial regulations.
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Part 1  General

1.1  REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.
.2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
.3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
.4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
.5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.
.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.
.7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
.8 CSA B52, Mechanical Refrigeration Code.
.9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

Part 2  Products

2.1  TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
.1  Hard copper: to ASTM B280, type ACR-B.

2.2  FITTINGS

.1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).
.2 Brazed:
.1  Fittings: wrought copper to ANSI/ASME B16.22.
.2  Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
.3 Flanged:
.1  Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.
.2  Gaskets: suitable for service.
.3  Bolts, nuts and washers: to ASTM A307, heavy series.
.4 Flared:
.1  Bronze or brass, for refrigeration, to ANSI/ASME 16.26.
2.3 PIPE SLEEVES
   .1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES
   .1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.
   .2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

2.5 FILTER-DRIER
   .1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
   .2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.
   .3 Size shall be full line size.
   .4 Approved manufacturers:
      .1 Mueller
      .2 Parker
      .3 Sporlan
      .4 Virginia

2.6 SIGHT GLASS
   .1 Combination moisture and liquid indicator with protection cap.
   .2 Sight glass shall be full line size.
   .3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.
   .4 Approved manufacturers:
      .1 Mueller
      .2 Henry
      .3 Parker
      .4 Superior

2.7 SUCTION LINE TRAP
   .1 Manufactured standard one-piece traps.
2.8 EXPANSION VALVES

.1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.

.2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.

.3 Approved manufacturers:
   .1 Henry
   .2 Mueller
   .3 Parker
   .4 Sporlan

2.9 FLEXIBLE CONNECTORS

.1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.

.2 Approved manufacturers:
   Anaconda “Vibration Eliminators” by Anamet
   Vibration Absorber Model VAF by Packless Industries
   Vibration Absorbers by Superior Valve Co
   Style “BF” Spring-flex freon connectors by Vibration Mountings.

2.10 ROOF FLASHING

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.11 PIPING SUPPORT ASSEMBLY

.1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.

.2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.

.3 Electro galvanized cush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.

.4 Acceptable materials:
   .1 Unistrut
   .2 Or equal
Part 3 Execution

3.1 GENERAL

.1 Hard copper to be used. Throughout the project, the use of annealed copper shall not be used without approval of the consultant.

.2 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.

.3 Connect to equipment with isolating valves and unions.

.4 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.

.5 Protect all openings in piping against entry of foreign material.

.6 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer’s recommendation and requirements.

.7 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer’s recommendations and requirements.

3.2 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

.1 General:

.1 Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.3 Provide trap at base of risers greater than 2.4m (8’) high and at each 7.6m (25’-0”) thereafter.

.4 Provide inverted deep trap at top of each riser.

.5 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified above.

.2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.
3.5 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02” WC) absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:

   .1 Twice to 14 Pa (0.056” WC) absolute and hold for 4 h.
   .2 Break vacuum with refrigerant to 14 kPa (0.056” WC).
   .3 Final to 5 Pa (0.02” WC) absolute and hold for at least 12 h.
   .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
   .5 Submit all test results to Consultant.

.7 Charging:

   .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
   .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
   .3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

   .1 Make all checks and measurements as per manufacturer’s operation and maintenance instructions.
   .2 Record and report all measurements to Consultant.

3.6 INSTRUCTIONS

.1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

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  Control Chem Canada 1-866-882-2436

2.2  POT FEEDER
   .1  Existing.

2.3  WATER TREATMENT FOR HYDRONIC SYSTEMS
   .1  Hot water heating system: Existing.
   .2  Glycol solution shall be 40% propylene glycol ECO thermal fluid. Temperature range (-
50°F -325°F).

2.4  CHEMICALS
   .1  Provide 1 year’s supply.
2.5 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.

2.6 CLEANING CHEMICALS
   .1 Provide as required to make system clean.
   .2 Cleaner chemical: compatible and of the same manufacturer of the water treatment supplier.

2.7 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 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.

3.3 START-UP
   .1 Start-up water treatment systems in accordance with manufacturer's instructions.
3.4 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 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.

.6 Certificates:
   .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
.7 Commissioning Reports:
   .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Consultant.

.8 Commissioning activities during Warranty Period:
   .1 Check out water treatment systems on regular basis and submit written report to Consultant.

3.5 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.

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).
   .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:

<table>
<thead>
<tr>
<th>Size Type</th>
<th>Class A Gauge</th>
<th>Class B Gauge</th>
<th>Class C Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square and Rectangular</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 600 mm (24&quot;)</td>
<td>22</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>625 mm to 1000 mm (25” to 40”)</td>
<td>20</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>1025 mm to 1800 mm (41” to 72”)</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>1825 mm to 2400 mm (73” to 96”)</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size Type</th>
<th>Class A Gauge</th>
<th>Class B Gauge</th>
<th>Class C Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round and Oval</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 300 mm (12&quot;)</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>325 mm to 600 mm (13” to 24&quot;)</td>
<td>22</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>625 mm to 900 mm (25” to 36&quot;)</td>
<td>20</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>925 mm to 1200 mm (37” to 48&quot;)</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
</tbody>
</table>

.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 Nexus 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 “I” 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:

<table>
<thead>
<tr>
<th>Maximum Pressure Pa (&quot; w.c.)</th>
<th>SMACNA Seal Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500 (10&quot;)</td>
<td>A</td>
</tr>
<tr>
<td>1500 (6&quot;)</td>
<td>A</td>
</tr>
<tr>
<td>1000 (4&quot;)</td>
<td>A</td>
</tr>
<tr>
<td>750 (3&quot;)</td>
<td>A</td>
</tr>
<tr>
<td>500 (2&quot;)</td>
<td>B</td>
</tr>
<tr>
<td>250 (1&quot;)</td>
<td>B</td>
</tr>
<tr>
<td>125 (0.5&quot;)</td>
<td>C</td>
</tr>
</tbody>
</table>

.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 **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 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.  

.3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

<table>
<thead>
<tr>
<th>Duct Size</th>
<th>Angle Size</th>
<th>Rod Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm (&quot;)</td>
<td>mm (&quot;)</td>
<td>mm ('')</td>
</tr>
<tr>
<td>up to 750 (30)</td>
<td>25 x 25 x 3 (1 x 1 x 1/8)</td>
<td>6 (1/4)</td>
</tr>
<tr>
<td>&gt;750 to 1050 (&gt;30 to 42)</td>
<td>40 x 40 x 3 (1½ x 1½ x 1/8)</td>
<td>6 (1/4)</td>
</tr>
<tr>
<td>&gt;1050 to 1500 (&gt;42 to 60)</td>
<td>40 x 40 x 3 (1½ x 1½ x 1/8)</td>
<td>10 (3/8)</td>
</tr>
<tr>
<td>&gt;1500 to 2100 (&gt;60 x 84)</td>
<td>50 x 50 x 3 (2 x 2 x 1/8)</td>
<td>10 (3/8)</td>
</tr>
<tr>
<td>&gt;2100 to 2400 (&gt;84 x 96)</td>
<td>50 x 50 x 5 (2 x 2 x 1/8)</td>
<td>10 (3/8)</td>
</tr>
<tr>
<td>&gt;2400 (96) and over</td>
<td>50 x 50 x 6 (2 x 2 x ¼)</td>
<td>10 (3/8)</td>
</tr>
</tbody>
</table>

.4 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:

<table>
<thead>
<tr>
<th>System</th>
<th>Class</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC Supply and Return</td>
<td>B</td>
<td>Galvanized steel</td>
</tr>
<tr>
<td>General Exhaust</td>
<td>B</td>
<td>Galvanized steel</td>
</tr>
<tr>
<td>Ventilation Plenum</td>
<td>B</td>
<td>Galvanized steel</td>
</tr>
<tr>
<td>Exhaust Plenum</td>
<td>B</td>
<td>Galvanized steel</td>
</tr>
<tr>
<td>Individual Exhaust</td>
<td>C</td>
<td>Galvanized steel</td>
</tr>
</tbody>
</table>

.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:

<table>
<thead>
<tr>
<th>Duct Size</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm (&quot;&quot;)</td>
<td>mm (&quot;&quot;)</td>
</tr>
<tr>
<td>to 1500 (60&quot;)</td>
<td>3000 (120&quot;)</td>
</tr>
<tr>
<td>over 1500 (60&quot;)</td>
<td>2500 (100&quot;)</td>
</tr>
</tbody>
</table>

.4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

### 3.3 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.

### 3.4 LEAKAGE TESTS

.1 Co-ordinate leakage testing with TAB contractor. 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 then 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).

### 3.5 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.

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.
.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

.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

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 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 National Controlled Air (NCA)
   .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

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

**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 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
.3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
.5 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 Rigid fibrous glass duct liner: air stream side faced with mat facing.
.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
.3 Acceptable material:

.1 Johns Manville, Permacote Linacoustic R-300
.2 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: 36 kg/m² (7.4 lb/ft²).
.4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness 1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.

2.2  ADHESIVE

.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 -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 SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.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
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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.

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 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

.7 Provide factory mounted speed control for all direct drive motors.

2.2 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.

2.3 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 at roofline.

.3 Provide backdraft damper at building exterior penetration.

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 him 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 Krueger
      .2 E.H. Price
      .3 Nailor
2.2 RETURN AND EXHAUST GRILLES

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.

.2 Type R1: Off white finish, steel 32 mm (1¼”) border, single 45 deflection, horizontal face bars, heavy duty gymnasium grille, flat border frame, screwed fastening. Model: Krueger S480.

.3 Type, size, and capacity: as indicated.

2.3 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.

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.
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 Rain caps.

.3 Venting manufacturer shall provide shop drawings for review based on boiler model and 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.
The vent shall be constructed with an inner and outer tube, with an annular space between the tubes of 25 mm (1”).

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.

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.

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.

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.

All systems components shall include a factory installed, internal mechanical locking band for fastening and securing all vent components against each other.

Vent layout shall be designed and installed in compliance with manufacturer’s installation instructions boiler manufacturer, and all applicable local codes.

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

### 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.

### TYPE B GAS VENT

1. ULC labelled, 288ºC (550ºF) rated maximum, atmospheric gas vent only.
2.4 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 Rain cap.
.5 Expansion sleeves with heat resistant caulking, held in place as indicated.
.6 Stainless Steel 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 rain caps and cleanouts, as indicated.

END OF SECTION
Part 1  General

1.1  OWNER PRE-PURCHASED UNITS
   .1 The HVAC unit identified in this specification and on the drawings has been pre-
       purchased by the Owner. This contractor is responsible for coordinating delivery,
       receiving the unit, storing the unit as necessary, craning the unit on to the roof, and
       maintaining the unit warranty.

1.2  REFERENCES
   .1 All codes, standards, etc. as referenced shall be the latest edition.
   .3 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.
   .4 CSA B52, Mechanical Refrigeration Code.
   .5 CSA C22.1, Canadian Electrical Code, Part 1.
   .7 ANSI/UL 1995, Central Cooling Air Conditioning.

1.3  SHOP DRAWINGS
   .1 Submit shop drawings in accordance with general requirements.
   .2 Indicate:
       .1 Equipment, and connections, together with control assemblies, auxiliaries and
           hardware, and recommended ancillaries which are mounted, wired and piped
           ready for final connection to building system, its size and recommended bypass
           connections.
       .2 Piping, valves, fitting shipped loose showing final location in assembly.
       .3 Control equipment shipped loose, showing final location in assembly.
       .4 Dimensions, internal and external construction details, recommended method
           of installation with proposed structural steel support, mounting curb details,
           sizes and location of mounting bolt holes; include mass distribution drawings
           showing point loads.
       .5 Detailed composite wiring diagrams for control systems showing factory
           installed wiring and equipment on packaged equipment or required for
           controlling devices or ancillaries, accessories, controllers.
       .6 Details of vibration isolation.
       .7 Estimate of sound levels to be expected across each individual octave band in
           dB referred to A rating.
       .8 Type of refrigerant used.
1.4 MAINTENANCE DATA
.1 Provide maintenance data for incorporation into manual specified in general requirements.
.2 Indicate:
  .1 Brief description of unit, indexed, with details of function, operation, control, and service for each component.
  .3 Manufacturer’s installation instructions shall govern and unless otherwise noted, operation, maintenance and service of items. Include names and addresses of spare part suppliers.
.4 Include following:
  .1 Provide for each unit, manufacturer’s name, type, year, number of units, and capacity.

1.5 WARRANTY
.1 Manufacturer hereby warrants refrigeration compressors in accordance with GC 24, but for 5 years.
.2 Manufacturer hereby warrants the gas heat sections for a minimum of 10 years.

Part 2 Products

2.1 HIGH EFFICIENCY HVAC EQUIPMENT (15 TONS & LESS)
.1 Efficiency:
  .1 Exceeds the minimum ASHRAE 90.1 Energy standards ratings by 2 units (5 ton and under) and by 1.0 unit (over 6 tons).
  .2 Units under 5 tons of cooling meet a SEER rating of 15.0.
  .3 Units 6 tons of cooling and larger meeting a EER rating of 12.0 (9.6 for 12½ ton unit).
  .4 Electronic controls with data link and diagnostic operation.
  .5 Energy Star rated.
.2 General:
  .1 Roof mounted, self-contained single zone unit with gas burner and DX refrigeration and bear label of CSA, CGA, and ULC.
  .2 Units to consist of cabinet and frame, supply fan, glycol heating coil, air filter, refrigerant cooling coil, compressor, condenser coil and fans, motorized opposed blade outside air damper, return damper, gravity exhaust damper or power exhaust as indicated.
  .3 Prefabricated roof curb complete with isolation rails (where indicated) to conform to requirements of National Roofing Contractors Association (NRCA), minimum height as indicated.
  .4 Conform to ANSI/ARI 210/240, rating for unit larger than 40 kW (136 MBH) nominal.
  .5 All units shall be of the same manufacture.
.3 Cabinet:

.1 Cabinets: weatherproofing tested and certified to AGA and soundproofing tested to ARI 270.

.2 Framing and supports: 2 mm (14 gauge) thick welded steel, galvanized after manufacture, with lifting lugs.

.3 Outer casing: weathertight galvanized steel, bonderized with baked enamel finish, complete with flashing.

.4 Access: removable gasketted panels with screwdriver operated flush cam type fasteners. Provided hinged access doors with \( \frac{1}{4} \)" polyamide handles turn.

.5 Insulation: foil faced neoprene coated glass fiber on all surfaces where conditioned air is handled, 1.6 mm (16 gauge) thick, 2.2 kg/m (1.5 lb/ft) density.

.6 Provide hinged side filter access door.

.4 Fans:


.5 Air Filters:

.1 50 mm (2") thick, MERV 8, permanent metal framed, replaceable media standard to unit manufacturer.

.2 To meet ANSI/NFPA 90A, air filter requirements.

.6 Heating Coil:

.1 Extended surface type, constructed of 15 mm (1/2") O.D. seamless copper tube and continuous aluminum plate fins.

.2 Tubes shall be pressure bonded to the fin collars by expanding the tubes into the fin collars.

.3 Stagger tube design circuited to optimize capacity with minimum pressure drop.

.4 Die formed into a rippled pattern aluminum fins to provide maximum capacity with minimum air pressure drop and spaced not closer than 12 fins per 25 mm (per inch).

.5 Headers shall be seamless copper tubes with 3 mm (1/8") drain and vent connections brazed into tubes.

.6 Casings shall be constructed of heavy gauge galvanized steel with tube sheets having extruded tube holes.

.7 Coil shall be factory leak tested at 2070 kPa (300 psig) dry air pressure and shall be designed for 125 working pressure. Maximum water pressure drop shall be 15 kPa (2.17 psi or 5.0 ft w.c.) and maximum air pressure drop shall be 0.1 kPa (0.375 in w.c.).

.8 Coils shall be removable from the unit at the header end, unless shown otherwise on the drawings. All water coils shall be equipped with a capped vent tapping at the top of the return header, and a capped drain tapping at the bottom of the supply header.
.9 Coils shall be cleanable type provided with brass fittings and removable plugs for each tube at the return end. Cast iron headers must have brass plugs to prevent oxidization.

.10 Water and glycol coils shall be circuited to provide adequate tube velocities to meet design requirements. Internal turbulators are not acceptable.

.11 Water coils shall be A.R.I. Certified.

Refrigeration:

.1 Conform to CSA B52 and ANSI/UL 1995 requirements.

.2 Compressor/condenser section:
  .1 Semi-Hermetic compressor(s), vibration isolated with flexible suction and discharge connections, oil sight glass, oil pressure switch, crankcase heater, and with control to liquid line solenoid valve.
  .2 Fans: propeller type with single piece spun venturi outlets and zinc plated guards. Motors shall be sequenced for head pressure control.
  .3 Electrical system shall have operating controls, oil and refrigerant pressure protection, motor overload protection, weatherproof electrical wiring with weatherproof, rain tight disconnect.
  .4 Include refrigerant piping with automatic hot gas bypass, sight glass, filter and valves.
  .5 Condenser: staggered copper tube aluminum fin coil assembly with sub-cooling rows.
  .6 Capacity reduction: hot gas bypass and or cylinder unloading.
  .7 Refrigerant: R410A.

.3 Evaporator:
  .1 Rated to ANSI/ARI 210/240.
  .2 Thermostatic expansion valve, with adjustable super heat and external equalizer.
  .3 Coil: staggered seamless copper tubes expanded into aluminum fins, and insulated condensation pan.
  .4 Cooling coil condensate drain pans: designed to avoid any standing water, to be easily cleaned or removable for cleaning. Drain connection to have deep seal trap and be complete with trap seal primer.

Controls and Safeties:

.1 Electronic control.
.2 Network monitoring.
.3 Scrolling Marquee display.
.4 Unit control with standard suction pressure transducers and condensing temperature thermistors.
.5 Provide a 5 F° temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard.
.6 Display a current alarm list and an alarm history list.
.7 Automatic compressor redundancy.
.8 Service run test capability.
.9 Shall accept input from a CO₂ sensor (both indoor and outdoor).

.10 Configurable alarm lights shall be provided which activates when certain types of alarms occur.

.11 Compressor minimum run time (3 minutes) and minimum off time (5 minutes).

.12 Service diagnostic mode.

.13 Economizer with enthalpy control.

.14 Self-contained low-voltage control circuit.

.15 Unit shall have 0°F low ambient operation.

.16 Solid-state compressor lockout which provides optional reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:

.1 Compressor lockout protection provided for either internal or external overload.

.2 Low-pressure protection.

.3 Freeze protection (evaporator coil).

.4 High-pressure protection (high pressure switch or internal).

.5 Compressor reverse rotation protection.

.6 Loss of charge protection.

.17 Supply-air sensor located in the unit and detect both heating and cooling operation.

.18 Heating section with the following minimum protections:

.1 High-temperature limit switch.

Unit Controls:

.1 In addition to combustion safety controls, provide low limit on supply.

.2 Zone cooling control:

.1 Zone sensor or room thermostat to activate cooling relay in control circuit cycling compressor. Provide safeties and pressure controls. Condenser fans to operate in sequence.

.2 When call for cooling is satisfied, relay is de-energized. On two compressor units provide separate circuits to evaporator and condenser and manual double pole double throw switch for lead-lag unit choice.

.3 Zone heating control:

.1 Adjustable zone sensor or room thermostat controls burner operation, to maintain room temperature setting.

.4 Mixed air control:

.1 Motorized outside, return and gravity relief dampers with spring return damper operator and control package to automatically vary outside air quantity. Outside air and exhaust air dampers, normally closed.

.2 Tight fitting opposed blade dampers with neoprene or suitable gaskets, synthetic bushings and 1% maximum leakage.

.3 Damper operation: 24 V, spring return motor with gear train sealed in oil.
.4 Mixed air controls: maintain 14°F (57°F) mixed air temperature, lock out compressor below 10°C (50°F) ambient, restart 15°C (59°F), revert dampers to provide 25% fresh air above 21°C (70°F) adjustable.

.5 Two speed fans shall operate on low speed for ventilation and first stage heating. On call for 2 stage heating or cooling, the fan shall operate at high speed.

.6 The units shall be capable of accepting a BAS signal to operate in high speed when requested.

2.2 SYSTEM CONTROL

.1 Equipment control will be by the unit manufacturer and integral economizer controls.

.2 System controls will be by Building Automation System Contractor.

.3 The HVAC equipment shall be capable of controlling the outdoor air damper thru a 0 – 10 Vdc BAS signal via the CO₂ port input. Manufacturers shall visit the site and reset equipment so 0 volts is closed, 10 volts is 100% open and in a linear response from the BAS controls.

2.3 CAPACITY

.1 As indicated.

2.4 ACCESSORIES

.1 Adapter curb.

.2 Vibration rail.

.3 Opposed blade economizer dampers.

.4 Condenser coil guard.

.5 Power exhaust.

.6 CO2 control of economizer damper with W7220 Economizer control.

.7 One ‘VFD Display Kit’ to reset slow speed to a value determined by the consultant and TAB contractor.

2.5 ELECTRICAL REQUIREMENTS

.1 As indicated.

2.6 ACCEPTABLE MATERIALS

.1 York.
Part 3  Execution

3.1  INSTALLATION

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated. Provide all necessary continuous welded wood blocking to install roof curb level complete with 20 gauge liner to ensure combustible wood blocking is not exposed in the building.

.2 Manufacturer to certify installation, supervise start-up and commission unit.

.3 Run drain line from cooling coil condensate drain pan to discharge over roof drain.

3.2  START-UP/COMMISSIONING

.1 Unit manufacture shall perform start-up and commissioning.

3.3  SPARE PARTS

.1 Two (2) complete sets of filters.

.2 One (1) set of spare belts.

3.4  WARRANTY

.1 One (1) year on parts and labour on all components.

.2 Five (5) years on compressor.

.3 Ten (10) years on reheat coil.

END OF SECTION
Part 1  GENERAL

1.1  GENERAL NOTES

.1 This Section is to be read in conjunction with Division 1, the General Conditions and Section 20 05 11, the General Requirements of the Mechanical Trades, and the documents required by the BIDDING REQUIREMENTS and CONDITIONS OF THE CONTRACT sections.

1.2  SCDSB BAS CONTROL DESIGN BRIEF

.1 The control design brief shall form an integral part of the specifications and be read in conjunction with this section. Where system functions and or equipment has been indicted elsewhere the most stringent shall apply.

.2 General

.1 This project is an upgrade of an existing DDC control system. The work shall include an upgrade to the existing and provision of a new BAS system including 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 SCDSB 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.
.3 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 SCDSB 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 SCDSB operations, maintenance and technical staff. See Training.

.4 Approved System

.1 Bids for the BAS contract will only be accepted from authorized vendors/installers of the Reliable Controls product:

.1 Set Point Building Automation Inc.
16 Spinnaker Way, Unit 1
Concord, Ontario
L4K 2T8
Tel: 905-669-8012
Fax: 905-669-6912
Contact: Mr. Mark Remus

.5 Submittals

.1 Submit the six (6) copies of following information to the consultant and/or the SCDSB 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.
.6 Related Work

.1 Unless otherwise specified, the following work shall be furnished by others.

.2 The mechanical sub-contractor shall provide:
   .1 Water treatment system mechanical wiring.

.3 The BAS contractor shall provide:
   .1 AHU freeze stats and high limit

.4 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.

.7 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, 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 SCDSB.

.2 Supply licenses for all supplied software directly to the SCDSB Project Supervisor.

.8 System Remote Access

.1 WAN Access

Provide necessary interface and cabling to connect the BAS to the SCDSB WAN. Obtain the particular WAN system details from the Engineer or SCDSB Project Supervisor.

WAN IP address to be supplied by SCDSB.

.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 laminate ID label.

.8 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 SCDSB.
      .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 SCDSB 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 whenever specified system alarms are active.

.9 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°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 Cover 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°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 CO2 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.

.10 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 SCDSB-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.

.11 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.

.12 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 +/-1°C 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.
.13 Training

.1 SCDSB 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.

.14 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.

.15 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 SCDSB 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 SCDSB 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.

.16 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 SCDSB 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:

.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 SCDSB 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 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 from 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 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.

.17 Reliable BAS Database Naming Conventions and Programs
   .1 Miscellaneous Equipment Naming Conventions

<table>
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<th>OUTPUTS</th>
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</thead>
<tbody>
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</tr>
<tr>
<td>Exhaust Fan Status</td>
<td>EF # Status</td>
</tr>
<tr>
<td></td>
<td>Exhaust Fan Control</td>
</tr>
</tbody>
</table>

.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.

1.3 RELATED WORK SPECIFIED ELSEWHERE
   .1 Plumbing & Drainage
   Ventilation & Air Conditioning
   Testing & Balancing
   HVAC System Commissioning
   Electrical
   .2 Supply all necessary efforts to provide the project DDC system as specified.

1.4 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. The work shall include but is not limited to the following:
     .1 Extension of the existing programmable building automation control (BAS) system.
     .2 Control and monitoring of indoor space temperature.
.3 Local/remote system control/monitoring via BACnet/IP TCP/IP Ethernet LAN/WAN connections.

.4 RTU-1 AND RTU-2

.5 Exhaust Fan Control.

.6 Radiation heating control.

.7 Building low temperature Low building temperature alarm (all spaces with sensor).

.8 All control valves, dampers, operators, etc, required under this contract.

.9 All electric wiring, switches, relays, etc., for a complete operating system.

.10 All wiring incidental to controls system.

.11 System and equipment trending and scheduling.

.12 System training.

.4 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.

.5 All electrical wiring, mechanical installations, and control sequences shall comply with local and provincial electrical and mechanical codes.

.6 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.

1.5 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 ELECTRICAL 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/m² (30 cfm/ft²) 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/m² (6 cfm/ft²) 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.

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.

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.

Acceptable Material

.1 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.

.3 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.

.4 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.

<table>
<thead>
<tr>
<th>User Date</th>
<th>Consultant Date</th>
</tr>
</thead>
</table>

.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.

<table>
<thead>
<tr>
<th>User Date</th>
<th>Consultant Date</th>
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</table>

.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.

<table>
<thead>
<tr>
<th>User Date</th>
<th>Consultant Date</th>
</tr>
</thead>
</table>
.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 DESCRIPTION

.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 colour graphic 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 colour graphic 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:

- Facility layout (showing buildings, streets, etc.)
- Individual area layouts or isometrics
- Any other graphics necessary for logical penetration
- Individual HVAC systems graphics
- Sequences of operation
- Flowcharts for critical DDC loops
- Supervisor graphics
- 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:

- 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.

- 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

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 SCDSB 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 SCDSB 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.

.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 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 humidities (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 no 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:

.1 Boiler Graphic (glycol Loop Similar)
   .1 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 from 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 Exhaust Fan (EX-EF-1 THRU EF-EX-6)
.1 Provide programmable override start/stop status control at the OWS.
.2 Provide dual voltage relays for exhaust fan rated for 120V/1/60. Install dual voltage relays in accessible ceiling space adjacent to exhaust fan.
.3 Existing fan to be interlocked to new dishwasher.

.3 EXHAUST FAN (EF-3)
.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 the electrical contractor.
.4 Provide override stop/start/status for fans with local control.

.4 HVAC UNITS’ CONTROL (CONSTANT VOLUME) (RTU-1)
.1 Unit Control
The HVAC unit consists of outdoor air/economizer, power exhaust, filter, Dx cooling coil, supply fan, and an internal glycol heating coil with remote 2-way control valve. The unit is DDC controlled using electronic actuation. Building automation control functions shall include unit scheduling, occupied/unoccupied mode, room air temperature setpoint adjustment, mixed air damper minimum position setpoint, demand control ventilation setpoint adjustment, power exhaust fan enable setpoint adjustment, timed override and alarm shutdown
Note: 2-speed control relays not required, fan speed is controlled via integral controller based on heat-cool demand.
.2 Fan Start-Stop Control
Temperature Start-Stop: The HVAC unit is started and stopped based on a time schedule.
Occupied Mode
Space temperature demand determines unit heat-cool mode.
The space temperature setpoint is adjustable at the operator workstation.
Heating capacity control modulates the two control valve on the glycol heating coil to maintain the space heating demand.
Cooling capacity control stages DX compressors to maintain the space cooling demand.
Economizer free cooling control shall remain with the HVAC unit integral economizer control system.
Night Cycle: Should temperature still drop below setpoint HVAC unit will energize in heating mode until setpoint is reached then shut off.
Supply Fan Shutdown Delay: If the fan system is shut down while heating or cooling stages are energized, the stages will immediately de-energize and the fan will continue to run for 60 sec. (heating mode, adj.) or 30 sec. (cooling mode, adj.) more, then shut down.

Manual Override Timer: The HVAC shall be started if the manual override timer switch is activated. The HVAC system will then run until the switch times out in the optimum temperature start/stop mode (OTSS).

.3 Fan "OFF" Mode: The cooling and heating stages are disabled. The outdoor air and relief air dampers are fully closed and the return air damper is open.

.4 Fan "ON" Mode, Room Temperature Control: The heating and cooling stages will be activated appropriately to maintain the space air temperature at its setpoint.

Mechanical Cooling Low Temperature Lockout: If the outdoor air temperature falls below its Mechanical Cooling Lockout setpoint, it will prevent the cooling stages from being energized.

Fan System Failure Alarm: An alarm is generated whenever the supply fan fails to respond to start-stop commands.

Ventilation: The HVAC unit shall operate in the ventilation schedule when the unit is neither heating or cooling.

CO2 Control: When a CO2 sensor mounted in the space and in the occupied time schedule, the respective HVAC unit outdoor air damper shall adjust open until the CO2 level is acceptable (one CO2 sensor per system).

CO2 setpoints shall be linear as follows:

.1 10% at 500 ppm
.2 40% (maximum) at 1200 ppm

2 Speed Control: When there is no call for heat/cool, the fan is at 67%. Unit will control to space temperature setpoint as sensed by the thermostat. On call for heating, fan is 100%. On a call for cooling, above 50% cooling demand, fan is 100%.

Override: Provide a 3 hour override button on thermostat to change unoccupied period to occupied. BAS can schedule units off.

Safety

When the OAT is less than 50 degrees F (10 degrees C), the 2-way heating valve and dampers modulates to maintain the mixed air temperature at 50 degrees F (10 degrees C). When the OAT is 50 degrees F (10 degrees C) or above, the 2-way heating valve closes. All other dampers and valves position to their normal position after the fans are de-energized.

A hard wired low temperature detector in the discharge duct de-energizes the supply fan when temperatures below 38 degrees F (3 degrees C) are sensed.
.5 HVAC UNITS’ CONTROL (CONSTANT VOLUME) (RTU-2)

.1 Unit Control
The HVAC unit consists of outdoor air/economizer, power exhaust, filter, Dx cooling coil, supply fan, and an internal glycol heating coil with remote 2-way control valve. The unit is DDC controlled using electronic actuation. Building automation control functions shall include unit scheduling, occupied/unoccupied mode, room air temperature setpoint adjustment, mixed air damper minimum position setpoint, demand control ventilation setpoint adjustment, power exhaust fan enable setpoint adjustment, timed override and alarm shutdown.

Note: 2-speed control relays not required, fan speed is controlled via integral controller based on heat-cool demand.

.2 Fan Start-Stop Control

**Temperature Start-Stop:** The HVAC unit is started and stopped based on a time schedule.

**Occupied Mode**
Supply air temperature discharge sensor operates the 2-way heating valve, the DX cooling, and the mixing dampers (for mixed air temperature and/or free cooling) in sequence to maintain setpoint which is reset from outside air temperature as follows:

<table>
<thead>
<tr>
<th>OAT (°C)</th>
<th>SAT (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22°C</td>
<td>13°C</td>
</tr>
<tr>
<td>10°C</td>
<td>18°C</td>
</tr>
</tbody>
</table>

Heating capacity control modulates the two control valve on the glycol heating coil to maintain the space heating demand.

Cooling capacity control stages DX compressors to maintain the space cooling demand.

Economizer free cooling control shall remain with the HVAC unit integral economizer control system.

**Night Cycle:** Should temperature still drop below setpoint HVAC unit will energize in heating mode until setpoint is reached then shut off.

**Supply Fan Shutdown Delay:** If the fan system is shut down while heating or cooling stages are energized, the stages will immediately de-energize and the fan will continue to run for 60 sec. (heating mode, adj.) or 30 sec. (cooling mode, adj.) more, then shut down.

**Manual Override Timer:** The HVAC shall be started if the manual override timer switch is activated. The HVAC system will then run until the switch times out in the optimum temperature start/stop mode (OTSS).

.3 Fan "OFF" Mode: The cooling and heating stages are disabled. The outdoor air and relief air dampers are fully closed and the return air damper is open.

.4 Fan "ON" Mode, Room Temperature Control: The heating and cooling stages will be activated appropriately to maintain the space air temperature at its setpoint.

**Mechanical Cooling Low Temperature Lockout:** If the outdoor air temperature falls below its Mechanical Cooling Lockout setpoint, it will prevent the cooling stages from being energized.
Fan System Failure Alarm: An alarm is generated whenever the supply fan fails to respond to start-stop commands.

Ventilation: The HVAC unit shall operate in the ventilation schedule when the unit is neither heating or cooling.

CO2 Control: When a CO2 sensor mounted in the space and in the occupied time schedule, the respective HVAC unit outdoor air damper shall adjust open until the CO2 level is acceptable (one CO2 sensor per system).

CO2 setpoints shall be linear as follows:

1. 10% at 500 ppm
2. 40% (maximum) at 1200 ppm

2 Speed Control: When there is no call for heat/cool, the fan is at 67%. Unit will control to space temperature setpoint as sensed by the thermostat. On call for heating, fan is 100%. On a call for cooling, above 50% cooling demand, fan is 100%.

Override: Provide a 3 hour override button on thermostat to change unoccupied period to occupied. BAS can schedule units off.

Safety
When the OAT is less than 50 degrees F (10 degrees C), the 2-way heating valve and dampers modulates to maintain the mixed air temperature at 50 degrees F (10 degrees C). When the OAT is 50 degrees F (10 degrees C) or above, the 2-way heating valve closes. All other dampers and valves position to their normal position after the fans are de-energized.

A hard wired low temperature detector in the discharge duct de-energizes the supply fan when temperatures below 38 degrees F (3 degrees C) are sensed.

Building Low Temperatures

1. All space sensors shall be capable of indicating building low temperature. Alarm building low temperatures at OWS.

3.7 ELECTRICAL

1. Rules and Regulations: The entire installation shall conform to Division 16 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 Reliable 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.

AH # Start PG – contains all start stop parameters for the air handler.

AH # Setpoint PG – contains all setpoint calculations for the specific air handler.

AH # Control PG – contains all control points for the air handler for both occupied and unoccupied modes.

AH # Zone Setpoint PG – contains all setpoint calculations and limitations for zones serviced by the air handler.

AH # Zone Feedback PG – contains calculation of zone temperature averages, coldest and warmest spaces.

All Rooftop air handlers shall start with the letters RT in the naming conventions.

.2 Boilers, Pumps, and Hydronic Heating Systems Examples:

Heating Enable PG – contains all enable/disable calculations for the entire heating system.

Heating Setpoint PG – contains all setpoint calculations for scheduled water temperatures for both occupied and unoccupied periods.

Heating Control PG – contains control strategies for all heating equipment controlled from the panel.

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.

### Air Handler Systems Name Conventions

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Point Name</th>
<th>Equipment</th>
<th>Point Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Fan Status</td>
<td>AH# SF Status</td>
<td>Supply Fan Control</td>
<td>AH# SF Control</td>
</tr>
<tr>
<td>Return Fan Status</td>
<td>AH# RF Status</td>
<td>Return Fan Control</td>
<td>AH# RF Control</td>
</tr>
<tr>
<td>Supply Fan Speed Status</td>
<td>AH# SF Spd St</td>
<td>Supply Fan Speed Control</td>
<td>AH# SF Spd Ctrl</td>
</tr>
<tr>
<td>Return Fan Speed Status</td>
<td>AH# RF Spd St</td>
<td>Return Fan Speed Control</td>
<td>AH# RF Spd Ctrl</td>
</tr>
<tr>
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.2 Heating Systems

.3 Heating Systems Naming Conventions

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.3 Lighting Equipment Naming Conventions

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.4 Miscellaneous Equipment Naming Conventions

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.5 Network Status Panel Naming Conventions should indicate the school, panel location, and panel number. The school name can be abbreviated as necessary to fit the space.
3.9 POINTS LIST

.1 The points list appended here 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 the contractor in providing a complete system. It is the contractor’s responsibility to ensure the BAS system is installed and operates as specified.

END OF WRITTEN SECTION
PLEASE REFER TO ATTACHED POINTS LIST
<table>
<thead>
<tr>
<th>CONTROL POINTS</th>
<th>DEVICE</th>
<th>DO</th>
<th>DI</th>
<th>AO</th>
<th>AI</th>
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