



**Request for Tender  
RFT 24-061**

**Gymnasium Addition  
at Glenview Public School**

**Closing Date: May 31, 2024**

**Closing Time: 2:00 p.m.**

Sealed RFTs will be received **via email to [chatelaina@hdsb.ca](mailto:chatelaina@hdsb.ca)**  
on or before 2:00 p.m., Eastern Daylight Time

***Late or Facsimile Bids will not be considered***

May 6, 2024

Amanda Chatelain, CPPO, CPPB  
Supervisor – Purchasing

## **Communications Notice**

To obtain documents online please visit: <https://hdsb.bidsandtenders.ca>

If you subscribe to bids & tenders you can login to your account to download the document(s) without the preview watermark. You may also opt to purchase a one-time download for this opportunity. Documents are not provided in any other manner.

All proponents shall be registered as a Plan Taker for this opportunity, which will enable the proponent to download the Request for Proposal (RFP) without the watermark preview, to receive addenda email notifications, and to download addenda.

Should the HDSB receive a proposal that is subsequently found to be from a bidder that is not registered with bids & tenders and the bidder did not obtain the proposal document from <https://hdsb.bidsandtenders.ca> the HDSB reserves the right to remove the proposal from further consideration.

To ensure receipt of the latest information and updates via email regarding this opportunity, the onus is on the proponent to register as a Plan Taker for this opportunity at <https://hdsb.bidsandtenders.ca>.

The following documents form part of all HDSB competitive proposal documents:

HDSB Procurement Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/Procurement.pdf>

HDSB Asbestos Management in Facilities Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/AsbestosManagementInFacilities.pdf>

HDSB Vendor Performance Management Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf>

Broader Public Sector Procurement Directive

[https://www.doingbusiness.mgs.gov.on.ca/mbs/psb/psb.nsf/Attachments/001-BPS\\_Procurement\\_Directive/\\$FILE/BPS\\_Procurement\\_Directive.pdf](https://www.doingbusiness.mgs.gov.on.ca/mbs/psb/psb.nsf/Attachments/001-BPS_Procurement_Directive/$FILE/BPS_Procurement_Directive.pdf)

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## **Part A – Outline and Instructions**

### **1. Introduction and Board Profile**

The Halton District School Board is composed of approximately 104 school locations (86 elementary and 18 secondary schools). These locations service approximately 65,000 regular day school students (Junior Kindergarten to Grade 12). The HDSB employs approximately 10,860 employees. Please visit <http://www.hdsb.ca> for additional information.

### **2. General Terms of the RFT**

The Halton District School Board, hereinafter referred to as HDSB, is seeking qualified Contractors to provide all the necessary labor, materials and equipment to complete a Gymnasium Addition at Glenview Public School located at 143 Townsend Ave, Burlington, ON L7T 1Z1. Specific details of the RFT are to be found in the attached scope of work, drawings and photographs.

### **3. Bid Security and Bonding Requirements**

Any bid submission equal to or greater than \$500,000 inclusive of tax, must be submitted with a Bid Bond in the value of ten percent (10%) of the Total Cost and a Surety Consent in favour of the Halton District School Board. The Surety Consent shall cover a Performance Bond and a Labour & Materials Payment bond, each in the amount of fifty percent (50%) of the contract price as a guarantee that the Bidder shall execute the contract upon award. The Bid Security so submitted shall be irrevocable and valid for 90 from the closing date set for the submission of tender.

In order to be considered for award of a contract equal to or over \$500,000 inclusive of tax, the Bidder shall submit as part of their Submission, a Surety Consent, completed by a Bonding Company. Any others will not be accepted.

Upon receipt of written notice from the Halton District School Board that it has been awarded the Contract, the successful Bidder shall provide, within five (5) working days of such notice, an original Performance Bond and a Labour and Material Payment Bond, each for the amount of fifty per cent (50%) of the total lump sum price, to guarantee the performance of all obligations of the Contract.

### **4. RFT Closing Information**

The HDSB is currently unable to accept submissions via the Bids and Tenders platform. Bidders must submit their Submission **via email** on or before 2:00 p.m., Eastern Daylight Time on **May 31, 2024** (the “Closing Time”) to the following address:

**chatelaina@hdsb.ca**  
**Attention: Amanda Chatelain**

Submissions will be deemed to be officially received by the time stamp issued by the HDSB’s email server. Submissions received after the official closing time will be

declared non-compliant and shall not be considered during the selection process. Electronic submission shall be no larger than 25MB. Proponents are responsible for confirming that their submission has been successfully received.

### **5. Accuracy of Information/Liability for Errors or Omissions**

While the HDSB has used considerable efforts to ensure an accurate representation of information in this document, the information contained in it is supplied solely as a guideline for Bidders. Any data contained in this RFT or provided by way of Addenda are estimates only and are for the sole purpose of indicating to the Bidder the general size of what is being requested hereunder. The information is not guaranteed or warranted to be accurate by the HDSB, nor is it necessarily comprehensive or exhaustive. Nothing in this document is intended to relieve Bidders from forming their own opinions and conclusions with respect to the matters addressed in this RFT. It is the Bidder's responsibility to avail itself of all the necessary information to prepare a Submission in response to this RFT.

### **6. Communication After RFT Issuance**

All Communications regarding any aspect of this RFT must be submitted via Bids and Tenders. Bidders that fail to comply with the requirement to direct all communications to the RFT Authority via Bids and Tenders may be disqualified from this RFT process.

Without limiting the generality of this provision, Bidders shall not communicate with or attempt to communicate with the following as it relates to this RFT:

- any employee or agent of the HDSB, other than the RFT Purchasing contact;
- any member of the HDSB governing body including, without limitation, the director, officers, trustees, superintendents, and any advisors thereto;

Bidders shall promptly examine this RFT and all Appendices, including the Form of Tender, and:

- shall report any errors, omissions or ambiguities; and
- may direct questions or seek additional information on or before the Deadline for Questions to the RFT Purchasing contact.

It is the responsibility of the Bidder to seek clarification, by submitting questions to the RFT Authority via Bids and Tenders, on any matter it considers to be unclear. The HDSB shall not be responsible for any misunderstanding on the part of the Bidder concerning this RFT or its process.

In the event a Bidder has any reason to believe that an error, omission or ambiguity exists, the Bidder must notify the RFT Authority via Bids and Tenders prior to submitting a Proposal.

If appropriate, the RFT Authority will then clarify the matter for the benefit of all Bidders by publication on the same public platform, its website or by notice to Bidders who have requested a copy of this RFT in the same manner as set out in section 6 below.

In answering a Bidder's questions, the HDSB will set out the question, without identifying the Bidder that submitted the question, and the HDSB may in its sole discretion:

- edit the question for clarity;
- answer similar questions from various Bidders only once.

Where an answer results in any change to the RFT, such answer will be formally evidenced through the issue of a separate addendum for this purpose.

### **7. Addenda**

If the HDSB for any reason, determines that it is necessary to provide additional information relating to this RFT, such information will be communicated to all Bidders by addendum in the same manner the RFT was communicated. Each Addendum shall form an integral part of this RFT. This RFT may only be amended in accordance with this section.

**All questions related to this Tender must be submitted in writing via bids and tenders prior to 2 p.m. on May 22, 2024. Any addendum will be posted no later than May 24, 2024.**

Any amendment or supplement to this RFT made in any other manner will not be binding on the HDSB. All Addenda shall become an integral part of this RFT and shall be incorporated into any content. Each Bidder shall be responsible for verifying before depositing its Proposal that it has received all Addenda that have been issued.

### **8. Planned Schedule of Events – Project Schedule**

<b>Event</b>	<b>Date</b>
Release of RFT	May 6, 2024
Site Meeting	May 7, 2024
Question Deadline	May 22, 2024
Issuance of Final Addendum	May 24, 2024
RFT Closing	May 31, 2024

## **9. Bidder's Costs**

Bidders shall bear all costs and expenses incurred relating to any aspect of its participation in this RFT process, including all costs and expenses relating to the Bidder's participation in:

- the preparation, presentation and receipt of its Submission;
- the Bidders attendance at any meeting in relation to the RFT process, including any presentation or interview;
- the conduct of any due diligence on its part, including any information-gathering activity;
- the preparation of the Bidder's own questions prior to the Deadline for Questions; and
- any discussion and/or finalization, if any, in respect of the Form of Agreement.

## **10. Bidding Format**

Unless otherwise specified in these RFT documents or the final contract entered into between the HDSB and the successful Bidder, responses shall be for a stipulated sum without escalator clauses or other qualifications (when applicable). Bidders submitting a bid with escalator clauses or other qualifications that are not in accordance with the terms and conditions of this RFT may have their bid rejected.

All information entered on this RFT document must be typewritten or entered in ink. No pencil entries will be accepted.

Erasure(s), overwriting or strike-out(s) must be initialed in ink by the person signing this Submission.

**Respondents will use the following format for their submission:**

- Form of Tender (complete form must be included with your submission, including bonds and any other information as may be required herein)
- Appendix A - Signed Declaration Sheet (must be included with your submission)
- Bid Security and Bonding Requirements as required

## **11. Pricing**

Please do not add tax to base (unit) price. (when applicable). Early payment discounts may be considered part of the Submission. Credit Card payment acceptance may be considered part of the Submission.

## **12. Subcontractors**

The General Contractor must select a subcontractor from the HDSB pre-qualified list of sub-contractors attached in Appendix B.

The Contractor agrees to preserve and protect the rights of the parties under the contract with respect to work performed under subcontract, and shall:

- enter into contracts or written agreements with their subcontractors to require them to perform their work in accordance with and subject to the terms and conditions of the contract. Further, the Contractor shall be fully responsible to the Owner for acts and omissions of their subcontractors and of any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by them.
- therefore, agree that they will incorporate the terms and conditions of the Contract Documents into all Subcontractor Agreements they enter into with their subcontractors.

The HDSB reserves the right, at its discretion to waive the requirement to utilize the mandatory list of pre-qualified sub-trades at any time during the tendering process based on market conditions.

## **13. Site Meeting**

There will be a Mandatory Site Meeting on May 7, 2024 at the main office of Glenview Public School located at 143 Townsend Ave, Burlington, ON L7T 1Z1. The Mandatory Site Meeting will start at 3:00 p.m..

Bidders must sign in upon their arrival. Bidders arriving after the specified start time will not be permitted to participate in the meeting, will be disqualified from the project, and asked to remove themselves from the site. Failure to be present and to sign in at all site visits will result in the disqualification of your submission.

Bidders shall follow Public Health and HDSB Covid-19 protocols while on site.

# Part B – Standard Terms and Conditions

## 14. Scope

Unless otherwise expressly stated these Standard Terms and Conditions form a part of this document and apply in like force to contracts for the purchase of commodities as stated in this document. All Bidders will be bound by the terms and conditions set forth, except as specifically qualified in Special Terms and Conditions issued in connection with this document or any Addenda issued relating to this document.

## 15. Definitions

As used herein as well as in all RFSQ, RFQ, RFP, RFI, Tender or contract documents issued by the Halton District School Board, the following definitions will apply.

<b>Addenda/Addendum</b>	an addition/change made to this document, subsequent to its printing or publication.
<b>Applicable Law and Applicable Laws</b>	means any common law requirement and all applicable and enforceable statutes, regulations, directives, policies, administrative interpretations, orders, by-laws, rules, guidelines, approvals and other legal requirements of any government and/or regulatory authority in effect from time to time.
<b>Bid/Submission/Proposal</b>	an offer from a Bidder in response to a Proposal/Tender which is subject to acceptance or rejection.
<b>Proponent</b>	a legal entity, being a company, partnership or individual who submits a Bid, Proposal, or Submission in response to a formal request for Bid, Proposal, or Submission.
<b>Board/HDSB</b>	means the Halton District School Board.
<b>Contract</b>	means the agreement, in writing, governing the performance of the Work and/or the purchase and sale of commodities and includes, without limitation, the document (including standard terms and conditions), Bidder Submission and the written document accepting the Bidder Submission (including any notice of acceptance or award).

<b>Document</b>	means the document describing the Goods and/or Services to be purchased and the terms upon which the Goods and/or Services are to be purchased and includes, without limitation, those documents referenced on the index of the document and such Addenda as may be issued by the HDSB.
<b>Goods or Services</b>	product and/or any and all labour, vehicles or equipment used by a Bidder in fulfilling a Contract.
<b>HST</b>	means Harmonized Sales Tax.
<b>Intellectual Property</b>	means any trademark, copyright, moral right, patent, industrial design, trade name, domain name, trade secret, know how, integrated circuit topography or other intellectual property, industrial property or proprietary right owned by, licensed to, or used by any third person.
<b>Mandatory Requirement</b>	a minimum requirement – where the words “mandatory”, “must”, “required”, “shall” and/or “will” are referenced in this document and such requirement is identified as a Mandatory Requirement. Failure to comply will deem the submission non-compliant and the bid/submission will be disqualified.
<b>Proposal/RFP</b>	a sealed written offer to supply Goods and/or Services of any value, acceptance of which may be subject to negotiation.
<b>Quotation/RFQ</b>	a written offer to supply Goods and/or Services with a value that is less than \$100,000.
<b>Response</b>	the package submitted by a Bidder in response to an RFP or RFT.
<b>Specifications</b>	those stated requirements for the Goods and/or Services set out in the document.
<b>Subcontractor</b>	a person, firm or corporation having a direct contract with the contractor to perform a part or parts of the Work, or to supply Goods worked to a special design according to the contract documents, but does not include one who merely supplies Goods not so worked.
<b>Tender/RFT</b>	a sealed written offer to supply Goods and/or Services with a value that is greater than \$100,000.

<b>Bidder Submission</b>	means the document as completed by the Bidder for the purpose of offering to sell to the HDSB the services and/or goods specified in the document, and includes but is not limited to Quotations, Tenders and Proposals.
<b>Work</b>	means the Work to be undertaken by the Bidder pursuant to the provisions of the Contract.

### **16. Reserved Rights of the HDSB**

The HDSB reserves the right to:

- (a) make public the names of any or all Bidders;
- (b) request written clarification or the submission of supplementary written information in relation to the clarification request from any Bidder and incorporate a Bidder's response to that request for clarification into the Bidder's Submission;
- (c) assess a Bidder's Submission on the basis of:
  - (i) a financial analysis determining the actual cost of the Submission when considering factors including quality, service, price and transition costs arising from the replacement of existing goods, services, practices, methodologies and infrastructure (howsoever originally established);
  - (ii) information provided by references;
  - (iii) the Bidder's past performance on previous contracts awarded by the HDSB;
  - (iv) the information provided by a Bidder pursuant to the HDSB exercising its clarification rights under this RFT process; or
  - (v) other relevant information that arises during this RFT process;
- (d) waive formalities and accept Submissions that substantially comply with the requirements of this RFT;
- (e) verify with any Bidder or with a third party any information set out in a Submission;
- (f) check references other than those provided by any Bidder;
- (g) disqualify any Bidder whose Submission contains misrepresentations or any other inaccurate or misleading information;
- (h) disqualify any Bidder or the Submission of any Bidder who has engaged in conduct prohibited by this RFT;
- (i) disqualify a Bidder for any conduct, situation or circumstance that constitutes a Conflict of Interest, as solely determined by the HDSB and at any time.
- (j) make changes, including substantial changes, to this RFT, provided that those changes are issued by way of addenda in the manner set out in this RFT;
- (k) select any Bidder other than the Bidder whose bid reflects the lowest cost to the HDSB;
- (l) review all Bidders utilizing the HDSB Vendor Performance Management Administrative Procedure, which can include suspension of Bidders who fail to meet the HDSB's expectations or who are involved in litigation or threatened



litigation against HDSB. The HDSB Vendor Performance Management Administrative Procedure is found at the attached link

([www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf](http://www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf))

- (m) award to one or more bidders according to their requirements;
- (n) cancel this RFT process at any time and for any or no reason;
- (o) cancel this RFT process at any stage and issue a new RFT for the same or similar deliverables;
- (p) accept any Submission in whole or in part; or
- (q) award to multiple bidders if circumstances are warranted;
- (r) reject any or all Submissions;
- (s) to limit the number of pre-qualified Bidders eligible to submit proposals for any future projects. HDSB shall not be obligated to provide all pre-qualified Bidders with the same opportunity to bid on all future projects within each stated category. By participating in this RFT, Bidders acknowledge that there is no guarantee that a Bidder will receive any assignments, work or projects and that there is no expectation that any specified number of projects will be made available during the pre-qualification term;

and these reserved rights are in addition to any other express rights or any other rights that may be implied in the circumstances.

In addition, the HDSB reserves the right at any time during normal business hours, and as often as the HDSB may deem necessary, to examine, the successful Bidder's records with respect to the successful Bidder's services under the Bidder's purchase order and/or Submission and any Contract. The successful Bidder shall permit the HDSB to audit, examine, and make copies, excerpts or transcripts from such records, and to make audits of data relating to matters covered by a Submission, any purchase order and/or any Contract. The successful Bidder shall maintain and retain all records and other documents related to a Submission, any purchase order, and/or any Contract for a period of seven (7) years from the date of final payment, except in cases where unresolved audit questions require a longer period of time for resolution, as determined by the HDSB.

### ***17. Litigation with the HDSB***

The HDSB may, in its absolute discretion, reject a Submission submitted by a Bidder **prior to or after a Submission opening, if the Bidder:**

- (a) is or has in the past 10 years been a party to litigation with the HDSB; or
- (b) directly or indirectly, including by common ownership or control or otherwise, is related to a party currently in litigation with the HDSB or a party that has in the past 10 years been in litigation with the HDSB; or

- (c) intends to use a subcontractor in respect of a specific project who is, or has in the past 10 years been a party to litigation with the HDSB, or who is related to a party currently in litigation with the HDSB or a party that has in the past 10 years been in litigation with the HDSB.

For the purposes hereof, the phrase “litigation with the HDSB” includes cases in which the Bidder or prospective Bidder or any of the parties named above, has advised the HDSB in writing of their intention to commence litigation, or have commenced or have advised the HDSB of their intention to commence an arbitral proceeding against the HDSB (excepting only construction lien demands, notices or proceedings or arbitrations under O. Reg 444/98 of the Education Act).

In determining whether or not to exercise its discretion as set out herein, the HDSB will consider whether the litigation (past or current) is likely to affect a Bidder’s ability to work with the HDSB, its consultants and representatives, and whether the HDSB’s experience with the Bidder, the related party or subcontractor, as the case may be, in the matter giving rise to the litigation, indicates that the HDSB is likely to incur increased staff and legal costs in the administration of the Contract if it is awarded to the Bidder.

### ***18. Accessibility for Ontarians with Disabilities (AODA)***

The HDSB is committed to accessibility and preventing and removing barriers for persons with disabilities. Where practicable, the HDSB will incorporate accessibility features and criteria when procuring or acquiring goods, services and facilities, in which case, a Bidder must be capable of recommending and delivering same in an inclusive and accessible manner, consistent with the Ontario Human Rights Code (“OHRC”), the Ontarians with Disabilities Act, 2005 (“AODA”) and its Regulations, in order to achieve accessibility for Ontarians with disabilities. If the HDSB determines that it is impractical to do so an explanation will be provided upon request.

In accordance with Ontario Regulation 429-07 made under the AODA, the HDSB has established policies, practices and procedures governing the provisions of its services to persons with disabilities, which may be found at:

<https://www.hdsb.ca/our-board/Pages/Accessibility.aspx>

### ***19. Ability to Negotiate/Contract Negotiations***

The HDSB reserves the right to enter into negotiations with any Bidder as it sees fit, or with another Bidder concurrently. The HDSB will not incur liability to any Bidder as a result of these negotiations.

The HDSB may, prior to and after Contract award, negotiate changes to the specifications, the type of materials or any conditions with the successful or preferred Bidder or one or more of the Bidders without having any duty or obligation to advise any other Bidder or to allow them to vary their bid prices as a result of such changes, and

the HDSB shall have no liability to any other Bidder as a result of such negotiations or modifications.

## ***20. Agree to Abide by the Established Process***

It is vital to the HDSB that the process leading to the recommendation of a bidder(s) and the conclusion of an agreement for the provision of these services be, and be seen to be, open and fair and that each of the respondents is treated equally.

No respondent can be seen to be deriving, intentionally or otherwise, an advantage or information, which is not equally available to all other respondents. Nor is it acceptable that any advantage or information be sought or obtained from any unauthorized staff or representative of the HDSB, or any benefit derived from any special or personal relationships or contacts.

All communications, including requests for information, between respondents to this RFT and the HDSB should be between only the representative(s) of the HDSB who has been authorized and designated for that particular purpose. Bidders must not rely on information from any other source.

## ***21. Assignment***

Unless otherwise stated in this document, it is mutually agreed and understood that the successful Bidder will not assign, transfer, convey, sublet or otherwise dispose of the Contract (in whole or in part) or the right, title or interest therein, or the Bidder's power to execute such contract to any other person, firm, company or corporation without the previous written consent of the HDSB. Any act in derogation of the foregoing shall be null and void. For the purposes hereof, the transfer or issuance of shares by a Bidder of more than fifty (50%) percent of the voting securities of a Bidder to any third party other than to an affiliate (as such term is defined in the Business Corporations Act (Ontario)) or the shareholder or shareholders of the Bidder as of the Closing Date, whether or not such transfer or issuance of voting securities takes place in one or more transactions, shall, for the purposes of this Agreement, be deemed to be an assignment of the Contract requiring the consent of the HDSB, unless such transfer or issuance of shares is made pursuant to an initial public offering of common shares under the Securities Act (Ontario).

## ***22. Award***

The final award will be based on (but not limited to) the best value for money and quality service delivery from a Bidder who complies with the provisions of this Submission solicitation, including specifications, contractual terms and conditions, who can reasonably be expected to provide satisfactory performance on the proposed Contract based on reputation, references, performance on previous contracts, and sufficiency of financial and other resources, and provides a solution that is a fit with the HDSB's requirements. The lowest price or bid shall not be the sole, determinative factor.

### **23. Breaking a Tie**

In the event of a tie score, the HDSB will resolve same based on the earlier date/time stamp of when the bid was received by HDSB in accordance with this RFT.

### **24. Change Orders**

A change order results when unforeseen conditions are identified from the original scope of work (Contract or Purchase Order) and is inextricably tied to the original scope.

The following steps should occur prior to issuance of a change order that does not originate from HDSB senior management:

- appropriate HDSB approval must be acquired prior to modifying any Contract or Purchase Order
- appropriate written HDSB approval must be obtained prior to commencing the work.

All requests or recommendations for Change Orders shall include the impact to both price and schedule for the work to be performed. HDSB shall have the right to retain consultants or experts to help identify the need or to verify the impact of the change order on the project.

No change in the work shall proceed without the written approval of the Owner. Any change shall be initiated by Owners "WORK ORDERS" which shall bear the change cost and the Contractor's and Owner's representative's signatures as an instruction to proceed. All changes shall be restricted to five percent (5%) overhead and five percent (5%) profit applied to the labour and material cost.

### **25. Conflict of Interest**

For the purposes hereof, "Conflict of Interest" includes:

- (a) in relation to the Submission process, the Bidder has an unfair advantage or engaged in conduct, directly or indirectly, that may give the Bidder an unfair advantage, including:
  - (i) having or having access to information in the preparation of the Submission that is confidential to the HDSB and not available to other Bidders;
  - (ii) communicating with any person with a view to influencing preferred treatment in the Submission process; or
  - (iii) engaging in conduct that compromises or could be seen to compromise the integrity of the open and competitive process and render that process non-competitive and unfair; or

- (b) in relation to the performance of the Work, services or contractual obligations, the Bidder's other commitments, relationships or financial interests:
  - (i) could or could be perceived to exercise an improper influence over the objective, unbiased and impartial exercise of the Bidder's independent judgments; or
  - (ii) could or could be perceived to compromise or impair or be incompatible with the effective performance of the Bidder's work, services or contractual obligations.

The Bidder shall:

- (a) avoid any Conflict of Interest in the Submission process and in the performance of its contractual obligations;
- (b) disclose to the HDSB without delay any actual or potential Conflict of Interest that arises during the Submission process or during the performance of its contractual obligations; and
- (c) comply with any requirements prescribed by the HDSB to resolve any Conflict of Interest.

In addition to all other contractual rights or rights available at law or in equity, the HDSB may immediately disqualify a Submission or terminate the Contract upon giving notice to the Bidder where:

- i. the Bidder fails to disclose an actual or potential Conflict of Interest;
- ii. the Bidder fails to comply with any requirements prescribed by the HDSB to resolve a Conflict of Interest; or
- iii. the Bidder's Conflict of Interest cannot be resolved.

This paragraph shall survive any termination or expiry of the Contract.

## **26. HDSB Confidential Information**

For the purposes hereof, "HDSB Confidential Information" means all information of the HDSB that is of a confidential nature, including all confidential information in the custody or control of the HDSB, regardless of whether it is identified as confidential or not, and whether recorded or not, and however fixed, stored, expressed or embodied, which comes into the knowledge, possession or control of the Bidder in connection with the Contract. For greater certainty, HDSB Confidential Information shall:

- (a) include:
  - (i) all new information derived at any time from any such information whether created by the HDSB, the Bidder or any third party;
  - (ii) all information (including Personal Information) that the HDSB is obliged or has the discretion not to disclose under provincial or federal legislation or otherwise at law; but
- (b) not include information that:
  - (i) is or becomes generally available to the public without fault or breach on the part of the Bidder of any duty of confidentiality owed by the Bidder to the HDSB or to any third party;
  - (ii) the Bidder can demonstrate to have been rightfully obtained by Bidder without any obligation of confidence, from a third party who had the right to transfer or disclose it to the Bidder free of any obligation of confidence;
  - (iii) the Bidder can demonstrate to have been rightfully known to or in the possession of the Bidder at the time of disclosure, free of any obligation of confidence when disclosed; or
  - (iv) is independently developed by the Bidder;

but the exclusions in this subparagraph shall in no way limit the meaning of Personal Information or the obligations attaching thereto under the Contract or at law.

During and following the term of the Contract, the Bidder shall:

- (a) keep all HDSB Confidential Information confidential and secure;
- (b) limit the disclosure of HDSB Confidential Information to only those of its directors, officer, employees, agents, partners, affiliates, volunteers or subcontractors who have a need to know it for the purpose of carrying out its obligations under the Contract and who have been specifically authorized to have such disclosure;
- (c) not directly or indirectly disclose, destroy, exploit or use any HDSB Confidential Information (except for the purpose of carrying out its obligations under the Contract or except if required by order of a court or tribunal), without first obtaining:
  - (i) the written consent of the HDSB; and
  - (ii) in respect of any HDSB Confidential Information about any third party, the written consent of such third party;
- (d) provide HDSB Confidential Information to the HDSB on demand; and
- (e) return all HDSB Confidential Information to the HDSB before the end of the Term, with no copy or portion kept by the Bidder.

## **27. Criminal Background Checks**

The Bidder acknowledges that the HDSB must be in compliance with Regulation 521/01 of the Education Act (Ontario) - Collection of Personal Information with respect to criminal background checks and offence declarations. The Bidder covenants and agrees to assist the HDSB in complying with same by providing the HDSB, or such other entity as the HDSB may designate, with a criminal background check covering offences under the Criminal Code, the Narcotics Control Act, and any other offences which would be revealed by a search of the automated Criminal Records Retrieval System maintained by the RCMP or, in instances where the Bidder will have access to or is responsible for minors or vulnerable persons, a Vulnerable Persons Clearance certificate in addition to the above ("Criminal Background Check"), together with an Offence Declaration in HDSB approved form, for every individual or employee of the Bidder who may come into direct contact with students on a regular basis at a school site of the HDSB, or who may have access to student information.

For the purposes of this document, the HDSB shall determine in its sole and unfettered discretion whether an individual or employee of the Bidder may come into direct contact with students on a regular basis or may have access to student information. The Bidder agrees to indemnify and save harmless the HDSB from all claims, liabilities, expenses, and penalties to which it may be subjected on account of the Bidder's failure to provide a Criminal Background Check and an Offence Declaration, as aforesaid. This indemnity shall survive the expiration or sooner termination of the Contract. In addition, and notwithstanding anything else herein contained, if the Bidder fails to provide a Criminal Background Check and an Offence Declaration for an individual or employee of the Bidder who may come into direct contact with students on a regular basis at a school site of the HDSB or who may have access to student information, then the HDSB shall have the right to forthwith terminate the Contract without prejudice to any other rights which it may have in the Contract, in law or in equity.

## **28. Debrief**

The HDSB, at the written request of a Bidder will conduct a debriefing. Bidders must submit their request within sixty (60) days of Contract award notification. The HDSB will only identify any weaknesses or strengths in the Bidder's submission. No information regarding other Bidders' submissions will be disclosed. The intent of the debriefing information session is to assist a Bidder in presenting a better Submission in subsequent procurement opportunities. Any debriefing provided is not for the purpose of providing any opportunity to challenge the procurement process.

## **29. Dispute Resolution**

In the event that a Bidder wishes to review the decision of the HDSB in respect of any material aspect of the RFT process, and subject to having attended a debriefing, the Bidder shall submit a protest in writing to the RFT Authority within ten (10) days from such a debriefing.



Any request that is not received in a timely manner will not be considered, and the Bidder will be notified in writing.

A protest in writing shall include the following:

- (a) a specific identification of the provision and/or procurement procedure that is alleged to have been breached;
- (b) a specific description of each act alleged to have breached the procurement process;
- (c) a precise statement of the relevant facts;
- (d) an identification of the issues to be resolved; and
- (e) the Bidder's requested remedy.

For the purpose of a protest, the HDSB will review and address any protest in a timely and appropriate manner. HDSB's decision in this regard is final.

### ***30. Environmental Statement***

The HDSB, when practically and financially feasible, will consider the acquisition of goods and services that will reduce the environmental footprint of the HDSB.

### ***31. Force Majeure***

Delays in or failure of performance by either party under the Contract shall not constitute default thereunder or give rise to any claim for damages if caused by occurrences beyond the control of the party affected, including but not limited to, decrees of Governments, acts of God, fires, floods, riots, wars, rebellion, sabotage, and atomic or nuclear incidents. Lack of finances, strikes, lockouts or other concerted acts by workers shall not be deemed to be a cause beyond a party's control.

In the event that performance of the Contract in the reasonable opinion of either party is made impossible by an occurrence beyond the control of the party affected, then either party shall notify the other in writing. The HDSB shall either terminate the Contract forthwith and without any further payments being made, or authorize the Bidder to continue the performance of the Contract with such adjustments as may be required by the occurrence in question and agreed upon by both parties. In the event that the parties cannot agree upon the aforementioned adjustment, it is agreed by the parties that the Contract shall be terminated.

### ***32. Guarantees and Warranties***

All Work shall be done in a good and workmanship like manner. All materials, goods and services must meet the applicable specifications, either by the HDSB, its consultant on the project or the manufacturer. The Bidder warrants and guarantees that all materials, Goods; Services and workmanship will be free from defects and fit for the purpose intended by the HDSB. All Goods delivered by the Bidder must be new, in good working order and of the latest model possessing all accessories standard to the



manufacturer's stock model. The Goods and/or Services must be covered by written guarantees and warranties acceptable to the HDSB.

### **33. Health & Safety / WHMIS**

Bidders and/or contractors must comply with the Occupational Health and Safety Act and its regulations. All Bidder's contractors and subcontractors and their respective employees will have received health and safety training appropriate to their trade, and will be able to provide proof thereof to the HDSB upon request. Contractors shall be held responsible for any subcontractors where such are permissible by the HDSB. The HDSB may request and suppliers/contractors/subcontractors will provide evidence of such training at any time.

Suppliers/contractors/sub-contractors shall comply with the HDSB policies, programs and procedures at all times while on site. All suppliers/contractors/sub-contractors are required to sign in upon arrival/exit at a HDSB location prior to beginning and at completion of Work.

Suppliers and/or contractors/sub-contractors shall be held responsible for all fines and/or contraventions of legislation which have been incurred by the HDSB.

As per Ontario regulation 278/05 section 10 (5) the HDSB will provide contractors/sub-contractors performing work in HDSB buildings access to the site-specific asbestos inventory. Site specific asbestos inventories are available at each HDSB site. Contractors/sub-contractors shall review the site-specific asbestos inventory in relation to the scope of work they are undertaking, prior to the commencement of work. The requirements of the HDSB's Asbestos Management Administrative Procedure are to be adhered to at all times. A copy of the HDSB's Asbestos Management Administrative Procedure can be found at:

<http://www.hdsb.ca/our-board/Policy/AsbestosManagementInFacilities.pdf>

All Work is subject to prior approval by the appropriate HDSB department.

Contractors shall examine carefully the HDSB's Asbestos Register for the Work site, in addition to examining existing conditions for suspected Asbestos Containing Materials (ACM), on which completion of Work is dependent.

Upon discovery of unforeseen suspected ACM affecting completion of the Work, the Contractor shall cease any operations that may disturb said materials and notify the Owner immediately.

The Contractor shall arrange for removal of ACM affecting completion of Work through a HDSB-approved ACM abatement contractor, and arrange for coordination of testing through HDSB Facility Services, if required.

Contractors shall be responsible for any sub-contractors in their employ with respect to the aforementioned requirements.

### ***34. Indemnification and Liability***

The Bidder hereby agrees to indemnify and hold harmless the HDSB, its directors, officers, trustees, employees and agents from and against all liability, loss, costs, damages and expenses (including legal, expert and consultant fees), causes of actions, actions, claims, demands, lawsuits or other proceedings, by whomever made, sustained, incurred, brought or prosecuted if:

- (a) resulting from the Bidder's failure to observe and conform to the standards established by law or by any other association which has established standards recognized by the Province of Ontario;
- (b) relating to labour and equipment furnished for the Work; and
- (c) involving inventions, copyrights, trademarks or patents, and rights thereto, used in doing the Work and in the subsequent use and operation of the Work or any part thereof upon completion.

### ***35. Insurance and Liability***

The successful bidder must indemnify the HDSB from any and all manner of damage or injury, risk, claims, demands, actions, penalties, causes of action, damages and any and all costs arising out of, or incurred by reason of provision of goods and/or services by the bidder. The cost of such insurance will be the responsibility of the Bidder.

The successful bidder(s) will obtain and provide current proof of insurance upon the award, that the successful Bidder will be covered by:

**at least Two Million Canadian Dollars (C\$2,000,000.00) of comprehensive commercial general liability insurance** for bodily injury, property damage, operations liability, contractual liability and tenant's legal liability, including umbrella liability insurance covering liability arising from premises, operations, independent contractors, products-completed operations, personal injury and liability assumed under the Contract;

**at least One Million Canadian Dollars (C\$1,000,000.00) of business automobile liability insurance** and, if necessary, umbrella liability insurance for owned, hired and non-owned vehicles covering bodily injury and property damage: and with an insurer licensed to carry on business in the Province of Ontario.

In the case of multi-year contracts, a copy of a valid certificate must be provided to the Halton District School HDSB annually thereafter, at least thirty (30) days prior to the anniversary date of the contract commencement date. At commencement of the Contract and throughout the Contract duration, certification shall be submitted on a Certificate of Insurance form with the above-mentioned coverage, thereby protecting the

Halton District School Board against claims for property damage and bodily injuries, including accidental death, caused by the successful Bidder(s) or its employees and/or Subcontractors during the performance of its obligations under the Contract.

The Halton District School Board must be named as additional insured, and the policy must contain a cross liability clause, and thirty (30) day prior notice clause of any cancellation, non-renewal or product change in coverage, terms or conditions.

As a condition precedent to contract award, Certificates of all such insurance policies shall be filed with the HDSB by the successful Bidder and shall be subject to the HDSB's approval as to the adequacy of protection.

All the above-mentioned insurance shall be maintained until the HDSB certifies that the work is complete.

### ***36. Invoicing/Payment/EFT***

To ensure that payment is not deferred, the following information shall be on all invoices:

- Bidder's Name or Business Number, Address, Telephone Number and HST registration number
- Invoice Date
- Invoice Number
- Purchase Order Number, Name of Requester, Shipment Destination
- Name of Halton District School Board staff that issued this order
- Complete Good/Service Description (including hourly rates, service/delivery dates, service location)
- Attach Copy of Service Report/Work Order Completed
- Terms of payment
- Total of HST where applicable
- Total Amount Payable

The HDSB's method of payment is by Electronic Funds Transfer (EFT). If the Bidder is a new vendor or current vendor who has not previously utilized the EFT payment service or has banking information which has changed, then an "Application of Vendor Direct Deposit" form is required to be completed, which is available through the Purchasing contact for this document. This form along with a voided cheque or letter from the Bidder's bank should be sent to:

Halton District School Board  
Attention: Accounts Payable Department  
J.W. Singleton Centre,  
PO Box 5005 Stn LCD 1,  
Burlington ON L7R 3Z2 or

electronically to: [apeft@hdsb.ca](mailto:apeft@hdsb.ca) before any invoices are submitted to the HDSB for payment. Payment terms are Net 28. Early payment discounts may be considered.

### **37. Irrevocability**

The Submission will be open for acceptance by the HDSB and irrevocable by the Bidder for a period of ninety (90) calendar days from the Closing Date.

### **38. Municipal Freedom of Information and Protection of Privacy Act (“MFIPPA”)**

- (a) The Bidder acknowledges and agrees that the HDSB is subject to MFIPPA. The Bidder further expressly acknowledges and agrees that, upon the acceptance of a successful Submission and conclusion of this process (including execution and delivery of the Contract between the HDSB and the successful Bidder), subject to subsection (b) below, the Submission shall not be considered confidential for the purposes of Section 10 of MFIPPA and, in the event of an access request or at the discretion of HDSB, shall be subject to release in its entirety without redaction.
- (b) Notwithstanding paragraph (a) above, the Bidder and the HDSB acknowledge and agree that the information listed below is considered to be supplied by the Bidder to the HDSB in confidence:
  - 1. For Services: Hourly rates/fees and information from which such rates/fees could be reasonably deduced.
  - 2. For Goods: Unit costs and information from which such unit costs could be reasonably deduced.
- (c) Notwithstanding the foregoing, the Bidder acknowledges and agrees that, because the HDSB is subject to MFIPPA, all or part of any Submission, including information supplied in confidence, may be subject to release in response to an access request submitted pursuant to MFIPPA. In the event that the HDSB receives a request for access to all or part of a Submission supplied in confidence, the HDSB shall deliver the relevant notice to the Bidder, who shall bare all costs, legal or otherwise, with respect to any objection the Bidder may have in respect of the release of any or all parts of the Submission pursuant to MFIPPA.

### **39. No Guarantee of Work or Exclusivity of Contract**

The HDSB makes no guarantee of the value or quality of goods or services or volume of work to be assigned to the successful Bidder. Any Contract executed with a successful Bidder may not be an exclusive Contract for the provision of the requested Goods or Services. Quantity where specified more or less, are estimates of previous consumption and are furnished without liability to the HDSB.

#### **40. Non-Performance/Termination of Contract**

If the Bidder delivers substandard, unapproved or defective items, which are rejected by the HDSB, the Bidder agrees to replace these items at the Bidder's expense with items of a quality deemed acceptable to the HDSB within a 48-hour period of the mutual satisfactory agreement being reached. If the Bidder fails to replace the items within this 48-hour period, the parties agree that the HDSB may purchase substitutes for the rejected items in the open market at no additional cost or liability to the HDSB.

Where at any time the quality of the Goods or Service supplied by the successful Bidder is not of a satisfactory standard, the HDSB may issue a verbal warning outlining the deficiency in supply or other aspects of performance and requiring the successful Bidder to correct those deficiencies within such period of time as stated. If the deficiency is not corrected within the time specified, or having been corrected, there is a further instance of deficient performance, the HDSB may issue a written notice to the successful Bidder, identifying the deficiency in performance and setting a final date or time period for its correction, and advising that if corrective steps are not taken by that date or within that time, the HDSB may terminate the Contract and take corrective action itself.

Until the HDSB is satisfied that the unsatisfactory performance has been corrected, the HDSB may hold back from any payment an amount sufficient to rectify the unsatisfactory performance until its requirements have been met.

The HDSB reserves the right, in its absolute discretion, to terminate a Contract immediately without penalty, costs or damages of any kind whatsoever, where the Bidder has violated any laws or performed any of the following acts while performing work with the HDSB and further reserves the right to take that failure into account with respect to the award of any future contract.

- a) over-billing or duplicate billing;
- b) splitting of invoices;
- c) charging for items not supplied;
- d) charging for items not approved prior to invoicing;
- e) charging for items of one grade, while supplying items of an inferior grade;
- f) Misrepresentation as to the quality or origin of goods, their functionality or suitability for a purpose, or their performance characteristics;
- g) not responding to the HDSB or, failure to complete contract.

#### **41. Ownership**

The Submission, along with all correspondence, documentation and information provided to the HDSB by any Bidder in connection with or arising out of the Submission, once received by the HDSB, shall become the property of the HDSB and may be appended to any Contract and/or purchase order with the successful Bidder.

#### **42. Permits, Licences and Approvals**

Bidders shall obtain all permits, licences and approvals required in connection with the supply of the Goods and/or Services. The costs of obtaining such permits, licences and approvals shall be the responsibility of, and shall be paid for by the Bidder.

Where a Bidder is required by any Applicable Law to hold or obtain any such licence, permit, or approval to carry on an activity contemplated in its Submission or in the Contract, neither the acceptance of the Submission nor the execution of the Contract by the HDSB shall be considered an approval by the HDSB for the Bidder to carry on such activity without the requisite licence, permit, consent or authorization.

Without in any way limiting the generality of the foregoing, any electrical Goods being proposed for consideration pursuant to this RFT must be authorized or approved in accordance with the Electrical Safety Code or by a certification organization accredited with the Standards Council of Canada Act (Canada), and shall bear the certification organization's mark identifying the Goods certified for use in Canada. Certification shall be to the standard that is appropriate for the intended use of the electrical Goods at any of the HDSB's schools or facilities.

#### **43. Co-operative Purchasing Provisions**

This document is being issued by the HDSB to meet the HDSB's requirements. The successful Bidder acknowledges that the Provincial Government encourages cooperative procurement initiatives by School HDSBs. Bidders shall indicate on the Form of Quotation if they are willing to extend pricing and submission terms to other District School Boards in the province of Ontario where the scope of work is deemed similar or the same and where both parties are in agreement, in which case they shall be deemed to have granted consent to the HDSB to share the Submission with such HDSBs, subject to such HDSBs agreeing to receive the Submission in confidence on the understanding that the Submission contains financial, commercial, technical and other sensitive information of the Bidder. The Bidder will not be penalized if it does not agree to this provision. The HDSB will not incur any financial responsibility in connection with any purchase by another School Board. Each School Board shall accept sole responsibility for its own contract management such as placing orders and making payments to the successful Bidder.

#### **44. Proof of WSIB Coverage**

If the Bidder is subject to the Workplace Safety and Insurance Act ("WSIA") or the Workplace Safety and Insurance Amendment Act, 2008 ("WSIAA"), the Bidder shall submit a valid clearance certificate of Workplace Safety and Insurance Board ("WSIB") coverage to the HDSB before commencing the performance of any work or services. In addition, the Bidder shall, from time to time during the term of the Contract and at the request of the HDSB, provide additional WSIB clearance certificates. The Bidder covenants and agrees to pay when due, and to ensure that each of its subcontractors pays when due, all amounts required to be paid by it or its subcontractors, from time to



time during the term of the Contract, under the WSIA and/or the WSIAA, failing which the HDSB shall have the right, in addition to and not in substitution for any other right it may have pursuant to the Contract or otherwise at law or in equity, to pay to the WSIB any amount due pursuant to the WSIA or the WSIAA unpaid by the Bidder or its subcontractors and to deduct such amount from any amount due and owing from time to time to the Bidder pursuant to the Contract together with all costs incurred by the HDSB in connection therewith.

#### ***45. Right to Withdraw***

Submissions may be withdrawn prior to the Closing Time. Following Closing, no Submission may be withdrawn. Any Bidder who attempts to do so may have a negative Performance Evaluation placed on record with the HDSB in accordance with the Vendor Performance Management Administrative Procedure

[www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf](http://www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf)

#### ***46. Smoking on HDSB Property***

Smoking of any substance and in any manner is prohibited in all HDSB buildings and on all HDSB property. This includes, without limitation, tobacco, cannabis in any form and vaping.

#### ***47. Vehicle Operation on HDSB Property***

The successful Bidder shall use due care and caution when motorized vehicles are in operation on school property while students are expected to enter or exit the school building and/or are visible outside the school building on school property or adjacent property, particularly during recess, lunch period and preceding and following the end of the school day. Vehicles operated in parking lot and driveway areas shall not be driven at a speed in excess of 8-kilometers/per hour.

Further, on school property drivers must turn off vehicles and remove the keys during any stop. At no time are vehicles to be left running while unattended. It is recommended that the vehicle be locked when left unsupervised. The HDSB will not be responsible for any theft of, or any theft from, vehicles operated by the successful Bidder.

Asphalt play areas around the exterior of the school building are not constructed to handle heavy vehicles. Bidders will be held responsible for any damage to HDSB property including but not limited to asphalt or natural surfaces as a result of using them for access of heavy vehicles. Making good of natural surfaces or asphalt areas that are damaged in the course of the work shall be to the original (new) condition irrespective of their condition prior to commencement of the work, or the condition of the adjacent unaffected areas. Vehicles are only permitted to access, stand or be parked in areas designated by administrative staff of HDSB, which for the purposes of this provision does not include principals of schools.

#### **48. Bidder Conduct**

When on HDSB property, the Bidder and its employees must:

- have proper identification (name badge, uniform with logo, photo I.D. etc.).
- be dressed appropriately (the following are not appropriate: clothing that fails to contain the anatomy when the person is carrying out normal duties; clothing with printed slogans, advertising or designs that are obscene or could have a double meaning).
- use appropriate language.
- refrain from wearing scented products or fragrances such as perfume, cologne, after shave, shampoos (as required).
- work with dignity, courtesy and respect for self and others.
- not make noise or move in corridors during morning announcements, and playing of the national anthem.
- observe procedures during fire evacuation and lockdowns, whether they are actual or test (drills).
- park in spots designated by the Principal.

The Bidder must observe all HDSB policies and procedures including but not limited to: Smoke-Free Environment; Sexual, Racial and Ethno Cultural Harassment, etc.

The Bidder will ensure that the education program is not interrupted and that the health and safety of the students and staff is not compromised.

No person who is impaired by alcohol or drugs will enter and/or remain on HDSB property.

The Bidder agrees that its employees and subcontractors will observe and comply with all standards, procedures, policies, rules and regulations of the HDSB, including but not limited to privacy, use of facilities, equipment, building security and computer technology.





## FORM OF TENDER

**Project:** Gymnasium Addition - Glenview Public School  
**Project Reference #:** RFT 24-061

From (Bidder): \_\_\_\_\_  
Company Name

Street Address

City, Province and postal code

Phone Number Email Address

To (Owner): Halton District School Board  
2050 Guelph Line  
Burlington, Ontario L7P 5A8

We, the undersigned, having examined the Tender Documents for the above-named Project, including Addenda, hereby offer to perform the Work in accordance with the Tender Documents, for the Stipulated Price of:

### Base Bid Amount

<b>A - Base Bid Amount (Exclusive of HST)</b>	\$
<b>B - Cash Allowance</b>	\$ 100,000.00
<b>C - Contingency Allowance</b>	\$ 200,000.00
<b>Total Base Bid Amount (A + B + C) (Excluding HST)</b>	\$





**APPENDIX A - DECLARATION SIGNATURE SHEET**

1. I/WE DECLARE that this Submission is made without collusion, knowledge, and comparison of figures or arrangement with any other company, firm or person submitting a Submission for the same work.
2. I/WE DECLARE that to our knowledge no member of Halton District School Board is, will be or has become financially interested, directly or indirectly, in any aspect of the Contract other than in the appropriate discharge of his/her obligations as an employee/officer of Halton District School Board.
3. I/WE HAVE READ, Understood and agree to abide by the Agreement to Abide by the Established Process.
4. I/WE HAVE CAREFULLY examined the RFT documents, and have a clear and comprehensive knowledge of what is being requested hereunder. By submitting the Submission, the Bidder agrees and consents to the administrative procedures of the Board, as well as the procedures, terms, conditions and provisions of the RFT, including the Form of Tender.
5. I/WE have carefully examined all of the Proposal Documents, and that we have thoroughly reviewed all proposal documentation and addenda number \_\_\_\_to\_\_\_\_, and hereby accept and agree to same as forming part and parcel of the proposed Contract.
6. I/WE ARE AUTHORIZED BY and have the authority to bind the Bidder.

DATE: \_\_\_\_\_

NAME: \_\_\_\_\_

Please Print

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_

COMPANY NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE NUMBER: \_\_\_\_\_

E-MAIL ADDRESS: \_\_\_\_\_

E-MAIL to Send PO: \_\_\_\_\_

## **APPENDIX B - HDSB LIST OF PRE-QUALIFIED SUB-CONTRACTORS**

### **ELECTRICAL**

B-Safe Electric.	Dan More	dan@b-safe.ca brian@b-safe.ca	905-872-7233
Best Electric Co.	Gurmukh Sehmbi	gsehmbi@bestelectric.ca	416-677-3851
Elite Electrical Solutions Ltd.	Amar Taneja	estimate@eliteelectrical.ca	905-789-5511
Indcon Inc.	Nitesh Patel	indcon74@gmail.com	416-677-3303
Star Electrical Services Inc.	Harvinder Kahlon	info@starelectrical.ca	905-799-3883

### **MECHANICAL**

Anvi Services Ltd.	Amit Bamba	amit@anviservices.com	905-660-6595
Kirk Mechanical Limited.	Robert Kirk	kirkmech@bellnet.ca	905-681-0140
L. J. Barton Mechanical Inc.	Bruce Hunter	estimating@ljbarton.com	905-304-1976
Mattina Mechanical Ltd.	Domenic Mattina	dmattina@mattina.ca	905-544-6380
Mekcon Ltd.	Inaam Cheema	info@mekcon.ca	905-918-1899
SFB Plumbing and Heating.	Stan Bliszczyk	stan@sfbplumbing.com	289-527-1499

## **ROOFING**

Atlantic Roofers Ontario Ltd.	Tony Pocobene	tpocobene@on.aibn.com	905-573-6202
Atlas-Apex Roofing Inc.	John McDowell	inquiries@atlas-apex.com	416 421 6244
Flynn Canada Ltd.	Joseph Raposo	Joseph.Raposo@flynncompanies.com	905-643-9515
GRRRC Roofing Inc.	George Roque	george@grrc.ca	905-393-7989
Semple Gooder Roofing Corporation.	Mark Baxter	rcapretta@semplegooder.com	416-743-5370
Triumph Roofing & Sheet Metal Inc.	Marco Peneda	info@triumphinc.ca	416-534-8877

Project Manual for the  
Construction of the  
**GLENVIEW PUBLIC SCHOOL GYM ADDITION**

at

143 Townsend Avenue  
Burlington, Ontario

for



The Halton District School Board  
2050 Guelph Line  
Burlington, Ontario

Project No.: 2314

HDSB RFT # 24-061

**sn/der**architects

*100 Broadview Avenue, Suite 301  
Toronto, Ontario  
Tel.: 416.966.5444*

1 General

1.1 OWNER

.1 Owner for the Project is:

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

1.2 CONSULTANTS

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

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

.1 Architect (A)

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

.2 Structural Engineer (S)

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

.3 Mechanical Engineer (M)

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

.4 Electrical Engineer (E)

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

.5 Landscape Architect (L)

OMC Landscape Architecture  
270 Sherman Avenue North, Suite 315-MILL  
Hamilton, Ontario  
L8L 6N4  
Telephone: 905.681.7604

.6 Civil Engineer (C)

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

.7 Designated Substance Abatement Consultant (DS)

Arcadis Canada Inc.  
121 Granton Drive, Suite 12  
Richmond Hill, Ontario  
L4B 3N4  
Telephone: 905.764.9380

END OF DOCUMENT



**PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP**

**Document  
 Responsibility**

**Division 00 - Procurement and Contracting Requirements**

**Introductory Information**

00 01 03	Project Directory . . . . .	A
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END OF TABLE OF CONTENTS

1 General

1.1 STATUS OF AVAILABLE PROJECT INFORMATION

- .1 Available Project information means information of any type and in any form that is expressly identified as available project information relevant to Place of the Work, that have been prepared by third-parties, and are intended strictly as additional information for consideration by Bidders.
- .2 No available Project information forms part of the Contract Documents unless copied or transcribed into Drawings or Specifications, or is expressly listed in the agreement as a Contract Document.

1.2 USE AND RELIANCE UPON AVAILABLE PROJECT INFORMATION

- .1 Available Project information is made available to Bidders to fulfill Owner's duty to disclose all relevant Project information to Bidders.
- .2 Bidders shall interpret and draw their own conclusions about available Project information, including consideration of the time when it was created. Available Project information may be time sensitive. Owner and Consultant assume no responsibility for such interpretations and conclusions.
- .3 Available Project information, or any part thereof, shall not be construed as contract requirements unless also reflected in Drawings or Specifications, and in case of conflict, Drawings or Specifications shall govern.
- .4 Bidders, acting reasonably, may rely on available Project information in preparing their bids, subject to any qualifications stated in such available Project information and unless expressly stated otherwise.
- .5 Bidders are cautioned that such documents, by their nature, cannot reveal all conditions that exist or can occur at Place of the Work.
- .6 Should conditions at Place of the Work, in Consultant's opinion, be found to substantially vary from those identified in available Project information, then changes in the Work may need to be made, with appropriate adjustments being made to Contract Price and Contract Time.
- .7 Direct questions pertaining to available Project information by contacting issuing organization.

1.3 PROPERTY AND TOPOGRAPHIC SURVEYS

- .1 A copy of a property survey with respect to Place of the Work is being made available as part of the Bid Documents; titled as follows:
  - Titled: Plan of Survey of PARCEL A, REGISTERED PLAN PF834, and PART OF LOT 5, BROKEN FRONT CONCESSION, (Originally in Township of East Flamborough), CITY OF BURLINGTON, REGIONAL MUNICIPALITY OF HALTON;
  - File No.: 9964-SRPR-T;
  - Dated: February 22, 2024;
  - Prepared by: Tarasick McMillan Kubicki Limited.

1.4 GEOTECHNICAL INVESTIGATION REPORTS

- .1 A copy of a detailed geotechnical investigation report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
  - Titled: Geotechnical Investigation, Glenview Public School Gym Replacement, 143 Townsend Avenue East, Burlington, Ontario;
  - Ref. No.: 23HF019;
  - Dated: November 2023;
  - Prepared by: Peto MacCallum Ltd.

- .2 Such reports record properties of soils and include recommendations for design of foundations and pavements.

#### 1.5 DESIGNATED SUBSTANCE SURVEYS AND AUDITS

- .1 A copy of a designated substance audit report with respect to Place of the Work is being made available as part of the Bid Documents; described as follows:
  - Titled: Updated Survey of Asbestos-Containing Materials, Glenview Public School, 143 Townsend Avenue, Burlington, Ontario;
  - Ref. No.: 702170-050;
  - Dated: April 18, 2017;
  - Prepared by: Arcadis Canada Inc.
- .2 Such reports identify locations and types of designated substances found to be present at Place of the Work, and may include recommendations for their safe removal and disposal.
- .3 Conditions at Place of the Work identified in the report are relevant only at time of survey.
- .4 The condition of some building materials may have changed.
- .5 Items discovered during the execution of the Work that are not itemized within the report should be analytically tested by an accredited laboratory before further disturbance.

#### 1.6 DOCUMENTS DESCRIBING EXISTING FACILITY

- .1 Documents describing the existing facility are being made available as part of the Bid Documents.
- .2 These documents were prepared by others and neither Owner nor Consultant take responsibility for the accuracy of information nor verify they represent actual conditions at Place of the Work.

END OF SECTION

1 General

1.1 AGREEMENT

- .1 CCDC 2-2020 Stipulated Price Contract, as amended below, forms the basis of Agreement between Owner and Contractor.

1.2 AMENDMENTS TO THE AGREEMENT

.1 Article A-5 - Payment

- .1 Revise Subparagraph A-5.1.1 by adding the following words to the end: *"... or, where there is no payment certifier, jointly by the Owner and Contractor"*.

.2 Article A-6 - Receipt and Addresses for Notices in Writing

- .1 Delete Paragraph A-6.5 in its entirety and replace it with the following: *"Contact information for a party may be changed by Notice in Writing to the other party setting out the new contact information in accordance with this Article."*

END OF SECTION



1 General

1.1 DEFINITIONS

- .1 CCDC 2-2020 Stipulated Price Contract includes the Definitions of specific words and terms.

1.2 SUPPLEMENTARY DEFINITIONS

- .1 Add a new Definition for Proper Invoice as follows: *"Proper Invoice means a proper invoice as defined in the Payment Legislation, if any, and as may be modified by written agreement between the parties to the extent permitted by such Payment Legislation."*
- .2 Add a new Definition for Submittals, as follows: *"Submittals are documents or items required by the Contract Documents to be provided by the Contractor, such as:*
- .1 Shop Drawings, samples, models, mock-ups to indicate details or characteristics, before the portion of the Work that they represent can be incorporated into the Work; and*
  - .2 As-built drawings and manuals to provide instructions to the operation and maintenance of the Work."*

END OF SECTION

1 General

1.1 GENERAL CONDITIONS

- .1 CCDC 2-2020 Stipulated Price Contract is the General Conditions between Owner and Contractor.

1.2 SUPPLEMENTARY CONDITIONS

- .1 Refer to Section 00 73 00 - Supplementary Conditions for amendments and supplements to General Conditions.
- .2 Where a General Condition of the Contract or a paragraph of the General Conditions of the Contract is deleted by Supplementary Condition, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

END OF SECTION

1 Supplements to General Conditions

1.1 GC 1.1 - CONTRACT DOCUMENTS

- .1 Delete Paragraph 1.1.3 in its entirety and replace with the following: *"The Contractor shall review the Contract Documents for the purpose of facilitating and coordination and execution of the Work by the Contractor. The Contractor shall report promptly to the Consultant any ambiguities, design issues or other matters requiring clarification made known to the Contractor or that the Contractor may discover from such a review. Such review by the Contractor shall comply with the standard of care described in paragraph 3.9.1 of the Contract."*
- .2 Delete Paragraph 1.1.4 in its entirety and replace with the following: *"Except for its obligation to review the Contract Documents and report the result pursuant to paragraph 1.1.3, the Contractor is not responsible for ambiguities, design issues or other matters requiring clarification in the Contract Documents and does not assume any responsibility to the Owner or to the Consultant for the accuracy of the Contract Documents. Without limiting the foregoing, the Contractor shall not be liable for any damages or costs resulting from any ambiguities, design issues or other matters requiring clarification in the Contract Documents which the Contractor could not reasonably have discovered from such review in accordance with the standard of care. If the Contractor does discover any ambiguities, design issues or other matters requiring clarification in the Contract Documents, the Contractor shall not proceed with the work affected until the Contractor has received modified or additional information from the Consultant. The impacts of any ambiguities, design issues or other matters requiring clarification in the Contract Documents, including to the Contract Price and Contract Time, shall be addressed by the parties in accordance with Part 6 - CHANGES IN THE WORK."*
- .3 Revise Subparagraph 1.1.6.2 by adding the following clause to the end: *"except to the extent the Consultant is indemnified as a third party beneficiary as provided in subparagraphs 9.2.7.4 and 9.5.3.4 and in paragraph 13.1.3."*

1.2 GC 2.2 - ROLE OF THE CONSULTANT

- .1 Add new Sentence to Paragraph 2.2.3, as follows: *"Without limiting the foregoing, the Consultant may appoint one or more authorized representatives in writing who may fulfill the obligations of the Consultant under this Contract."*
- .2 Revise Paragraph 2.2.8 by adding the words *'written statements'* after the word *'interpretations'* in both the first and second sentences; and by adding the following sentence to the end of the paragraph: *"The Owner and the Contractor shall waive any claims against the Consultant arising out of its making of any interpretations, written statements or findings in accordance with paragraphs 2.2.6, 2.2.7, 2.2.8 and 7.1.2, but only to the extent that any such interpretations, written statements and findings are made by the Consultant in an unbiased manner, and in accordance with the Consultant's professional standard of care at law."*
- .3 Revise Paragraph 2.2.13 by adding the words *"which are submitted"* before the words *'by the Contractor'*.

1.3 GC 2.4 - DEFECTIVE WORK

- .1 Delete Paragraph 2.4.1 in its entirety and replace with the following: *"The Contractor shall promptly correct, in a manner acceptable to the Owner and the Consultant, defective work that has been rejected by the Consultant as failing to conform to the Contract Documents, or work that the Contractor discovers to be defective, whether or not the defective work had been identified by the Consultant, and whether or not the defective work was incorporated in the Work or the defect is the result of poor workmanship, use of defective Products or damage through carelessness or other act or omission of the Contractor."*

- .2 Add new Paragraph 2.4.4 as follows: *"The Contractor shall prioritize the correction of any defective work which, in the sole discretion of the Owner, adversely affects the day-to-day operation of the Owner."*
- 1.4 GC 3.1 - CONTROL OF THE WORK
    - .1 Add new Paragraph 3.1.3 as follows: *"Prior to commencing individual procurement, fabrication and construction activities, Contractor shall verify at Place of the Work 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 Contract Documents. Where dimensions are not included or contradictions exist, or exact locations are not apparent, Contractor shall immediately notify Consultant in writing and obtain written instructions from Consultant before proceeding with any affected part of the Work."*
  - 1.5 GC 3.2 - CONSTRUCTION BY THE OWNER AND OTHER CONTRACTORS
    - .1 Add new Paragraph 3.2.7 as follows: *"At commencement of the Work, the Contractor shall prepare for the review and acceptance of the Owner and the Consultant, a schedule indicating the times, within the construction schedule referred to in GC 3.4 - CONSTRUCTION SCHEDULE, that items that are specified to be Owner purchased and Contractor installed or hooked up are required at the Place of the Work to avoid delaying the progress of the Work."*
  - 1.6 GC 3.6 - SUBCONTRACTORS AND SUPPLIERS
    - .1 Revise Paragraph 3.6.2 by adding the following sentence to the end of the paragraph: *"The Contractor shall not subsequently change Subcontractors without the prior written approval of the Owner."*
  - 1.7 GC 3.7 - LABOUR AND PRODUCTS
    - .1 Revise Paragraph 3.7.1 by adding the following to the end: *"The Contractor represents that it has sufficient skilled employees to replace, subject to the Owner's approval, acting responsibly, its designated supervisor and project manager in the event of death, incapacity, removal or resignation."*
    - .2 Add new Paragraph 3.7.4 as follows: *"The Owner shall provide the Contractor in a timely manner with all relevant information (including storage, protection, and installation requirements) regarding Products to be supplied by the Owner or other contractors and, prior to delivery of any such Products to the Place of the Work, the Owner shall obtain the Contractor's written approval of the delivery date and proposed storage, protection and installation requirements."*
    - .3 Add new Paragraph 3.7.5 as follows: *"Once the Contractor has accepted delivery of Products, the Contractor shall be responsible for the safe storage and protection of Products as required to avoid dangerous conditions or contamination to the Products or other persons or property. Products shall be stored in locations and at the Place of the Work to the satisfaction of the Owner and the Consultant as agreed and approved by the Contractor pursuant to paragraph 3.7.4."*
    - .4 Add new Paragraph 3.7.6 as follows: *"Notwithstanding the foregoing, the Contractor shall not be responsible for any Products supplied by the Owner or other contractors unless:
      - .1 the Contract Documents expressly stipulate that such Product is to be the Contractor's responsibility and to be installed by the Contractor as part of the Work;
      - .2 the Contractor has or has received from the Owner proof of insurance coverage sufficient, at a minimum, to cover the replacement cost of such Product; and
      - .3 the Owner obtained the Contractor's approval as required by paragraph 3.7.4."*

1.8 GC 3.8 - SHOP DRAWINGS

- .1 Add the words "*AND OTHER SUBMITTALS*" to the title of GC 3.8 after the words 'SHOP DRAWINGS'.
- .2 Add the words "*and Submittals*" after the words '*Shop Drawings*' in paragraphs 3.8.1, 3.8.2, 3.8.3, subparagraph 3.8.3.2, and paragraphs 3.8.5, 3.8.6 and 3.8.7.
- .3 Delete Paragraph 3.8.2 in its entirety and replace it with the following: "*Prior to the first application for payment, the Contractor and the Consultant shall jointly prepare a schedule of the dates for submission and return of Shop Drawings and Submittals in an orderly sequence.*"
- .4 Revise Paragraph 3.8.7 by deleting the clause 'with reasonable promptness so as to cause no delay in the performance of the Work' and replace it with the following clause: "*within 10 Working Days or such longer period as may be reasonably required*".

1.9 ADD NEW GC 3.9 - PERFORMANCE BY CONTRACTOR

- .1 Add new Paragraph 3.9.1 as follows: "*In performing its services and obligations under the Contract, the Contractor shall exercise a standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The Contractor acknowledges and agrees that throughout the Contract, the Contractor's obligations, duties and responsibilities shall be interpreted in accordance with this standard. The Contractor shall exercise the same standard of due care and diligence in respect of any Products, personnel, or procedures which it may recommend to the Owner.*"

1.10 GC 4.1 - CASH ALLOWANCES

- .1 Delete Paragraph 4.1.7 in its entirety and replace with the following: "*At the commencement of the Work, the Contractor shall prepare for the review and acceptance of the Owner and the Consultant, a schedule indicating the times, within the construction schedule referred to in GC 3.4 - CONSTRUCTION SCHEDULE that items called for under cash allowances are required to be delivered to the Place of the Work to avoid delaying the progress of the Work.*"
- .2 Add new Paragraph 4.1.8 as follows: "*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.*"

1.11 GC 5.2 - APPLICATIONS FOR PAYMENT

- .1 Revise Paragraph 5.2.7 by deleting the words 'first payment' and replacing them with the words "*second payment*".

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

- .1 Delete Paragraph 5.4.1 in its entirety and replace it with the following: "*When the Contractor considers that the Work is substantially performed, or if permitted by the lien legislation applicable to the Place of the Work a designated portion thereof which the Owner agrees to accept separately is substantially performed, the Contractor shall, within five (5) Working Days, deliver to the Consultant and to the Owner a comprehensive list of items to be completed or corrected, together with a written application for a review by the Consultant to establish Substantial Performance of the Work or substantial performance of the designated portion of the Work. Failure to include an item on the list does not alter the responsibility of the Contractor to complete the Contract.*"

- .2 Delete Paragraph 5.4.2 in its entirety and replace it with the following: *"The Consultant will review the Work to certify or verify the validity of the application and shall promptly, and in any event, no later than 10 calendar days after receipt of the Contractor's application:*
    - .1 *advise the Contractor in writing that the Work or the designated portion of the Work is not substantially performed and give reasons why, or*
    - .2 *state the date of Substantial Performance of the Work or a designated portion of the Work in a certificate and issue a copy of that certificate to each of the Owner and the Contractor."*
  - .3 Delete Paragraph 5.4.3 in its entirety and replace it with the following: *"Where the holdback amount required by the applicable lien legislation has not been placed in a separate lien holdback account, the Owner shall, no later than 10 calendar days prior to the expiry of the holdback period stipulated in the lien legislation applicable to the Place of the Work, place the holdback amount in a bank account in the joint names of the Owner and the Contractor."*
  - .4 Delete Paragraph 5.4.4 in its entirety and replace it with the following: *"Subject to the requirements of any Payment Legislation, all holdback amounts prescribed by the applicable lien legislation for the Place of the Work shall become due and payable to the Contractor no later than 10 Working Days following the expiration of the holdback period stipulated in the lien legislation applicable to the Place of the Work, as certified or verified by the Consultant when permitted by any Payment Legislation."*
  - .5 Delete Paragraph 5.4.5 in its entirety and replace it with the following: *"The Contractor shall submit an application for release of the lien holdback amount in accordance with the lien legislation applicable to the Place of the Work. Except to the extent required by any Payment Legislation, such application for release of the holdback shall not constitute an application for payment that is subject to Proper Invoice requirements."*
  - .6 Delete Paragraph 5.4.6 in its entirety and replace it with the following: *"Where legislation permits progressive release of the holdback for a portion of the Work and the Consultant has certified or verified that the part of the Work has been performed prior to Substantial Performance of the Work, the Owner hereby agrees to release, and shall release the holdback for such portion of the Work to the Contractor in accordance with such legislation."*
  - .7 Add new Paragraph 5.4.7 as follows: *"Notwithstanding any progressive release of the holdback, the Contractor shall ensure that such parts of the Work are protected pending the issuance of a final certificate for payment or until the Owner takes early occupancy in accordance with GC 12.2 - EARLY OCCUPANCY BY THE OWNER, whichever comes first, and shall be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when the holdback was released."*
- 1.13 GC 5.5 - FINAL PAYMENT
- .1 Revise Paragraph 5.5.1 by adding the following Sentence to the end of the paragraph: *"The application for final payment shall meet the requirements of Proper Invoice."*
  - .2 Revise Paragraph 5.5.3 by adding the following Sentence to the end: *"Subject to any Payment Legislation, when the Consultant finds the Contractor's application for final payment to be not valid, the Contractor shall revise and resubmit the application when the Contractor has addressed the reasons given by the Consultant."*
- 1.14 GC 6.3 - CHANGE DIRECTIVE
- .1 Revise Subparagraph 6.3.7.18 by deleting the word 'and' from the end of the subparagraph.
  - .2 Revise Subparagraph 6.3.7.19 by deleting the period at the end of the subparagraph, and replacing it with *"; and"*.
  - .3 Add new Subparagraph 6.3.7.20 as follows: *"safety measures and requirements."*

1.15 GC 6.4 - CONCEALED OR UNKNOWN CONDITIONS

- .1 Add new Paragraph 6.4.5 as follows: *"The Contractor confirms that, prior to bidding the Project, it carefully investigated the Place of the Work and applied to that investigation the degree of care and skill described in paragraph 3.9.1, given the amount of time provided between the issue of the bid documents and the actual closing of bids, the degree of access provided to the Contractor prior to the submission of its bid, and the sufficiency and completeness of the information provided by the Owner. The Contractor is not entitled to compensation or to an extension of the Contract Time for conditions which could reasonably have been ascertained by the Contractor by such review undertaken in accordance with this paragraph 6.4.5."*

1.16 GC 6.6 - CLAIMS FOR A CHANGE IN CONTRACT PRICE

- .1 Revise Paragraph 6.6.5 by adding the words *"as noted in paragraph 6.6.3"* after the words 'of the claim' and add the words *"and the Consultant"* at the end of the paragraph.

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

- .1 Add Paragraph 7.1.7 as follows: *"When a performance bond has been obtained and submitted to Owner by Contractor, the provisions of paragraph 7.1.5 shall be exercised in accordance with the conditions of such performance bond unless Owner chooses to forfeit its rights under said bond."*

1.18 GC 8.2 - ADJUDICATION

- .1 Revise Paragraph 8.2.1 by deleting the word 'prescribed' and replacing it with the words *"provided for"*.

1.19 GC 8.3 - NEGOTIATION, MEDIATION AND ARBITRATION

- .1 Add new Paragraph 8.3.9 as follows: *"Within five (5) days of receipt of the notice of arbitration by the responding party under paragraph 8.3.6, the Owner and the Contractor shall give the Consultant a written notice containing:
  - .1 a copy of the notice of arbitration;
  - .2 a copy of supplementary conditions 8.3.9 to 8.3.13 of this Contract, and;
  - .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."*
- .2 Add new Paragraph 8.3.10 as follows: *"The Owner and the Contractor agree that the Consultant may elect, within ten (10) days of receipt of the notice under paragraph 8.3.9, to become a full party to the arbitration under paragraph 8.3.6 if the Consultant:
  - .1 has a vested or contingent financial interest in the outcome of the arbitration;
  - .2 gives the notice of election to the Owner and the Contractor before the arbitrator is appointed;
  - .3 agrees to be a party to the arbitration within the meaning of the rules referred to in Paragraph 8.3.6, and;
  - .4 agrees to be bound by the arbitral award made in the arbitration."*
- .3 Add new Paragraph 8.3.11 as follows: *"Without limiting and subject to the Owner's and Contractor's rights under paragraph 8.3.12 to challenge whether the Consultant has satisfied the requirements of Paragraph 8.3.10, if an election is made under Paragraph 8.3.10:
  - .1 the Owner or Contractor may request particulars and evidence of the Consultant's vested or contingent financial interest in the outcome of the arbitration;
  - .2 the Consultant shall participate in the appointment of the arbitrator; and,
  - .3 notwithstanding the rules referred to in paragraph 8.3.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date the respondent receives a copy of the notice of arbitration."*

- .4 Add new Paragraph 8.3.12 as follows: *"The arbitrator in the arbitration in which the Consultant has elected under paragraph 8.3.10 to become a full party may:*
  - .1 *on application of the Owner or the Contractor, determine whether the Consultant has satisfied the requirements of paragraph 8.3.10, and;*
  - .2 *make any procedural order considered necessary to facilitate the addition of the Consultant as a party to the arbitration."*
- .5 Add new Paragraph 8.3.13 as follows: *"The provisions of paragraph 8.3.9 shall apply (with all appropriate changes being made) to written notice to be given by the Consultant to any sub-consultant."*
- 1.20 GC 9.1 - PROTECTION OF WORK AND PROPERTY
  - .1 Delete Subparagraph 9.1.1.1 in its entirety and replace it with the following: *"errors in the Contract Documents which the Contractor could not have discovered applying the standard of care described in paragraph 3.9.1;"*.
  - .2 Delete Paragraph 9.1.2 in its entirety and replace it with the following: *"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 Paragraph 3.9.1."*
- 1.21 GC 9.2 - TOXIC AND HAZARDOUS SUBSTANCES
  - .1 Revise Paragraph 9.2.6 by adding the following clause after the word "responsible": *"... or whether any toxic and hazardous substances or materials already at Place of the Work (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the Contractor or anyone for whom the Contractor is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the Owner or others, the Owner shall ..."*
  - .2 Revise Subparagraph 9.2.7.4 by adding the words *"and the Consultant"* after the word 'Contractor'.
  - .3 Revise Paragraph 9.2.8 by adding the following clause after the word "responsible": *"... or that any toxic and hazardous substances or materials already at the Place of the Work (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the Contractor or anyone for whom the Contractor is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the Owner or others, the Contractor shall ..."*
- 1.22 GC 9.5 - MOULD
  - .1 Revise Subparagraph 9.5.3.4 by adding the words *"and the Consultant"* after the word 'Contractor'.
- 1.23 GC 10.2 - LAWS, NOTICES, PERMITS, AND FEES
  - .1 Revise Paragraph 10.2.5 by deleting the word 'The' from the start of the paragraph and substituting it with the words *"Subject to paragraph 3.9.1, the"*.
- 1.24 GC 11.1 - INSURANCE
  - .1 Revise Subparagraph 11.1.1.3 by deleting the Liability Insurance for manned aircraft and watercraft, either owned or non-owned.



1.25 GC 12.1 - READY-FOR-TAKEOVER

- .1 Revise Paragraph 12.1.3 by deleting the words 'written application for *Ready-for-Takeover*', and replacing them with the words "*written application for determination of Ready-for-Takeover*".

1.26 GC12.2 - EARLY OCCUPANCY BY THE OWNER

- .1 Revise Paragraph 12.2.4 by deleting the word 'achieve' and replacing it with the words "*have achieved*".

1.27 GC 12.3 - WARRANTY

- .1 Revise Paragraph 12.3.2 by deleting the word 'The' from the start of the paragraph and substituting it with the words "*Subject to paragraph 3.9.1, the*".
- .2 Amend Paragraph 12.3.3 by adding the following Sentence: "*The warranty period for corrected work shall re-commence upon acceptance of the correction.*"

1.28 GC 13.1 - INDEMNIFICATION

- .1 Revise Paragraph 13.1.3 by deleting the words 'paragraphs 13.1.1 and 13.1.2' and replacing them with the words "*paragraphs 13.1.1, 13.1.2 and 13.1.7*".
- .2 Add new Paragraph 13.1.7 as follows: "*The Contractor shall indemnify and hold harmless the Consultant, its agents and employees from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings by third parties that arise out of, or are attributable to the Contractor's performance of the Contract, provided such claims are:*
  - .1 *attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property,*
  - .2 *caused by negligent acts or omissions of the Contractor or anyone for whose negligent acts or omissions the Contractor is liable, and*
  - .3 *made by Notice in Writing within a period of 6 years from the Ready-for-Takeover date or within such shorter period as may be prescribed by any limitation statute or the Province or Territory of the Place of the Work.*"

END OF SECTION

1 General

1.1 SURETY BONDS

- .1 Prior to commencement of the Work, obtain and submit to Owner the required surety bonds.
- .2 Surety bonds shall be issued by a duly licensed surety company authorized to transact the business of suretyship at Place of the Work.
- .3 Bonds shall name The Halton District School Board as obligee and shall be signed, sealed and dated by both Contractor and surety company.
- .4 Maintain surety bonds in good standing until fulfilment of the Contract.

1.2 PERFORMANCE BOND

- .1 Obtain and submit a Performance Bond for Fifty percent (50%) of Contract Price, to assure the faithful performance of the Contract, including corrections to the Work required under GC 12.3 - WARRANTY; on Ontario Construction Act Form 32, Performance Bond Under Section 85.1 of the Act.

1.3 LABOUR AND MATERIAL PAYMENT BOND

- .1 Obtain and submit a Labour and Material Payment Bond for Fifty percent (50%) of Contract Price, to assume faithful payment of monies to parties in contract with the Contract; on Ontario Construction Act Form 31, Labour and Material Payment Bond Under Section 85.1 of the Act.

END OF SECTION

1 General

1.1 WORK OF THIS CONTRACT

- .1 Work of this Contract comprises the following:

Construction of the  
GLENVIEW PUBLIC SCHOOL GYM ADDITION

located at:  
143 Townsend Avenue,  
Burlington, Ontario;

and is further identified as:  
HDSB RFT No. 24-061, and  
SAi Project No.: 2314.

1.2 DIVISION OF WORK

- .1 Division of the Work among Subcontractors and Suppliers is solely Contractor's responsibility. Consultant and Owner assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the Work.

1.3 SPECIFICATIONS LANGUAGE AND STYLE

- .1 Specifications are written in imperative mood and in streamlined form. Imperative language is directed to Contractor, unless stated otherwise.
- .2 Complete sentences by reading "shall", "Contractor shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.
- .3 Fulfil and perform all indicated requirements whether stated imperatively or otherwise.
- .4 When used in the context of a Product, read the word "Provide" to mean "supply and install to result in a complete installation ready for its intended use".

1.4 SPECIFICATIONS MEASUREMENTS AND DIMENSIONS

- .1 Specifications are written using metric measurements and dimensions.
- .2 This does not preclude the use of Products manufactured or produced to imperial measurements.
- .3 It remains Contractor's responsibility to make the various parts of the Project come together properly and neatly in a complete manner, in accordance with Contract Documents.

1.5 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

- .1 Contract Documents were prepared by Consultant for the account of Owner. Information contained in Contract Documents reflects Consultant's best judgement in light of the information available to them at the time of preparation. Any use which a third party makes of Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. Consultant accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on Contract Documents.
- .2 Owner will supply Contractor with a complete set of Contract Documents in electronic form before commencement of the Work. Contractor may print hard copies for construction purposes as required.

1.6 DOCUMENTS AT PLACE OF THE WORK

- .1 Keep the following documents at Place of the Work, stored securely and in good order and available to Owner and Consultant in both hard copy and electronic formats.
  - .1 Current Contract Documents, including Drawings, Specifications, addenda, bid revisions and Notices in Writing.
  - .2 Proposed changes, Change Orders, Change Directives and Supplemental Instructions.
  - .3 Reviewed Shop Drawings, Product data and samples.
  - .4 Field test reports and records.
  - .5 Construction progress schedule.
  - .6 Construction daily log.
  - .7 Meeting minutes.
  - .8 Manufacturer's certifications.
  - .9 Current as-built drawings.
  - .10 Safety Data Sheets (SDS) for controlled Products.
  - .11 Manufacturer's installation and maintenance guidelines.
  - .12 Consultant's field review reports and deficiency reports.
  - .13 Permits and reports issued by authorities having jurisdiction.
- .2 Make documents available to Consultant for review at Place of the Work.

1.7 CONTRACTOR USE OF THE PREMISES

- .1 Except as otherwise specified in Section 01 14 00, Contractor has unrestricted use of Place of the Work from time of Contract award until Ready-for-Takeover.
- .2 Confine Construction Equipment, Temporary Work, storage of Products, waste materials and debris, and other construction operations to limits required by laws, ordinances, permits, and Contract Documents, whichever is most restrictive. Do not unreasonably encumber Place of the Work.

1.8 OWNER-SUPPLIED PRODUCTS

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

- .2 Review required submittals and notify Consultant of any observed discrepancies or anticipated problems.
  - .3 Ensure course of construction insurance is adequate to cover Owner-supplied Products.
  - .4 Receive and unload Owner-supplied Products at Place of the Work.
  - .5 Inspect deliveries jointly with Owner. Record and notify Owner and Consultant of shortages and visibly damaged or defective items.
  - .6 Handle Owner-supplied Products at Place of the Work, including uncrating and storage. Dispose of waste materials and debris.
  - .7 Take appropriate precautions to protect Owner-supplied Products from loss or damage.
  - .8 Repair or replace items damaged at Place of the Work.
  - .9 Assemble, install, connect, adjust and finish Owner-supplied Products.
  - .10 Arrange for inspections required by authorities having jurisdiction.
  - .11 Arrange for or perform testing required by authorities having jurisdiction.
  - .12 Workmanship warranty for installation.
  - .13 Make Good Owner-supplied Products damaged by Contractor or Subcontractors at Place of the Work.
- .3 Schedule of Owner-supplied Products
- .1 Paper towel dispensers.
  - .2 Toilet paper dispensers.
  - .3 Soap dispensers.
  - .4 Sanitary napkin disposal bins.

END OF SECTION

- 1 General
- 1.1 RESTRICTIONS ON USE OF PREMISES
  - .1 Limit use of premises for Work, for storage, and for access, to allow:
    - .1 Owner occupancy.
    - .2 Work by other contractors.
    - .3 Public usage.
  - .2 Coordinate use of premises under direction of Owner.
- 1.2 WORK BY OTHERS
  - .1 Work of the Project executed prior to start of Work of this Contract, and which is specifically excluded from this Contract.
    - .1 Removal and storage of Owner's existing furniture and equipment from defined areas of construction at Place of the Work.
- 1.3 OWNER OCCUPANCY OF EXISTING FACILITY
  - .1 Owner will occupy existing facility during entire construction period.
  - .2 Cooperate with Owner in scheduling operations to minimize disruptions and to facilitate Owner usage.
- 1.4 RESTRICTED HOURS OF WORK IN OCCUPIED FACILITIES
  - .1 When performing Work within existing facility beyond the defined areas of construction, coordinate with Owner's representative at Place of the Work to ensure operational program of existing facility is not disrupted. Conduct such coordination not less than 48 hours prior to commencing such portions of the Work.
  - .2 Work performed within existing facility beyond the defined areas of construction is restricted to the following times:
    - .1 July 1 to August 31: Mondays to Fridays, from 7:30 am to 4:00 pm.
    - .2 September 1 to June 30: Mondays to Fridays, from 4:00 pm to 10:30 pm.
  - .3 Make special arrangements with Owner to perform portions of the Work in existing facility beyond the defined areas of construction outside of these hours. Submit requests for special arrangements not less than 48 hours in advance.
  - .4 Submit written notice to Owner and Owner's representative at Place of the Work within 24 hours of any potential disruptions to continuing operations of existing facility.
  - .5 Allow for hours of work restrictions in construction progress schedule.
- 1.5 PRODUCT DELIVERY RESTRICTIONS IN OCCUPIED FACILITIES
  - .1 Schedule Product deliveries to Place of the Work only during the hours of 7:30 am and 4:00 pm, Mondays to Fridays.
- 1.6 NOISY WORK RESTRICTIONS IN OCCUPIED FACILITIES
  - .1 Schedule excessively noisy work to avoid disturbance to building occupants. Perform excessive noise generating work outside of Owner's business hours.
  - .2 Use powder actuated devices only with Consultant's written permission.
- 1.7 FOOD AND BEVERAGE RESTRICTIONS IN OCCUPIED FACILITIES
  - .1 Limit the consumption of food and beverages in occupied facilities to only those areas designated by Owner.

- .2 There shall be no food or beverages allowed within existing facility beyond the defined areas of construction.
- .3 Only water will be permitted to be consumed within existing facility.
- .4 No sunflower seeds, peanuts, nuts, or similar foods are permitted anywhere at Place of the Work.
- .5 Workers found to be in violation of this requirement will be required to leave Place of the Work and will be replaced by Contractor.

1.8 MAINTAINING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

- .1 Maintain operational life safety systems and public access to exits in occupied areas during execution of the Work.
- .2 Existing Entrances and Exits:
  - .1 Maintain existing entrances and exits to ensure public safety.
  - .2 Where existing entrances and exits are blocked or adversely affected by construction activities, construct temporary entrances and exits in accordance with authorities having jurisdiction.
- .3 Determine nature and exact locations of existing fire and smoke sensors prior to commencement of the Work. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.
- .4 Be responsible for costs incurred by Owner on account of false fire alarms activated as a result of the execution of the Work without adequate precautions.

END OF SECTION

1 General

1.1 CASH ALLOWANCES

- .1 Amount of each cash allowance includes:
  - .1 Costs to Provide specified Products, including supply, installation, and related costs, excluding Value Added Taxes.
  - .2 Costs related to specified services, excluding Value Added Taxes.
  - .3 Subcontractor's and sub-Subcontractor's overheads and profits related to cash allowance.
- .2 Amount of each cash allowance does not include Contractor's overhead and profit, and other related costs, which shall be included in Contract Price and not in cash allowance.
- .3 Allow the stipulated sum of \$100,00 for the following parts of the Work:
  - .1 Inspection and testing services, as specified in Section 01 40 00.
  - .2 Preparation of digital as-built drawings by Consultant, as specified in Section 01 78 00.
  - .3 Supply and installation of signage, as specified in Section 10 14 00.
  - .4 Supply and installation of traffic signage, as specified in Section 10 14 53.
  - .5 Supply and installation of a public address and gym sound system.

1.2 EXPENDITURE OF CASH ALLOWANCES

- .1 Owner, through Consultant, will supply Contractor with documentation required to permit pricing of a cash allowance item.
- .2 Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.
- .3 Owner, through Consultant, may request Contractor to disclose originals of each bid, quotation, and other price related information received from potential Suppliers or Subcontractors.
- .4 Owner, through Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain Owner's prior written approval in the form of a Change Order before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the Change Order, Contractor's responsibilities for a cash allowance item shall be the same as for other work of the Contract.

1.3 CONTINGENCY ALLOWANCE

- .1 Include in Contract Price a contingency allowance in the amount of \$200,000.

END OF SECTION



1 General

1.1 DEFINITION

- .1 Substitution means a Product, a manufacturer, or both, not originally specified in Contract Documents by proprietary name but proposed for use by Contractor in place of a Product, a manufacturer, or both, specified by proprietary name.

1.2 SUBSTITUTION PROCEDURES

- .1 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s), unless there is accompanying language indicating that Substitutions will not be considered.
- .2 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s) and accompanied by language such as "or equal", "or approved equal", or other similar words. Do not construe such language as an invitation to unilaterally Provide a Substitution without Consultant's prior written acceptance. Do not order or install any Substitution without a Supplemental Instruction or Change Order. Unauthorized Substitutions will be removed and replaced with specified Product by Contractor.
- .3 Provided a proposed Substitution submission includes all of the information specified in this Section under Submission Requirements for Proposed Substitutions, Consultant will promptly review and accept or reject the proposed Substitution.
- .4 Consultant may accept a Substitution if satisfied that:
- .1 The proposed substitute Product is the same type as, is capable of performing the same functions as, interfaces with adjacent work the same as, and meets or exceeds the standard of quality, performance and, if applicable, appearance, warranty and maintenance considerations, of the specified Product,
  - .2 The proposed substitute manufacturer has capabilities comparable to the specified manufacturer, and
  - .3 The Substitution provides a benefit to Owner.
- .5 If Contractor fails to order a specified Product or order a Product by a specified manufacturer in adequate time to meet Contractor's construction progress schedule, Consultant will not consider that valid reason to accept a Substitution.
- .6 If Consultant accepts a Substitution, and subject to Owner's agreement, the change in the Work will be documented in the form of either a Supplemental Instruction or Change Order as specified in Section 01 26 00.
- .7 If a Substitution is accepted in the form of a Supplemental Instruction or Change Order, Contractor shall not revert to an originally specified Product or manufacturer without Consultant's prior written acceptance.

1.3 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

- .1 Include with each proposed Substitution the following information:
- .1 Identification of the substitution, including product name, and manufacturer's name, address, telephone numbers, and web site address.
  - .2 Reason or reasons for proposing the Substitution.
  - .3 A statement verifying that the Substitution will not affect the Contract Price and Contract Time or, if applicable, the amount and extent of a proposed increase or decrease in Contract Price and Contract Time on account of the Substitution.
  - .4 A statement verifying that the Substitution will not affect the performance and warranty of other parts of the Work.
  - .5 Manufacturer's Product literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.
  - .6 Product samples as applicable.

- .7 A summarized comparison of the physical properties and performance characteristics of the specified Product and the proposed Substitution, with any significant variations clearly highlighted. Values describing the physical properties and performance characteristics of the proposed Substitution must be expressed using the same units of measurement as for the specified Product, and have been tested using the same test methods as used for the specified Product.
- .8 Availability of maintenance services and sources of replacement materials and parts for the proposed Substitution, as applicable, including associated costs and time frames.
- .9 If applicable, estimated life cycle cost savings resulting from the Substitution.
- .10 Details of other similar projects and applications where the Substitution has been used.
- .11 Identification of any consequential changes in the Work to accommodate the Substitution and any consequential effects on the performance of the Work as a whole. A later claim for an increase to the Contract Price or Contract Time for other changes in the Work attributable to the Substitution will not be considered.

END OF SECTION

1 General

1.1 CLARIFICATIONS

- .1 Request written clarifications when meaning of Contract Documents is unclear.
- .2 Do not proceed with related parts of the Work until clarification is received.
- .3 Failure to notify Consultant when Contract Documents are unclear or inconsistent will result in Contractor incurring responsibility for resulting deficiencies and additional costs.
- .4 Clarifications issued by Consultant are deemed to supercede the relevant parts of Contract Documents, regardless whether those documents are cited in the written clarification.

1.2 REQUESTS FOR INFORMATION

- .1 Contractor may, after exercising due diligence to locate the required information, request from Consultant clarification or interpretation of Contract Documents, hereinafter referred to as a request for information (RFI).
- .2 Submit RFI on a form acceptable in content to Consultant, including a detailed description of Contractor's review of Contract Documents leading up to issuance of the RFI. Requests for information that fail to include a detailed review description, or whose description is insufficient in the opinion of Consultant, may not be considered and may be rejected.
- .3 Maintain a log of RFI sent to and responses received from Consultant, complete with corresponding dates. Submit updated RFI log with each application for payment.
- .4 Submit RFI to Consultant sufficiently in advance of affected parts of the Work so as not to cause delay in the Work. Additional costs incurred as a result of failure to submit an RFI in sufficient time will not be reimbursed by Owner.
- .5 RFI will only be received from Contractor. RFI received directly from Subcontractors or Suppliers will not be considered.
- .6 Submit one RFI per RFI form, numbered consecutively in a single sequence, in the order submitted.
- .7 Consultant will review and respond to RFI with reasonable promptness.
- .8 Consultant's response to RFI will not be considered a Change Order or a Change Directive, nor does it authorize changes in the Work, Contract Price or Contract Time.
- .9 If, at any time, Contractor submits a large quantity of RFI, such that Consultant cannot process them within a reasonable period of time, then Consultant will notify Contractor of such in writing. In this event, Contractor and Consultant will jointly prepare an estimate of time necessary for processing RFI, as well as determining an order of priority among submitted RFI. Contractor will accommodate such necessary time at no increase in Contract Time or Contract Price.
- .10 If the information requested in an RFI is apparent from field observations, is contained in Contract Documents or is reasonably inferable from them, Contractor shall be responsible to Owner for reasonable costs charged by Consultant for additional services required to prepare and issue such information.
- .11 A request for information (RFI) will not constitute a notice of claim for a delay.

### 1.3 SCHEDULE OF LABOUR RATES

- .1 Prior to the first application for payment, submit for Consultant's review a schedule of labour rates for all Subcontracts and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the Work. Submit a breakdown of payroll burden component of labour rates.
- .2 Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of Contractor, Subcontractors, and sub-Subcontractors, stated as hourly rates, that will be used when:
  - .1 Preparing price quotations for Change Orders, and
  - .2 Determining the cost of work attributable to Change Directives.
- .3 Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the Work, during regular working hours. Labour rates shall not include any additional overhead and profit component.
- .4 Where collective agreements apply, labour rates shall not exceed those established by collective agreement.
- .5 Obtain Owner's written acceptance of the schedule of labour rates before submitting the first Change Order quotation.
- .6 Accepted schedule of labour rates will be used for evaluating Change Order quotations and cost of performing work attributable to Change Directives.
- .7 Contractor may request amendments to the accepted schedule of labour rates if changes in the labour rates that will actually be paid, or payroll burden cost that will actually be incurred, in the normal performance of the Work can be demonstrated. Obtain Owner's written acceptance of such changes.

### 1.4 SCHEDULE OF EQUIPMENT RATES

- .1 Prior to the first application for payment, submit for Consultant's review a schedule of equipment rates for Contractor owned Construction Equipment.
- .2 Equipment rates shall reflect the rates that will be used when:
  - .1 Preparing price quotations for Change Orders, and
  - .2 Determining the cost of work attributable to Change Directives.
- .3 Equipment rates stated in the schedule of equipment rates shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.
- .4 Obtain Owner's written acceptance of the schedule of equipment rates before submitting the first Change Order quotation.
- .5 Accepted schedule of equipment rates will be used for evaluating Change Order quotations and cost of performing work attributable to Change Directives.
- .6 Contractor may request amendments to the accepted schedule of equipment rates if changes in the local equipment rental market rates can be demonstrated. Obtain Owner's written acceptance of such changes.

### 1.5 VALUATION OF CHANGES BASED ON AGREED UNIT PRICES

- .1 Consultant may, at the outset of the Contract or at any other time, request Contractor to submit unit prices anticipated to be required in valuing changes in the Work.
- .2 Contractor shall promptly submit requested unit prices.

- .3 Unit prices are to be valid for a specified duration.
- .4 Unit prices are to exclude fees for overhead and profit, and will be subject to the percentage fees specified in this Section under Fees for Overhead and Profit - Change Orders.
- .5 Consultant will evaluate Contractor's quoted unit prices and, if accepted by Owner in writing, the agreed unit prices will be used to value subsequent proposed changes in the Work wherever they are applicable.

#### 1.6 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE ORDERS

- .1 Unless otherwise agreed, the adjustment of the Contract Price on account of a proposed change in the Work will be based on a quotation for a fixed price increase or decrease to Contract Price regardless of Contractor's actual expenditures and savings.

#### 1.7 CHANGE ORDER PROCEDURES

- .1 Upon issuance by Consultant to Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:
  - .1 Submit to Consultant a fixed price quotation for the proposed change in the Work within 5 days after receipt of the proposed change in the Work.
  - .2 If requested in the proposed change, submit a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
    - .1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
    - .2 Estimated Product costs, including Supplier quotations, estimated quantities and unit prices.
    - .3 Estimated Construction Equipment costs.
    - .4 Enumeration of other estimated costs included in the price quotation.
    - .5 Estimated credit amounts for labour and Products not required on account of the proposed change.
    - .6 Fees, not exceeding the specified allowable percentages for overhead and profit.
    - .7 Where applicable, Subcontractor quotations, also including a detailed breakdown of all the above items.
  - .3 Include in the quotation the increase or decrease to Contract Time, if any, for the proposed change, stated in number of days.
  - .4 Include in the quotation the number of days for which the quotation is valid.
- .2 The quotation will be evaluated by Consultant and Owner and, if accepted by Owner, be documented in the form of a signed Change Order.

#### 1.8 FEES FOR OVERHEAD AND PROFIT - CHANGE ORDERS

- .1 Where Contractor's price quotation for a Change Order results in a net increase to the Contract Price, Contractor's entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
  - .1 For work to be performed by Contractor's own forces, 10 percent of Contractor's price quotation before Contractor's fee is applied.
  - .2 For work performed by a Subcontractor, 5 percent of Subcontractor's price quotation including Subcontractor's fee.
- .2 Where a Subcontractor's price quotation for a Change Order results in a net increase to the Subcontractor's contract price, a Subcontractor's entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
  - .1 For work to be performed by Subcontractor's own forces, 10 percent of Subcontractor's price quotation before Subcontractor's fee is applied.
  - .2 For work performed by a sub-Subcontractor, 5 percent of sub-Subcontractor's price quotation including sub-Subcontractor's fee.

- .3 Where Contractor's or a Subcontractor's price quotation for a Change Order results in a net decrease in price before adjustment for fees for overhead and profit, such a price quotation shall be for the net decrease without any adjustment for fees for overhead and profit.

#### 1.9 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE DIRECTIVES

- .1 Unless Owner and Contractor reach an earlier agreement on the adjustment to the Contract Price by means of a Change Order that cancels the Change Directive, the adjustment in the Contract Price for change carried out by way of the Change Directive shall be determined as specified in the General Conditions of Contract after the change in the Work is completed.

#### 1.10 CHANGE DIRECTIVE PROCEDURES

- .1 If a Change Directive is issued for a change in the Work for which a proposed change was previously issued, but no Change Order has yet been signed, the Change Directive shall cancel the proposed change and any Contractor quotations related to that change in the Work.
- .2 When proceeding with a change in the Work under a Change Directive, keep accurate records of daily time sheets for labour and Construction Equipment, and invoices for Product and Construction Equipment costs. Submit such records to Consultant weekly, until the Change Order superseding the Change Directive is issued.

#### 1.11 FEES FOR OVERHEAD AND PROFIT - CHANGE DIRECTIVES

- .1 Contractor's entitlement to a fee for overhead and profit on Contractor's expenditures and savings attributable to a Change Directive shall be as follows, as applicable:
  - .1 For work to be performed by Contractor's own forces, 10 percent of Contractor's net increase in costs.
  - .2 For work performed by a Subcontractor, 5 percent of the sum of the Subcontractor's net increase in costs plus the Subcontractor's fee.
- .2 A Subcontractor's entitlement to a fee for overhead and profit on the Subcontractor's expenditures and savings attributable to a Change Directive shall be as follows, as applicable:
  - .1 For work to be performed by Subcontractor's own forces, 10 percent of Subcontractor's net increase in costs.
  - .2 For work performed by a sub-Subcontractor, 5 percent of the sum of the sub-Subcontractor's net increase in costs plus the sub-Subcontractor's fee.
- .3 Where a Change Directive results in net savings on account of work not required to be performed and a net decrease in the Contractor's or Subcontractor's cost, the net savings to the Contractor or Subcontractor shall be calculated without any adjustment for fees for overhead and profit.
- .4 When a Change Directive is ultimately recorded as a Change Order, there shall be no additional entitlement to fees for overhead and profit beyond those specified above.

#### 1.12 SUPPLEMENTAL INSTRUCTIONS

- .1 Consultant may issue Supplemental Instructions to clarify Contract Documents, issue additional information, or make minor variations in the Work not involving adjustments in Contract Price or Contract Time.
- .2 If Contractor considers a Supplemental Instruction to require an adjustment in Contract Price or Contract Time, Contractor shall promptly notify Consultant and Owner in writing and shall not proceed with any work related to the Supplemental Instruction pending receipt of a Change Order, a Change Directive, or, in accordance with the dispute resolution provisions of General Conditions of the Contract, a Notice in Writing of a dispute and instructions to proceed.

END OF SECTION

1 General

1.1 SCHEDULE OF VALUES

- .1 Prior to first application for payment, submit for Consultant's review an initial schedule of values.
- .2 Modify initial schedule of values if and as requested by Consultant.
- .3 Obtain Consultant's written acceptance of initial schedule of values prior to first application for payment.
- .4 Together with first and all subsequent applications for payment, submit updated versions of the schedule of values, indicating values, to date of application for payment, of work performed and Products delivered to Place of the Work.
- .5 Prepare schedule of values in an electronic spreadsheet format based on format and content described in CCDC 24-2022, A Guide to Model Forms and Support Documents.

1.2 CASH FLOW PROJECTION

- .1 Prior to first application for payment, submit for Consultant's review a forecast of approximate monthly progress payments for each month of Contract Time.
- .2 Submit revised cash flow forecasts when required due to significant changes in rate of progress of the Work, or due to significant changes in Contract Price, or when requested by Owner or Consultant.

1.3 WORKERS' COMPENSATION CLEARANCE

- .1 Submit proof of workers' compensation clearance with each application for payment.

1.4 PAYMENT FOR PRODUCTS STORED OFF SITE

- .1 Owner may, due to extraordinary circumstances and at Owner's sole discretion, make payments for Products delivered to and stored at a location other than Place of the Work, subject to:
  - .1 A request submitted by Contractor in writing, with appropriate justification, and
  - .2 Whatever conditions Owner or Consultant may establish for such payments, as required to protect Owner's interests.

END OF SECTION

- 1 General
- 1.1 COORDINATION
  - .1 Coordinate the Work to ensure the Project proceeds safely and expeditiously.
  - .2 Ensure adequate communication among involved parties.
  - .3 Allocate mobilization areas at Place of the Work; for field offices and sheds, for access, traffic and parking facilities.
  - .4 Coordinate use of Place of the Work and facilities through procedures for submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.
  - .5 Submit information required for preparation of coordination and interference drawings. Review and approve revised drawings for submission to Consultant.
- 1.2 OTHER CONTRACTORS
  - .1 Cooperate with Other Contractors employed by Owner and, if necessary, coordinate with their work.
  - .2 Submit necessary information to Owner to assist in required scheduling of Other Contractors.
- 1.3 GENERAL REQUIREMENTS FOR MEETINGS
  - .1 Schedule and administer meetings in consultation with Consultant, throughout progress of the Work.
  - .2 Prepare agenda for meetings.
  - .3 Distribute written notice of each meeting 5 Working Days in advance of meeting date to Consultant and Owner.
  - .4 Provide physical space and make arrangements for meetings.
  - .5 Preside at meetings.
  - .6 Record meeting minutes, including significant decisions and identifying action items and action dates by attendees or the parties they represent.
  - .7 Submit draft copy of minutes to Consultant within two Working Days after meeting.
  - .8 Consultant will review minutes and will submit comments for any necessary revisions or additions within 3 Working Days.
  - .9 Update minutes to reflect Consultant's comments.
  - .10 Reproduce and distribute copies of meeting minutes within 5 days after meeting and transmit to meeting participants, affected parties not in attendance, Consultant and Owner.
  - .11 Representatives of parties attending meetings shall be qualified and authorized to act on behalf of the party each represents.
  - .12 Schedule meetings on a day that is determined to be convenient by both Contractor and Consultant.
- 1.4 CONSTRUCTION START-UP MEETING
  - .1 Promptly after Contract award, Contractor shall establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities.



- .2 Senior representatives of Owner, Consultant, subconsultants, Contractor, including Contractor's project manager and site superintendent, and major Subcontractors shall be in attendance.
- .3 Agenda will include the following:
  - .1 Appointment of official representatives of Owner, Contractor, Subcontractors, Consultant, and subconsultants.
  - .2 Project communications.
  - .3 Contract Documents for construction purposes.
  - .4 Documents at Place of the Work.
  - .5 Contractor's use of premises.
  - .6 Owner-supplied Products.
  - .7 Work restrictions.
  - .8 Contract modification procedures.
  - .9 Payment procedures.
  - .10 Construction progress meetings.
  - .11 Construction progress schedule, including long lead time items.
  - .12 Submittals schedule and procedures.
  - .13 Special procedures.
  - .14 Quality requirements, including testing and inspection procedures.
  - .15 Contractor's mobilization.
  - .16 Temporary utilities.
  - .17 Existing utility services.
  - .18 Construction facilities.
  - .19 Temporary barriers and enclosures.
  - .20 Temporary controls.
  - .21 Field engineering and layout of work.
  - .22 Site safety.
  - .23 Site security.
  - .24 Cleaning and waste management.
  - .25 Closeout procedures and submittals.
  - .26 Procedures for publishing Certificate of Substantial Performance of the Work, including identification of publisher, and procedures for notifying Subcontractors and Suppliers of publication.
  - .27 Commissioning.
  - .28 Other items.

#### 1.5 PREINSTALLATION MEETINGS

- .1 During course of the Work, schedule preinstallation meetings as required by Contract Documents.
- .2 Wherever possible, schedule preinstallation meetings on same date as regularly scheduled progress meetings.
- .3 Contractor, affected Subcontractors and Suppliers, Consultant, manufacturer's representatives, field inspectors and supervisors, and any other specified parties are to be in attendance.
- .4 Agenda will include the following:
  - .1 Review of existing conditions and affected parts of the Work, and any testing thereof.
  - .2 Review of installation procedures and requirements.
  - .3 Review of environmental and field condition requirements.
  - .4 Schedule of the applicable parts of the Work.
  - .5 Schedule of submission for samples and other items requiring Consultant's selection.
  - .6 Requirements for Temporary Work.
  - .7 Requirements for notification for reviews. Allow a minimum of 48 hours notice for Consultant to review the affected parts of the Work.

- .8 Requirements for inspections and tests as applicable. Schedule and undertake inspections and tests.
- .9 Delivery schedule for Products.
- .10 Special requirements and procedures necessary to comply with regulatory requirements and authorities having jurisdiction.

#### 1.6 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule regular bi-weekly construction progress meetings for duration of the Work.
- .2 Contractor, major Subcontractors currently involved in the Work, Consultant, and Owner are to be in attendance.
- .3 Agenda will include the following:
  - .1 Review and approval of minutes from previous meeting.
  - .2 Work progress since previous meeting.
  - .3 Field observations, including any problems, difficulties, or concerns.
  - .4 Construction progress schedule.
  - .5 Submittals schedule.
  - .6 Proposed changes in the Work.
  - .7 Requests for information.
  - .8 Site safety issues.
  - .9 Maintenance of construction quality standards.
  - .10 Other business.

#### 1.7 PROGRESS DRAW MEETINGS

- .1 Schedule regular monthly progress draw meetings for duration of the Work.
- .2 Contractor, Owner and Consultant are to be in attendance.
- .3 Submit to Consultant a copy of the application for payment not less than two Working Days before scheduled progress draw meeting.
- .4 Consultant may require changes to application for payment prior to progress draw meeting occurring.

END OF SECTION

1 General

1.1 CONSTRUCTION PROGRESS SCHEDULE

.1 Format and Content:

- .1 Prepare schedule in the form of a critical path method (CPM) Gantt chart using appropriate scheduling software.
- .2 Incorporate a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery Products, inspection and testing activities, preparation and review of mock-ups, Owner decisions for cash allowances, shutdown or closure activities, delivery of Owner-supplied Products, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.
- .3 Indicate milestone dates for Ready-for-Takeover and Substantial Performance of the Work.

.2 Submission:

- .1 Submit initial schedule to Owner and Consultant within 10 Working Days after Contract award.
- .2 Submit schedule as portable document format (.pdf) files.
- .3 Consultant will review format and content of initial schedule and request necessary changes, if any, within 5 Working Days after receipt.
- .4 If changes are required, resubmit finalized initial schedule within 5 Working Days after return of reviewed copy.
- .5 Submit updated progress schedule monthly to Owner and Consultant, indicating actual and projected start and finish dates with report date line and progress, activity relationships, critical path, float, and baseline comparison to current progress.

1.2 SUBMITTALS SCHEDULE

.1 Format and Content:

- .1 Prepare schedule identifying required Shop Drawings, Product data and sample submissions, including samples required for testing and including those for Owner-supplied Products.
- .2 Prepare schedule in electronic format.
- .3 Incorporate separate line items for each required submittal, organized by Specification sections numbers and titles, and further broken down by individual Products and systems required.
- .4 For each required submittal, show planned earliest date for initial submission, earliest date for return of reviewed submittal by Consultant, and latest date for return of reviewed submittal without causing delay.
- .5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.

.2 Submission:

- .1 Submit initial schedule to Owner and Consultant within 15 Working Days after Contract award.
- .2 Submit schedule as portable document format (.pdf) files.
- .3 Consultant will review format and content of initial schedule and request necessary changes, if any, within 10 Working Days after receipt.
- .4 If changes are required, resubmit finalized initial schedule within 5 Working Days after return of reviewed copy.
- .5 Submit updated submittals schedule monthly to Owner and Consultant.

1.3 SCHEDULE MANAGEMENT

- .1 A schedule submitted as specified and accepted by Consultant will become the baseline schedule and shall be used as the baseline for updates.

- .2 At regular progress meeting, review and discuss current construction progress and submittals schedules with Consultant and Owner, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.
- .3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

#### 1.4 CONSTRUCTION DAILY LOG

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

#### 1.5 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

- .1 Keep one hard-copy set of Drawings at Place of the Work for the purpose of creating as-built drawings. Record information and maintain as-built drawings in clean, dry and legible condition.
- .2 Clearly label each drawing as "AS-BUILT DRAWING". Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Record actual construction including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by Change Orders and Supplemental Instructions.
  - .6 References to Shop Drawings, where Shop Drawings show more detail.
- .4 Do not use as-built drawings for construction purposes.

#### 1.6 PROGRESS PHOTOGRAPHS

- .1 Arrange for periodic digital photography to document and record the progress of the Work.
- .2 Photographs will be properly exposed and in focus, with unobstructed views.
- .3 Identify each photograph by Project name and date taken.
- .4 Format photographs as .jpg, .bmp, or .tif format files in high definition resolution.
- .5 Submit progress photographs monthly as part of the current application for payment.
- .6 Submit additional photographs showing special conditions when requested by Consultant.

- .7 Do not use progress photographs, or any other Project photographs for promotional purposes without Owner's written consent.

END OF SECTION

1 General

1.1 ADMINISTRATIVE

- .1 Submit specified submittals to Consultant for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time or for Product substitutions or other deviations from Drawings and Specifications.
- .2 Where required by authorities having jurisdiction, submit submittals to authorities having jurisdiction for review and approval.
- .3 Do not proceed with Work affected by a submittal until review is complete.
- .4 Present Shop Drawings, Product data and samples in SI Metric units. Where items or information is not produced in SI Metric units, converted values are acceptable.
- .5 Review submittals, verifying field measurements where applicable, and affix Contractor's review stamp prior to submission to Consultant. Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.
- .6 Verify field measurements and affected adjacent work is coordinated.
- .7 Submittals not meeting specified requirements will be returned with comments.
- .8 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.
- .9 Digital files are to be electronically created from original files. Scanned images will be rejected.
- .10 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data and sample submittals.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.
- .2 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.
- .3 Accompany submittals with a transmittal form containing the following information:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification of each submittal item and quantity.
  - .5 Other pertinent data.
- .4 Shop Drawing submittals will include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.

- .4 Contractor's stamp, date, and signature of Contractor's authorized representative responsible for Shop Drawing review, indicating that each Shop Drawing has been reviewed for compliance with Contract Documents and, where applicable, that field measurements have been verified.
- .5 Details of appropriate portions of the 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 Relationships to other parts of the Work.
- .5 Product data submittals for controlled Products must include safety data sheets (SDS).
- .6 Submit electronic copy of Shop Drawings, as portable document format (.pdf) files, where specified in Product Specifications.
- .7 Submit electronic copy of Product data sheets or brochures, as portable document format (.pdf) files, where specified in Product Specifications.
- .8 Where a submittal includes information not applicable to the Work, clearly identify applicable information and strike out non-applicable information.
- .9 Supplement standard information to include details applicable to Project.
- .10 Allow 10 Working Days for Consultant's review of each submittal and incorporate submittals schedule specified in Section 01 32 00. Allow additional 5 Working Days where subconsultant or commissioning agent review is required.
- .11 If upon Consultant's review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of work may proceed.
- .12 If upon Consultant's review significant errors or omissions are discovered, a copy noted as such will be returned for correction and resubmission. Do not commence fabrication or installation.
- .13 Consultant's notations on submittals are intended to ensure compliance with Contract Documents and are not intended to constitute a change in the Work requiring change to Contract Price or Contract Time. If Contractor considers any Consultant's notation to be a change in the Work, promptly notify Consultant in writing before proceeding with the Work.
- .14 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the Work proceeds. When resubmitting, notify Consultant in writing of any revisions other than those requested by Consultant.

### 1.3 ENGINEERED SUBMITTALS

- .1 Submittals required to be sealed by professional engineer are to be prepared, sealed, signed and dated under direct control and supervision of a qualified professional engineer licensed to practice at Place of the Work.
- .2 Include proof of Submittal engineer's professional liability insurance with a minimum limit of liability of \$5,000,000 per claim. Identify insurer, policy number and policy term on duly signed certificate of insurance.

- .3 Design includes life safety, sizing of supports, anchors, framing, connections, spans and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction and design requirements of Contract Documents.
- .4 Engineered submittals are to include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented in the submittal. Prepare calculations in a clear and comprehensive manner so that they can be properly reviewed.
- .5 Submittal engineer shall undertake periodic field review, including review of associated mock-ups when applicable. Such reviews will include review during fabrication at the point of manufacture, and during installation at Place of the Work. Prepare and submit a field review report for each review undertaken.
- .6 Conduct field reviews at intervals appropriate to the progress of the parts of the Work relevant to the engineered submittal. Report on progress and quality of the affected parts of the Work. Determine if installation is in general conformity with Contract Documents and in strict conformance with the accepted engineered submittal.
- .7 Upon completion of the parts of the Work affected by an engineered submittal, submittal engineer shall prepare and submit a Letter of General Conformity to Contractor, Consultant and authorities having jurisdiction. Certify that the parts of the Work affected by the engineered submittal have been designed, fabricated and installed in accordance with Contract Documents and applicable regulatory requirements.
- .8 Include costs of submittal engineer's services in Contract Price.

#### 1.4 SAMPLES

- .1 Submit samples for Consultant's review as requested in Contract Documents.
- .2 Label samples as to origin, Project name, and intended use.
- .3 Deliver samples prepaid to Consultant's business address.
- .4 Notify Consultant in writing of any deviations in samples from requirements of Contract Documents.
- .5 Where a required colour, pattern or texture has not been specified, submit full range of available Products meeting other specified requirements.
- .6 Consultant selection from samples is not intended to change Contract Price or Contract Time. If a selection would affect Contract Price or Contract Time, notify Consultant in writing prior to proceeding with the Work.
- .7 Resubmit samples as required by Consultant to comply with Contract Documents.
- .8 Reviewed and accepted samples will establish the standard against which installed Work will be reviewed.

#### 1.5 INTERFERENCE DRAWINGS

- .1 Prepare interference drawings, identifying and resolving potential conflicts among various parts of the Work, including sprinkler systems, HVAC ductwork, plumbing and drainage lines, lighting and electrical systems.
- .2 Submit interference drawings electronically as portable document format (.pdf) files to Consultant prior to commencement of the Work.
- .3 Coordinate and review interference drawings with affected Subcontractors prior to commencement of their portions of the Work.



1.6 CERTIFICATES AND CERTIFICATION SUBMITTALS

- .1 Submit written statements, as requested in Contract Documents, certifying installed Products meet specified criteria.
- .2 Include signature of person responsible for preparing certification.

1.7 TEST AND EVALUATION REPORTS

- .1 Submit manufacturers' test and evaluation reports electronically as portable document format (.pdf) files for requirements requested in Product Specifications and as Consultant may reasonably request.
- .2 Ensure results are expressed in SI Metric units of measurement. Test and evaluation reports recording results only in Imperial units of measurement may be rejected.
- .3 Clearly indicate compliance with specified performance criteria, tested in accordance with specified test methods, and conducted by an independent testing agency.
- .4 Test results achieved through the use of alternative test methods will be rejected.

END OF SECTION

- 1 General
- 1.1 PROPER CONDUCT OF WORKERS
  - .1 Ensure workers conduct themselves in a proper and civilized manner at all times.
  - .2 Workers using improper language, cat calls, lewd comments or improper behaviour will be required to leave Place of the Work and will be replaced by Contractor.
  - .3 Workers are required to be properly attired at all times.
  - .4 Workers wearing clothing exhibiting hateful or offensive images or language will be required to replace or cover such clothing. Workers refusing to do so will be required to leave Place of the Work and will be replaced by Contractor.
  - .5 Smoking or vaping of any substance is not permitted at Place of the Work.
  - .6 Consumption of alcohol and use of controlled substances is not permitted at Place of the Work.
- 1.2 SPECIAL PROCEDURES FOR INFECTION CONTROL
  - .1 Conform to latest edition of CCA COVID-19 - Standardized Protocols for All Canadian Construction Sites.
- 1.3 LABOUR CONDITIONS
  - .1 Ensure rates of wages, working hours and working conditions at Place of the Work are in accordance with regulatory requirements and authorities having jurisdiction.
- 1.4 EMERGENCY CONTACT INFORMATION
  - .1 Submit emergency contact information for site superintendent to authority having jurisdiction; for their use 24 hours a day, 7 days a week, 52 weeks a year.
  - .2 Immediately notify authority having jurisdiction when emergency contact information changes.
- 1.5 FIRST AID PERSONNEL
  - .1 A minimum of one person trained in basic first aid must be present at Place of the Work at all times during performance of the Work.
  - .2 This person may perform other duties, but must be immediately available to render first aid when needed.
- 1.6 SPECIAL PROCEDURES FOR CONTRACTORS WORKING IN AN EXISTING FACILITY
  - .1 Comply with Owner's procedures and requirements for construction personnel working in existing facilities.
  - .2 Conform to latest edition of "Guidelines For Maintaining Fire Safety During Construction in Existing Buildings", as issued by Office of the Fire Marshal.
  - .3 Coordinate requirements with local fire department. Discuss fire safety planning issues and alternative measures.
- 1.7 SPILL RESPONSE
  - .1 Prepare and initiate a spill response procedure in accordance with appropriate authorities having jurisdiction before commencing the Work.
  - .2 Supply and maintain spill kit at Place of the Work.

1.8 SPECIAL PROCEDURES FOR WORKING IN CONFINED SPACES

- .1 Perform work in confined spaces in accordance with applicable regulatory requirements.
- .2 Work in confined spaces must be supervised and performed by licenced confined space and hazardous materials personnel.

1.9 SPECIAL PROCEDURES FOR WORKING WITH DESIGNATED SUBSTANCES

- .1 Prepare and initiate a health and safety plan in accordance with authorities having jurisdiction prior to commencing construction operations involving excavating, removing, transporting, handling or disposing of potentially contaminated materials.
- .2 Keep an up-to-date copy of health and safety plan at Place of the Work.
- .3 Adhere to health and safety plan for duration of removal and disposal of contaminated material from Place of the Work.
- .4 Provide and maintain a safe working environment for on-site personnel and minimize the impact of construction activities on general public and surrounding environment.
- .5 Verify workers and visitors to Place of the Work have and are adequately trained in the use of appropriate personal protective equipment.
- .6 Should any unforeseen, or site-peculiar safety related factor, hazard, or condition become evident during performance of the Work, immediately notify authority having jurisdiction and Consultant, and take prudent temporary action to establish and maintain safe working conditions until suitable permanent action can be implemented. Safeguard workers, the public and the surrounding area from contamination.
- .7 Perform routine air monitoring at Place of the Work, testing for organic vapours, explosive conditions and oxygen deficient conditions. Evacuate affected areas immediately and implement corrective measures if unsatisfactory conditions are discovered.
- .8 Guidelines by Authorities Having Jurisdiction: Conform to the following guideline documents issued by Province of Ontario:
  - .1 Silica on Construction Projects.
  - .2 Lead on Construction Projects.
- .9 Mercury Precautions: Ensure workers handling, removing and disposing of mercury-containing materials have been properly trained by a competent and qualified person.
- .10 In the event of injury to on-site personnel, contact designated hospital and describe injury prior to or during transport of injured personnel. Transport injured personnel to designated medical facility along a predefined route.
- .11 Take appropriate measures to minimize contact of construction vehicles and Construction Equipment with potentially contaminated materials. Decontaminate construction vehicles, Construction Equipment and workers that have come into contact with contaminated materials prior to their leaving Place of the Work.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

- .1 Reference Standards means consensus standards, trade association standards, guides, and other publications expressly referenced in Contract Documents.
- .2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However, if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.
- .3 Reference standards establish minimum standards. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements shall govern.
- .4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Consultant for clarification.
- .5 Specifications refer to standards writing, testing and certification organizations by their acronyms or initialisms, as follows:
  - .1 AA The Aluminum Association;
  - .2 AABC Associated Air Balance Council;
  - .3 AAMA American Architectural Manufacturers Association;
  - .4 ACI American Concrete Institute;
  - .5 AISC American Iron and Steel Construction;
  - .6 AMCA Air Movement and Air Control Association;
  - .7 ANSI American National Standards Institute;
  - .8 ARI Air Conditioning and Refrigeration Institute;
  - .9 ASCC American Society of Concrete Contractors;
  - .10 ASME American Society of Mechanical Engineers;
  - .11 ASTM American Society for Testing and Materials;
  - .12 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.;
  - .13 AWMAC Architectural Woodwork Manufacturers' Association of Canada;
  - .14 AWPA American Wire Producers Association;
  - .15 BHMA Builders Hardware Manufacturers Association;
  - .16 BIA Brick Industry Association;
  - .17 CaGBC Canadian Green Building Council;
  - .18 CCMPA Canadian Concrete Masonry Producers Association;
  - .19 CFCA Concrete Floor Contractors Association of Canada;
  - .20 CGA Canadian Gas Association;
  - .21 CGSB Canadian General Standards Board;
  - .22 CHPVA Canadian Hardwood Plywood and Veneer Association;
  - .23 CISC Canadian Institute of Steel Construction;
  - .24 CISCA Ceiling & Interior Systems Construction Association;
  - .25 CKCA Canadian Kitchen Cabinet Association;
  - .26 CLFMI Chain Link Fence Manufacturers' Institute;
  - .27 CPC Concrete Polishing Council;
  - .28 CPCI Canadian Precast Concrete Institute;
  - .29 CPCQA Canadian Precast Concrete Quality Assurance;
  - .30 CPSC Consumer Product Safety Commission;
  - .31 CRCA Canadian Roofing Contractors' Association;
  - .32 CRI Carpet and Rug Institute;
  - .33 CSA Canadian Standards Association;
  - .34 CSC Construction Specifications Canada;
  - .35 CSDMA Canadian Steel Door Manufacturers' Association;
  - .36 CSSBI Canadian Sheet Steel Building Institute;

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

## 1.2 QUALITY ASSURANCE

- .1 Quality of work shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed.
- .2 Immediately notify Consultant if required work is such as to make it impractical to produce required results.
- .3 Decisions as to the quality or fitness of work in cases of dispute rest solely with Consultant, whose decision is final.

### 1.3 INDEPENDENT INSPECTION AND TESTING AGENCIES

- .1 Except as otherwise specified, Owner will appoint independent inspection and testing agencies to be retained and paid by Contractor to inspect, test, or perform other quality control reviews of parts of the Work.
- .2 Retain and pay for inspection and testing that is for Contractor's own quality control, or is required by regulatory agencies (including integrated systems testing of fire protection and life safety systems, to CAN/ULC-S1001).
- .3 Contract Price includes a stipulated price cash allowance for payment of independent inspection and testing services retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor's own quality control or is required by regulatory requirements. Refer to Section 01 21 00.
- .4 Employment of inspection and testing agencies by Contractor or Owner does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.
- .5 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off-site manufacturing and fabrication plants.
- .6 For inspection and testing required by Contract Documents or by authorities having jurisdiction, notify Consultant and inspection and testing agencies in a timely manner in advance of required inspection and testing.
- .7 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00.
- .8 Supply labour, Construction Equipment and temporary facilities needed to obtain and handle test samples at Place of the Work.
- .9 If defects are revealed during inspection and testing, the appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no additional cost to Owner. Pay costs for retesting and reinspection.

### 1.4 INSPECTION AND TESTING AGENCY REPORTS

- .1 For inspection and testing required by Contract Documents or by regulatory requirements, and performed by Contractor retained inspection and testing agencies, promptly submit copies of reports to Consultant, Owner and authority having jurisdiction. Submit reports electronically as portable document format (.pdf) files.
- .2 For inspection and testing performed by Owner-retained inspection and testing agencies, copies of inspection and testing agency reports will be promptly forwarded to Contractor.
- .3 In all cases, promptly forward inspection and testing agency reports to affected Subcontractors.

### 1.5 MANUFACTURER FIELD REVIEW

- .1 When required by Contract Documents, arrange for a qualified manufacturer's representative to review relevant parts of the Work and verify those portions of the Work are being executed in accordance with manufacturer's written recommendations and installation guidelines.
- .2 Manufacturer field review services are intended to ensure specified Products are being used and are being installed on substrates that have been prepared in accordance with manufacturer's written recommendations.
- .3 Unless specified otherwise, manufacturer's representative will undertake a minimum of one field review, with additional reviews being conducted as deemed necessary by manufacturer.

- .4 Within two Working Days of a field review, manufacturer will submit a field review report recording manufacturer representative's observations and recommendations.
- .5 Distribute copies of manufacturer's field review reports to affected Subcontractors, Consultant and authorities having jurisdiction.

1.6 MOCK-UPS

- .1 Prepare mock-ups of Work as specified in Contract Documents with reasonable promptness and in an orderly sequence, so as not to cause delay in the Work.
- .2 If a mock-up location is not indicated in Drawings or Specifications, locate where directed by Consultant.
- .3 Include all necessary Products and labour required to fully construct mock-ups.
- .4 Modify mock-up as required until Consultant acceptance is obtained.
- .5 Accepted mock-ups establish an acceptable standard for the Work.
- .6 Protect mock-ups from damage until the Work they represent is complete.
- .7 Unless specified otherwise, accepted mock-ups forming part of the Work may remain as part of the Work.
- .8 Remove mock-ups only when the Work they represent is complete or when otherwise directed by Consultant.

1.7 MILL TESTS

- .1 Submit mill tests certificates as may be requested.

1.8 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to facility services Sections for definitive requirements.

END OF SECTION

1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Provide temporary utilities as specified and as otherwise necessary to perform the Work.
- .2 Maintain temporary utilities in a neat and tidy condition.
- .3 Remove temporary utilities from Place of the Work after use.

1.2 TEMPORARY WATER SUPPLY

- .1 Connect to and use Owner's existing water supply for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to Contractor.
- .2 Arrange and pay for necessary water supply connections and disconnections.

1.3 TEMPORARY HEATING AND VENTILATION

- .1 Contractor may connect to and use Owner's existing supply of natural gas for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to Contractor.
- .2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.
- .3 Provide temporary heat for the Work as required to:
  - .1 Facilitate progress of the Work.
  - .2 Protect the Work against dampness and cold.
  - .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.
  - .4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation, and curing of Products.
  - .5 After Project is enclosed, maintain interior air temperature between 10 degrees C and 35 degrees C.
- .4 Provide temporary ventilation for the Work as required to:
  - .1 Prevent accumulation of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.
  - .2 Ensure hazardous, noxious, or volatile substances do not migrate to Owner occupied spaces.
  - .3 Ventilate temporary sanitary facilities.
- .5 After Project is enclosed, maintain minimum one air change per hour for enclosed areas receiving architectural finishes. Do not allow excessive build up of moisture in the Work.
- .6 New permanent building heating and ventilation systems may be used during construction, at Contractor's option. If used during construction:
  - .1 Owner will pay utility costs resulting from the use of permanent systems.
  - .2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.
  - .3 Just prior to Ready-for-Takeover, replace filters, clean ducts, and perform other required maintenance to ensure systems are in as near as new condition as possible.
  - .4 Ensure systems manufacturers' warranties do not commence until the date of Ready-for-Takeover or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or equivalent coverage under Contractor's warranty.



1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

- .1 Connect to and use Owner's existing electrical supply for temporary use during construction. Usage at no cost to Contractor.
- .2 Existing maximum power supply of 240V AC, 3-phase, 60 Hz, 20 amps, is available for temporary use during construction.
- .3 Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.
- .4 New permanent building power and lighting systems may be used during construction, at Contractor's option. If used during construction:
  - .1 Owner will pay utility costs resulting from the use of permanent systems.
  - .2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.
  - .3 Just prior to Ready-for-Takeover, replace lamps which have been used for more than two months.
  - .4 Ensure systems manufacturers' warranties do not commence until the date of Ready-for-Takeover or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or equivalent coverage under Contractor's warranty.

END OF SECTION

1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Provide temporary construction facilities as necessary for performance of the Work and in compliance with applicable regulatory requirements.
- .2 Maintain temporary construction facilities in good condition for duration of the Work.
- .3 Remove temporary construction facilities from Place of the Work when no longer required.

1.2 CONSTRUCTION PARKING

- .1 Limited parking will be permitted at Place of the Work as long as it does not disrupt Owner's continuing operation of existing facility.

1.3 VEHICULAR ACCESS

- .1 Provide and maintain adequate access to Place of the Work, ensuring continuous access by emergency vehicles.
- .2 Existing private roadways at Place of the Work may be used for access to Place of the Work. Contractor assumes responsibility for any damage caused by construction traffic, and agrees to prevent or promptly clean up mud tracking or material spillage.
- .3 Clean municipal roadways located immediately adjacent to Place of the Work, regardless of cause, as follows:
  - .1 At least once per week on Friday afternoons, just before end of Working Day,
  - .2 After construction equipment or vehicles have left Place of the Work, resulting in soil or debris being deposited on roadway surfaces,
  - .3 As directed by authorities having jurisdiction, and
  - .4 As directed by Consultant.
- .4 Municipal Road Closures: Conform to requirements of authorities having jurisdiction.

1.4 FIELD OFFICES

- .1 Provide a temperature controlled and ventilated Contractor's field office, with suitable lighting, sufficiently sized and furnished to accommodate Project meetings and Contract Document layout.
- .2 Consultant's Field Office: Provide minimum 10 square metres of temporary office space for Consultant, either separately or within Contractor's field office.
- .3 Provide field office with at least one operable window and a lockable door.
- .4 Provide field office with temperature control, ventilation, and suitable power and lighting.
- .5 Equip field office with table and chairs to accommodate at least 8 meeting attendees, one 3-drawer filing cabinet, and one Drawing rack.
- .6 Provide appropriate emergency and first aid equipment as required by authorities having jurisdiction. Mount equipment in a prominent and easily accessible location, complete with easily identifiable labels.
- .7 Provide public access wi-fi internet service for use by Contractor and Consultant.
- .8 Provide a photocopier / scanner for use by Contractor and Consultant.
- .9 Clean field office weekly.
- .10 Due to space restrictions at Place of the Work, Subcontractors may not be able to have their own offices at Place of the Work.

1.5 STORAGE FACILITIES

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of Products and Construction Equipment.
- .2 Do not store Products or Construction Equipment in field office or in existing facility beyond the defined areas of construction.
- .3 Whereas the Project is a renovation to an existing facility, space for storage of Products and equipment at Place of the Work will be limited, and may require Contractor to make alternate arrangements for storage of Products and equipment off-site. Pay additional storage, delivery and transportation costs.

1.6 SANITARY FACILITIES

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

1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection systems and equipment during construction.

1.8 HOISTS AND CRANES

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, Products and Construction Equipment.
- .2 Make financial arrangements with Subcontractors for use thereof.
- .3 Hoists and cranes shall be operated only by properly trained and qualified operators.

1.9 PROJECT IDENTIFICATION SIGNS

- .1 Provide one Project identification sign complete with graphics and text.
- .2 Project identification sign shall be 2 440 x 2 440 mm in size, of wood frame and plywood construction with graphics produced by a professional sign company.
- .3 Indicate on Project identification sign the following information:
  - .1 Name of Project,
  - .2 Name and logo of Owner,
  - .3 Name and logo of Consultant, and
  - .4 Name and logo of Contractor.
- .4 Relevant graphics and text will be supplied to Contractor by Owner and Consultant promptly after Contract award.
- .5 Submit Shop Drawings for Project identification sign graphics and text.
- .6 Erect Project identification sign within 3 weeks of Contract award, in location directed by Consultant.
- .7 Erect Project identification sign plumb and level, with bottom of sign set minimum 1 220 mm above finished grade.

- .8 No other signs or advertisements, other than safety, warning, or directional signs, are permitted without Consultant's prior written approval.
- .9 Maintain Project identification sign in clean condition.
- .10 Remove and dispose of Project identification sign when directed by Consultant.

END OF SECTION

- 1 General
- 1.1 ADMINISTRATIVE REQUIREMENTS
  - .1 Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure Place of the Work during performance of the Work.
  - .2 Comply with applicable regulatory requirements.
  - .3 Maintain temporary barriers and enclosures in good condition for duration of the Work.
  - .4 Remove temporary barriers and enclosures from Place of the Work when no longer required.
- 1.2 FENCING
  - .1 Erect temporary security and safety site fencing of type and height determined by Contractor, subject to applicable regulatory requirements.
  - .2 Provide lockable access gates as required to facilitate construction access.
- 1.3 WEATHER ENCLOSURES
  - .1 Provide weather tight enclosures to unfinished door and window openings, top of shafts, and other openings in floors and roofs.
  - .2 Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.
  - .3 Design weather enclosures to withstand wind pressure and snow loading requirements.
- 1.4 DUST TIGHT SCREENS AND PARTITIONS
  - .1 Provide dust tight wood stud and plywood partitions to localize interior building areas from dust and noise generating activities.
  - .2 Erect, maintain, and relocate screens and partitions as required to facilitate construction operations and Owner's operational requirements.
- 1.5 FIRE ROUTES
  - .1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.
- 1.6 SECURITY AT PLACE OF THE WORK
  - .1 Become familiar with Place of the Work and surrounding neighbourhood.
  - .2 Provide adequate security measures to prevent vandalism, theft, arson and trespassing by unauthorized persons at Place of the Work.
  - .3 Maintain security measures for 24 hours a day, 7 days a week, 52 weeks of the year, including times when construction may be shut down due to strikes or lockouts.
  - .4 Remove security measures upon Ready-for-Takeover.
- 1.7 PROTECTION OF BUILDING FINISHES
  - .1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially-completed finished surfaces from damage during performance of the Work.

END OF SECTION

1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Provide temporary controls necessary for performance of the Work and in compliance with applicable regulatory requirements.
- .2 Maintain temporary controls in good condition for duration of the Work.
- .3 Remove temporary controls and Construction Equipment used to provide temporary controls from Place of the Work when no longer required.

1.2 PLANT PROTECTION

- .1 Protect trees and other plant material designated to remain at Place of the Work where indicated on Drawings.
- .2 Protect trees and shrubs susceptible to damage during construction to OPSS.MUNI 801.
- .3 For trees designated to remain, protect roots inside dripline from disturbance or damage during excavation and grading. Avoid traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil near trees and other plant material designated to remain at Place of the Work.
- .5 Provide lockable access gates as required to facilitate construction access.

1.3 DUST AND PARTICULATE CONTROL

- .1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.
- .2 Execute Work by methods that minimize dust from construction operations and spreading of dust at Place of the Work or to adjacent properties.
- .3 Provide temporary dust tight enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area. Refer to Section 01 56 00.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .5 Use appropriate covers on trucks hauling fine, dusty or loose materials.

1.4 DEWATERING

- .1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations and other parts of the Work. Maintain such areas free of water arising from groundwater or surface runoff, as required to keep them stable, dry and protected from damage due to flooding.
- .2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.
- .3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface draining systems. Treat or dispose of such water in accordance with applicable regulatory requirements.

1.5 DRAINAGE AT PLACE OF THE WORK

- .1 Maintain grades to ensure proper drainage at Place of the Work.
- .2 Prevent surface water runoff from leaving Place of the Work.

- .3 Prevent precipitation from infiltrating or from directly running off stockpiled waste materials. Cover stockpiled waste materials with an impermeable liner during periods of work stoppage including at end of each Working Day.
- .4 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas and other work areas as required to prevent erosion and sedimentation.
- .5 Control surface drainage by ensuring gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure runoff from unfinished areas is intercepted and diverted to suitable outlets.
- .6 Periodically inspect and clean catch basins and storm lines at Place of the Work to ensure their continuous operation during performance of the Work and upon Ready-for-Takeover.

#### 1.6 EROSION AND SEDIMENT CONTROL

- .1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems and watercourses. Make Good damage caused by soil erosion and sedimentation.
- .2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes and other measures that may be required to prevent erosion and migration of silt, mud, sediment and other debris.
- .3 Do not disturb existing embankments or embankment protection.
- .4 Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.
- .5 If soil and debris from Place of the Work accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

#### 1.7 POLLUTION CONTROL

- .1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.
- .2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel at Place of the Work, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:
  - .1 Authority having jurisdiction.
  - .2 Person causing or having control of pollution source, if known.
  - .3 Owner and Consultant.
- .3 Contact manufacturer of pollutant, if known and applicable, to obtain safety data sheets (SDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.
- .4 Take immediate action to contain and mitigate harmful effects of the spill or release.

END OF SECTION

1 General

1.1 DEFINITIONS

- .1 Not In Contract (NIC) means an item that requires coordination for its later installation and which is neither supplied nor installed as part of the Work.
- .2 Owner-supplied Product means a Product that will be supplied by Owner to Contractor for installation as part of the Work. Refer to Section 01 11 00.

1.2 COMMON PRODUCT REQUIREMENTS

- .1 Provide Products that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by Consultant, furnish evidence as to type, source and quality of Products Provided in the Work.
- .2 Products referred to in the singular implies supply and installation of as many Products as necessary to complete the Work.
- .3 Unless specified otherwise, maintain uniformity of manufacture for like items throughout.
- .4 Unless specified otherwise, Consultant may select colours from a manufacturer's complete range of available colours, textures and patterns, including those considered to be premium.
- .5 Permanent manufacturer's markings, labels, trademarks, and nameplates on Products are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.3 PRODUCT OPTIONS

- .1 Subject to the provisions of Section 01 25 00:
  - .1 Wherever a Product or manufacturer is specified by a single proprietary name, Provide the named Product only.
  - .2 Wherever more than one Product or manufacturer is specified by proprietary name for a single application, Provide any one of the named Products.
- .2 Wherever a Product is specified by reference to a standard only, Provide any Product that meets or exceeds the specified standard. If requested by Consultant, submit information verifying that the proposed Product meets or exceeds the specified standard.
- .3 Wherever a Product is specified by descriptive or performance requirements, and includes a named example preceded by the abbreviation "eg." (meaning "for example"), Provide the named Product or a similar Product manufactured by one of the named manufacturers that meets or exceeds the specified descriptive and performance characteristics. If requested by Consultant, submit information verifying that a proposed Product meets or exceeds the specified requirements.
- .4 Wherever a Product is specified by descriptive or performance requirements only, Provide any Product that meets or exceeds specified requirements. If requested by Consultant, submit information verifying that proposed Product meets or exceeds specified requirements.

1.4 PRODUCT AVAILABILITY AND DELIVERY TIMES

- .1 Promptly upon Contract award and periodically during construction, review and confirm Product availability and delivery times. Order Products in sufficient time to meet the construction progress schedule and the Contract Time.
- .2 If a specified Product is no longer available, promptly notify Consultant. Consultant will take action as required.



- .3 If delivery delays are foreseeable, for any reason, promptly notify Consultant.
  - .1 If a delivery delay is beyond Contractor's control, Consultant will give direction how to proceed.
  - .2 If a delivery delay is caused by something that was or is within Contractor's control, Contractor shall propose actions to maintain the construction progress schedule for Consultant's review and acceptance.

#### 1.5 STORAGE, HANDLING AND PROTECTION

- .1 Store, handle and protect Products during transportation to Place of the Work and before, during and after installation in a manner to prevent damage, adulteration, deterioration and soiling.
- .2 Comply with manufacturer's instructions for storage, handling and protection.
- .3 Store packaged or bundle Products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.
- .4 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labelling and the submission of safety data sheets (SDS).
- .5 Store Products subject to damage from weather in weatherproof enclosures.
- .6 Store sheet Products on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store Products within existing occupied facility only when approved by Owner.
- .8 Move Products stored within the Work should they become a hindrance to the Work or to the delivery of other Products.
- .9 Remove flammable rubbish and packing materials from Place of the Work on a daily basis.
- .10 Remove and replace damaged Products.

END OF SECTION

- 1 General
- 1.1 SURVEYOR QUALIFICATIONS
  - .1 Engage a registered land surveyor, licensed to practice at Place of the Work.
- 1.2 SUBMITTALS
  - .1 Submit name and address of registered land surveyor performing survey work.
  - .2 Submit to Consultant surveys of the Work prepared and issued by registered land surveyor upon completion of the following stages of the Work:
    - .1 Building footings and foundations.
    - .2 Rough grading.
    - .3 Utility services and pavements.
    - .4 Finish grading and landscaping.
  - .3 Submit a certificate, signed by registered land surveyor and acceptable in content and form to authority having jurisdiction, certifying inverts, elevations, grades, and locations of completed Work are in conformance with Contract Documents.
- 1.3 SURVEY REFERENCE POINTS
  - .1 Locate and confirm permanent reference points prior to commencing work at Place of the Work.
  - .2 Preserve and protect permanent reference points at Place of the Work during performance of the Work.
  - .3 Do not change or relocate reference points without prior written notice to Consultant.
  - .4 Report to Consultant when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. Require registered land surveyor to replace reference points in accordance with original land survey.
- 1.4 SURVEY REQUIREMENTS
  - .1 Establish sufficient benchmarks at Place of the Work, referenced to established benchmarks by survey control points.
  - .2 Confirm that existing survey reference points are in accordance with Owner's survey and property limits.
  - .3 Establish initial lines and levels for Project layout.
  - .4 Maintain a complete, accurate log of control and survey work as it progresses. Record locations with horizontal and vertical data in Project as-built record drawings.
- 1.5 EXISTING UTILITIES AND STRUCTURES
  - .1 Before commencing excavation, drilling or other earthwork, establish or confirm location and extent of existing underground utilities and structures in work area.
  - .2 Promptly notify Consultant if underground utilities, structures, or their locations differ from those indicated in Contract Documents or in available project information. Consultant will give appropriate direction.
  - .3 Record locations of maintained, re-routed and abandoned utility lines.

1.6 VERIFICATION OF EXISTING CONDITIONS

- .1 Where work specified in any Section is dependent on the work of another Section or Sections having been properly completed, verify that work is complete and in a condition suitable to receive subsequent work. Commencement of work of a Section that is dependent on the work of another Section or Sections having been properly completed means acceptance of those existing conditions.
- .2 Verify ambient conditions are suitable before commencing the work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of Products used.
- .3 Ensure substrate surfaces are clean, dimensionally stable, cured and free of contaminants.
- .4 Notify Consultant in writing of unacceptable conditions.

END OF SECTION

1 General

1.1 DEFINITIONS

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

1.2 COLD WEATHER REQUIREMENTS

- .1 Perform the Work continually and avoid weather delays.
- .2 Provide temporary heating and cold weather working measures during cold weather periods and winter months. Refer to Sections 01 51 00 and 01 56 00.
- .3 Construction delays, whether the responsibility of Contractor or otherwise, which result in unanticipated or extended winter work will not be considered justification for claims for additional payments.
- .4 Uniformly distribute heat to avoid hot or cool areas or excessive drying.

1.3 MANUFACTURER'S INSTRUCTIONS

- .1 Install, erect, or apply Products in strict accordance with manufacturer's instructions.
- .2 Specifications requiring the installation, erection or application of Products to conform to a consensus standard does not replace or supercede the requirement to also conform to manufacturer's instructions.
- .3 Where a manufacturer's instructions and the requirements of a specified consensus standard are contradictory, manufacturer's instructions will govern.
- .4 Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions where, in Contractor's opinion, conformance with Contract Documents instead of manufacturer's instructions may be detrimental to the Work or may jeopardize manufacturer's warranty.
- .5 Do not rely on labels or enclosures supplied with Products. Obtain written instructions directly from manufacturers.
- .6 Allow manufacturer's representatives to have access to the Work at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities. Refer to Section 01 40 00.

1.4 CONCEALMENT

- .1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:
  - .1 After review by Consultant and authority having jurisdiction.
  - .2 Where locations differ from those shown on Drawings, after recording actual locations on as-built record drawings.
- .2 Provide incidental furring or other enclosure as required.
- .3 Notify Consultant in writing of interferences before installation.

1.5 FASTENINGS - GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.
- .2 Provide fasteners to full required complement. Products with missing fasteners will be rejected by Consultant.

- .3 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.
- .4 Use non-corrosive fasteners and anchors for securing exterior work and in spaces where high humidity levels are anticipated.
- .5 Space fasteners within individual load limit or shear capacity, and ensure fasteners provide positive permanent anchorage.
- .6 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .7 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.
- .8 Fasteners stressed in withdrawal will be rejected.
- .9 Powder-actuated fasteners are to be a system suitable for the specific application, corrosion-resistant, and capable of sustaining without failure a load equal to 10 times the design load when tested to ASTM E1190.
- .10 Do not use powder-actuated fasteners stressed in withdrawal for finished work.
- .11 Do not use powder-actuated fasteners within 100 mm of concrete or masonry edges.
- .12 Do not use powder-actuated fasteners in post-tensioned concrete.

#### 1.6 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Bolts shall not project more than one diameter beyond nuts.

#### 1.7 FIRE RATED ASSEMBLIES

- .1 When penetrating fire rated wall, ceiling, or floor assemblies, completely seal voids with firestopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

#### 1.8 TEMPLATES, BUILT-INS AND DIMENSIONS

- .1 Take field measurements and confirm dimensions necessary for the proper execution of the Work.
- .2 Assume responsibility for accuracy and completeness of dimensions.
- .3 Provide forms, templates, anchors, inserts and accessories to be fixed to or inserted as part of the Work.
- .4 Prepare and submit setting drawings, templates and other information necessary for the placement and installation of Products, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels.
- .5 Supply items in sufficient time, complete with templates and other necessary information, to accommodate installation without causing delay to the Work. Failure to do so will not result in an increase in Contract Price and Contract Time.
- .6 Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated, which maintain levels and clearances to adjacent work, as set out in Contract Documents.

- .7 Verify details and field measurements at Place of the Work prior to fabricating Products of special design to ensure fit.
- 1.9 INTERFERENCES
- .1 Prior to commencement of the Work, coordinate placement of Products to ensure components are properly accommodated within designed spaces. Prepare and submit interference drawings as specified in Section 01 33 00.
  - .2 Be responsible for additional work and costs necessitated by failure to coordinate the parts of the Work.
  - .3 Provide adequate access and clearances around Products as required by authorities having jurisdiction, and as required for maintenance purposes by manufacturers.
  - .4 Notify Consultant if Contract Documents are in conflict with access and clearance requirements.
- 1.10 LOCATION OF FIXTURES, OUTLETS AND DEVICES
- .1 Consider location of fixtures, outlets, and devices indicated on Drawings as approximate.
  - .2 Locate fixtures, outlets, and devices for minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.
  - .3 Promptly notify Consultant in writing of conflicting installation requirements for fixtures, outlets and devices. If requested, indicate proposed locations and obtain approval for actual locations.
- 1.11 REMEDIAL WORK AND MAKING GOOD
- .1 Notify Consultant of, and perform remedial work required to Make Good defective or unacceptable work.
  - .2 Ensure properly qualified workers perform remedial work.
  - .3 Coordinate adjacent affected work as required.
  - .4 Make Good defective and damaged parts of the Work.
  - .5 Make Good damage to property located adjacent to Place of the Work.
  - .6 Make Good damage to existing surfaces designated to remain as part of the Work.
  - .7 Make Good existing conditions as noted on Drawings.
  - .8 Prioritize the correction of defective work which, in the sole discretion of Owner, adversely affects Owner's day to day operations.
  - .9 Make Good damage to the Work resulting from lack of adequate heating protection.
  - .10 Make Good damage to utility services in accordance with authority having jurisdiction.

END OF SECTION

1 General

1.1 REQUESTS FOR CUTTING, PATCHING AND REMEDIAL WORK

- .1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:
  - .1 Structural integrity of any element of the Work.
  - .2 Integrity of weather-exposed or moisture-resistant elements.
  - .3 Efficiency, maintenance, or safety of any operational element.
  - .4 Visual qualities of sight-exposed elements.
  - .5 Work of Owner or Other Contractor.
  - .6 Warranty of Products affected.
- .2 Include in request:
  - .1 Identification of Project.
  - .2 Location and description of affected work, including drawings or sketches as required.
  - .3 Statement on necessity for cutting or alteration.
  - .4 Description of proposed work, and Products to be used.
  - .5 Alternatives to cutting and patching.
  - .6 Effect on work of Owner or Other Contractors.
  - .7 Written permission of affected Other Contractors.
  - .8 Date and time work will be executed.

1.2 PRODUCTS

- .1 Unless specified otherwise, when replacing existing or previously installed Products in the course of cutting and patching work, use replacement Products of same character and quality as those being replaced.
- .2 If an existing or previously installed Product must be replaced with a different Product, submit request for substitution as specified in Section 01 25 00.

1.3 PREPARATION

- .1 Inspect existing conditions as specified in Section 01 71 00.
- .2 Provide supports to assure structural integrity of surroundings.
- .3 Provide devices and methods to protect other portions of the Work from damage.
- .4 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

- .1 Where the Work involves breaking into or connecting to existing services, give authority having jurisdiction, Owner and Consultant 48 hours notice for necessary interruption of facility services.
- .2 Maintain excavations free of water.
- .3 Keep duration of interruptions to a minimum.
- .4 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless Owner's prior written approval is obtained.
- .5 Protect and maintain existing active services.
- .6 Record locations of services, including depth, on as-built drawings.
- .7 Construct or erect temporary barriers as specified in Section 01 56 00, as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING AND REMEDIAL WORK

- .1 Coordinate and perform the Work to ensure cutting and patching work is kept to a minimum.
- .2 Perform cutting, fitting, patching, and remedial work to make the affected parts of the Work come together properly and complete the Work.
- .3 Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical work.
- .4 Perform cutting by methods to avoid damage to other work.
- .5 Provide proper surfaces to receive patching, remedial work, and finishing.
- .6 Perform cutting, patching, and remedial work using competent and qualified specialists familiar with the Products affected, in a manner that neither damages nor endangers the Work.
- .7 Do not use pneumatic or impact tools without Consultant's prior written approval.
- .8 Ensure cutting, patching, and remedial work does not jeopardize manufacturers' warranties.
- .9 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.
- .10 Fit work to pipes, sleeves, ducts, conduit and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation and firestopping.
- .11 Maintain fire ratings of fire rated assemblies where cutting, patching or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping and smoke seal materials to full depth or with suitably rated devices.

END OF SECTION



1 General

1.1 REGULATORY REQUIREMENTS

- .1 Comply with applicable regulatory requirements when disposing of waste materials.
- .2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

- .1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.
- .2 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .3 Prevent cross-contamination during cleaning process.
- .4 Notify Consultant of the need for cleaning caused by Owner or Other Contractors.
- .5 Assign cleaning duties to special dedicated crew with own foreman and of sufficient size and skill to prevent accumulation of waste, debris and dirt at Place of the Work.

1.3 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

- .1 Maintain the Work in tidy and safe condition, free from accumulation of waste materials and construction debris.
- .2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables. Locate containers where they will not hinder the progress of the Work and Owner's continuing operations.
- .3 Owner's existing waste containers at Place of the Work may not be used during construction.
- .4 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each Working Day. Collect packaging materials for recycling or reuse.
- .5 Remove waste materials and recyclables from Place of the Work at regular intervals.
- .6 Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.
- .7 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

1.4 FINAL CLEANING

- .1 Before final cleaning, arrange a meeting at Place of the Work to determine the acceptable standard of cleaning. Ensure Owner, Consultant, Contractor and cleaning Subcontractor are in attendance.
- .2 Remove from Place of the Work surplus Products, waste materials, recyclables, Temporary Work and Construction Equipment not required to perform any remaining work.
- .3 Provide professional cleaning by a recognized, established cleaning company.
- .4 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.
- .5 Re-clean as necessary areas that have been accessed by Contractor's workers prior to Ready-for-Takeover.

- .6 Remove stains, spots, marks and dirt from finished surfaces, mechanical and electrical fixtures, furniture, fitments, walls, and floors.
  - .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate and all other finished surfaces, including mechanical and electrical fixtures. Replace broken, scratched or otherwise damaged glass.
  - .8 Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.
  - .9 Vacuum clean and dust exposed wall, floor, and ceiling surfaces, above suspended ceiling tiles, and behind grilles, louvres and screens.
  - .10 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment has been used during construction.
  - .11 Remove waste materials and debris from crawlspaces and other accessible concealed spaces.
  - .12 Remove stains, spots, marks, and dirt from exterior facades.
  - .13 Clean exterior and interior window glass and frames.
  - .14 Clean and sweep roofs, and clear roof drains.
  - .15 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
  - .16 Power wash exterior paved surfaces.
  - .17 Use leaf blower to clean landscaped surfaces.
- 1.5 WASTE MANAGEMENT AND DISPOSAL
- .1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.
  - .2 Do not burn or bury waste materials at Place of the Work.
  - .3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from Place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.
  - .4 Cover or wet down dry waste materials to prevent blowing dust and debris.
- 1.6 HAZARDOUS WASTE DISPOSAL
- .1 If and when required, remove and dispose of hazardous or contaminated waste materials in accordance with applicable regulatory requirements.
  - .2 Hazardous or contaminated waste materials must be transported by a licensed waste hauling company.
  - .3 Submit a copy of hauling company's Certificate of Approval to authority having jurisdiction prior to transporting any hazardous or contaminated waste materials.
  - .4 Stockpile suspected hazardous or contaminated waste material temporarily in neat and secure stockpiles overlying a double layer of 0.20 mm thick high density polyethylene.
  - .5 Isolate stockpiles from remainder of Place of the Work and cover with a single layer of 0.20 mm thick polyethylene to prevent entry, wind disturbance or collection of surface water.

- .6 Do not transport potentially hazardous or contaminated waste materials until such materials have been properly identified by appropriate authority having jurisdiction.

END OF SECTION

- 1 General
- 1.1 PROTECTION OF EXISTING PROPERTY
  - .1 Protect Owner's existing property and property adjacent to Place of the Work from damage.
  - .2 Make Good damage to Owner's existing property resulting from performance of the Work.
  - .3 Do not undertake to Make Good damage to any property located adjacent to Place of the Work, or acknowledge that such damage was caused or occasioned by Contractor, without first consulting with Owner and receiving written instructions as to the course of action to be followed.
    - .1 Under such circumstances, where there is danger to life or property, Contractor may take such emergency action as he deems necessary to remove the danger.
    - .2 Contractor shall indemnify and hold harmless Owner and Consultant, including their agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings by third parties that arise out of, or are attributable to, such emergency action.
- 1.2 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS
  - .1 Adequately protect parts of the Work completed and in progress from any kind of damage.
  - .2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the safety or integrity of the Work.
  - .3 Refer to Product Specifications for material-specific requirements regarding protection of installed Products.
  - .4 Unless specified otherwise, maintain protection until Ready-for-Takeover. Remove protection and protective coverings upon expiry of specified duration.
  - .5 Promptly Make Good parts of the Work damaged as a result of inadequate protection.

END OF SECTION

- 1 General
- 1.1 READY-FOR-TAKEOVER
  - .1 Prerequisites to attaining Ready-for-Takeover of the Work are described in General Conditions of the Contract.
  - .2 Ready-for-Takeover is required on or before December 6, 2024.
- 1.2 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER
  - .1 Contractor's Inspection: Before applying for Consultant's review to establish Ready-for-Takeover of the Work:
    - .1 Ensure specified prerequisites for Ready-for-Takeover of the Work are completed.
    - .2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.
    - .3 Prepare a comprehensive and detailed list of items to be completed or corrected.
    - .4 Submit an anticipated schedule and costs for items to be completed or corrected.
  - .2 Consultant's Review: Upon receipt of Contractor's application for review, together with Contractor's list of items to be completed or corrected, Consultant will review the Work. Consultant will advise Contractor whether or not the Work is Ready-for-Takeover and will prepare and give Contractor a list of items, if any, to be added to Contractor's list of items to be completed or corrected. Submit to Consultant a revised list of items to be completed or corrected.
  - .3 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. Contractor's inspection and Consultant's review procedures specified above shall be repeated until the Work is Ready-for-Takeover and no items remain on Contractor's list of items to be completed or corrected.
  - .4 When Consultant determines the Work is Ready-for-Takeover, Consultant will notify Contractor and Owner in writing to that affect.
- 1.3 PREREQUISITES TO FINAL PAYMENT
  - .1 After Ready-for-Takeover of the Work and before submitting an application for final payment in accordance with General Conditions of the Contract:
    - .1 Correct or complete all remaining defective, deficient, and incomplete work.
    - .2 Remove from Place of the Work surplus Products, Construction Equipment, and Temporary Work.
    - .3 Perform final cleaning and waste removal necessitated by Contractor's work performed after Ready-for-Takeover, as specified in Section 01 74 00.
- 1.4 SUBSTANTIAL PERFORMANCE OF THE WORK
  - .1 The prerequisites to, and the procedures for, attaining Substantial Performance of the Work shall be:
    - .1 Independent of those for attaining Ready-for-Takeover of the Work.
    - .2 In accordance with lien legislation applicable at Place of the Work.

END OF SECTION

- 1 General
- 1.1 OPERATION AND MAINTENANCE MANUAL
  - .1 Prepare a comprehensive operation and maintenance manual, in the language of the Contract, using personnel qualified and experienced for this task.
  - .2 Submit an initial draft of operation and maintenance manual for Consultant's review. If required by Consultant's review comments, revise manual contents and resubmit for Consultant's review. If required, repeat this process until Consultant accepts draft manual in writing.
  - .3 Submit final version of operation and maintenance manual to Owner in both hard copy and digital formats. Submit 3 hard copies.
- 1.2 OPERATION AND MAINTENANCE MANUAL FORMAT
  - .1 Organize data in the form of an instructional manual.
  - .2 Arrange content by systems, under Section numbers and sequence of Table of Contents.
  - .3 Hard Copy Requirements:
    - .1 Binders: Vinyl, hard covered, three D-rings, loose leaf, 215 x 280 mm size, with spine and face pockets.
    - .2 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine and front cover.
    - .3 Cover: Identify each binder with typed or printed title "Operation and Maintenance Manual", name of Project, and subject matter of contents.
    - .4 Include tabbed fly leaf for each separate Product or system, with typed description of Product and major component parts of equipment.
    - .5 Text: Manufacturer's printed data, or typewritten data.
    - .6 Drawings: With reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
  - .4 Digital Copy Requirements:
    - .1 Prepare digital copy of operation and maintenance manual as a portable document format (.pdf) file.
    - .2 When multiple files are used, correlate data into related consistent groupings. Identify contents of each file in file name.
    - .3 Submit digital copy of operation and maintenance manual on electronic media type acceptable to Owner.
    - .4 Include electronic bookmarks for each separate Product and system, with description of Product and major component parts of equipment.
    - .5 Include digital copy of Shop Drawings in manual as portable document format (.pdf) files.
- 1.3 OPERATION AND MAINTENANCE MANUAL - GENERAL CONTENT
  - .1 Table of Contents for each volume.
  - .2 Introductory information, including:
    - .1 Date of manual submission.
    - .2 Complete contact information for Consultant, subconsultants, other consultants, and Contractor, with names of responsible parties identified for each.
    - .3 Schedule of Products and systems indexed to content of volume.
  - .3 For each Product or system, include complete contact information for Subcontractors, Suppliers and manufacturers, including local sources for supplies and replacement parts.
  - .4 Product Data: Mark each sheet to clearly identify specific Products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

- .5 Reviewed Shop Drawings.
  - .6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.
  - .7 Warranties.
  - .8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.
  - .9 Training materials as specified in Section 01 79 00.
- 1.4 OPERATION AND MAINTENANCE MANUAL - EQUIPMENT AND SYSTEMS CONTENT
- .1 Each Item of Equipment and System: Include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  - .2 Panel Board Circuit Directories: Include electrical service characteristics, controls, and communications.
  - .3 Include installed colour coded wiring diagrams.
  - .4 Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter and any special operating instructions.
  - .5 Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing and checking instructions.
  - .6 Include servicing and lubrication schedule, and list of lubricants required.
  - .7 Include manufacturer's printed operation and maintenance instructions.
  - .8 Include sequence of operation by controls manufacturer.
  - .9 Include original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
  - .10 Include Contractor's coordination drawings, with installed colour coded piping diagrams.
  - .11 Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  - .12 Include list of original manufacturer's spare parts, current prices and recommended quantities to be maintained in storage.
  - .13 Include testing and balancing reports.
  - .14 Include additional content as specified in Product Specifications.
- 1.5 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES
- .1 Include Product data, with catalogue number, options selected, size, composition, and colour and texture designations. Include information for re-ordering custom manufactured Products.
  - .2 Include instructions for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

- .3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of building envelope will meet the initial building envelope criteria.
  - .4 Include additional content as specified in Product Specifications.
- 1.6 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT
- .1 Separate each warranty with index tab sheets keyed to Table of Contents listing.
  - .2 List each warrantor with complete contact information.
  - .3 Verify documents are in proper form and contain full information. Ensure warranties are for correct duration and are in Owner's name.
- 1.7 PROJECT AS-BUILT RECORD DRAWINGS
- .1 Arrange for Consultant to electronically transfer information marked up on as-built record drawings during progress of the Work to a digital set of drawing files.
  - .2 Pay Consultant for electronic transfer of as-built information from cash allowance specified in Section 01 21 00.
  - .3 Mark revised drawings as "AS-BUILT DRAWINGS".
  - .4 Submit completed as-built record drawings in digital formats to Owner.
  - .5 Submit as-built record drawings as both Autodesk AutoCAD (.dwg) files and portable document format (.pdf) files.
- 1.8 SPARE PARTS, EXTRA STOCK MATERIALS AND SPECIAL TOOLS
- .1 Supply spare parts, extra stock materials and special tools in quantities specified in technical specification Sections.
  - .2 Ensure spare parts and extra stock materials are new, not damaged or defective, and of same quality, manufacturer, and batch or production run as installed Products.
  - .3 Include tags for special tools identifying their function and associated Product.
  - .4 Deliver to and store items at location directed by Owner at Place of the Work. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.
  - .5 Catalogue items and submit to Consultant an inventory listing organized by specification Section numbers. Include Consultant reviewed inventory listing in operation and maintenance manual.

END OF SECTION



- 1 General
- 1.1 ADMINISTRATIVE REQUIREMENTS
  - .1 Demonstrate and train Owner's personnel on operation and maintenance of equipment, building envelope and systems prior to scheduled date of Ready-for-Takeover.
  - .2 Owner will prepare a list of personnel to receive training, and will coordinate their attendance at agreed upon times.
  - .3 Coordinate and schedule demonstration and training given by Subcontractors and Suppliers.
- 1.2 SUBMITTALS
  - .1 Submit proposed dates, times, durations, and locations for demonstration and training of each item of equipment and each system for which demonstration and training is required. Allow sufficient time for training and demonstration for each item of equipment or system, or time as may be specified in Product Specifications.
  - .2 Consultant and Owner will review submittal and advise Contractor of any necessary revisions.
  - .3 Submit reports within 5 Working Days after completion of demonstration and training:
    - .1 Identifying time and date of each demonstration and training session.
    - .2 Summarizing the demonstration and training performed.
    - .3 Including a list of attendees.
  - .4 Submit video recordings of demonstration and training sessions together with reports.
- 1.3 PREREQUISITES TO DEMONSTRATION AND TRAINING
  - .1 Ensure testing, adjusting and balancing has been performed in accordance with Contract Documents.
  - .2 Ensure equipment and systems are fully operational.
  - .3 Ensure copy of completed operation and maintenance manual is available for use in demonstration and training.
  - .4 Ensure conditions for demonstration and training comply with requirements specified in Product Specifications.
- 1.4 DEMONSTRATION AND TRAINING
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment and system.
  - .2 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.
  - .3 Prepare and insert additional data in operation and maintenance manual if required.

END OF SECTION

1 General

1.1 REFERENCES

- .1 CSA S350-M1980 (R2003): Code of Practice for Safety in Demolition of Structures.
- .2 CSA Z783-12: Deconstruction of Buildings and Their Related Parts.

1.2 SEQUENCING

- .1 Schedule deconstruction activities to minimize disruption to existing facility operations.
- .2 Verify deconstruction schedule with Consultant prior to commencement of the Work.
- .3 Protect existing facility occupants from dust and from any danger arising from deconstruction operations. Refer to Section 01 56 00.

1.3 SPECIAL PROCEDURE SUBMITTALS

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

1.4 QUALIFICATIONS

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

1.5 FIELD CONDITIONS

- .1 Inspect and photograph existing adjacent surfaces and assemblies.
- .2 Record conditions and stability in a manner suitable for evaluation of possible damage caused by deconstruction operations.
- .3 Approximate locations of existing facility services may be indicated on Drawings. Owner and Consultant assume no responsibility for accuracy of such information.

2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Permits and Fees: Include tipping charges and other related fees necessary for completion of deconstruction operations.
- .2 Utilities: Obtain approval from authorities having jurisdiction prior to commencing deconstruction operations.
- .3 Hazardous Waste: Conform to authorities having jurisdiction.

2.2 EQUIPMENT

- .1 Deconstruction: Appropriate equipment for type of deconstruction being contemplated.
- .2 Do not use heavy equipment for making openings in existing walls or in confined spaces where damage to other parts of the Work or adjacent property may result.

3 Execution

3.1 EXAMINATION

- .1 Refer to Section 01 71 00.

- .2 Verify locations and construction of structures to be demolished.
- .3 Verify construction and details of other existing and adjacent property.
- .4 Verify location of utility and facility services.
- .5 Undertake x-ray investigations of existing building elements designated for selective demolition to determine locations of concealed components, utility services and facility services.

### 3.2 PREPARATION

- .1 Erect shoring, bracing and other temporary structures to prevent collapse, settlement and movement of property. Refer to Section 01 56 00.
- .2 Provide and maintain dust protection screen as specified in Section 01 56 00.
- .3 Provide and maintain weather enclosures as specified in Section 01 56 00.
- .4 Barricade access by unauthorized persons to areas in which deconstruction is in progress.
- .5 Post danger signs in conspicuous locations to warn persons that deconstruction is in progress.
- .6 Erect protection to ensure safe access that must be maintained to existing areas still occupied by the public.
- .7 Protect adjacent property from damage caused by deconstruction operations.
- .8 Remove flammable and contaminated materials, and refuse from area before deconstruction operations commence.
- .9 Arrange for disconnection, capping and plugging of facility services that may be affected by deconstruction operations.

### 3.3 DECONSTRUCTION

- .1 Perform deconstruction work in an expeditious and safe manner.
- .2 Conform to CSA S350-M and CSA Z783.
- .3 Confine deconstruction operations to only those areas required.
- .4 Prevent and contain spread of dust.
- .5 Do not drop debris more than one storey unless in an enclosed chute. Lower large components carefully, under control and fully supported at all times.
- .6 Withdraw or flatten protruding nails as deconstruction operations proceed.

### 3.4 SALVAGE

- .1 Carefully remove materials scheduled for salvage to CSA Z783.
- .2 Clean and prepare salvaged items for use by others.
- .3 Store salvaged materials in secure locations, protected from damage.
- .4 Items not scheduled for salvage become property of Contractor.

### 3.5 CLEANING

- .1 Leave Place of the Work in a clean and orderly condition, ready for use by others.
- .2 Remove waste and debris in accordance with authorities having jurisdiction.

- .3 Remove protections, barricades and other temporary constructions on completion of deconstruction operations.
- .4 Make Good property and materials damaged during deconstruction operations.

END OF SECTION

## **PART 1 - GENERAL**

### **1.1 General Requirements**

- .1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

### **1.2 Work in Other Sections**

#### **.1 Related Work Specified in Other Sections**

Division 31	:	Earthwork
Section 03 20 00	:	Concrete Reinforcing
Section 03 30 00	:	Cast-in-Place Concrete
Section 03 35 00	:	Specially Finished Concrete

### **1.3 Reference Standards**

CSA-A23.1-19: Concrete Materials and Methods of Concrete Construction  
CSA-A23.2-19: Test Methods and Standard Practices for Concrete  
CSA S269.1-16 (R2021): Falsework and Formwork for Construction Purposes

### **1.4 Co-ordination**

- .1 Install anchors, sleeves, bolts, inserts, drains, expansion joint components and other items supplied under other sections of the specifications required to be built into, anchored to, or passing through concrete work, in co-ordination with the other trades.
- .2 Supply templates for setting all anchorages required for the buildings and shelters.

### **1.5 Design of Formwork**

- .1 Assume full responsibility for the complete structural design and construction of formwork including shoring and bracing to resist vertical and horizontal loads due to the weight of wet concrete, self weight of forms, wind, fluid pressure of concrete, and other forces arising from equipment used in placing the concrete.

### **1.6 Waste Management and Disposal**

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .3 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

## **PART 2 - PRODUCTS**

### **2.1 Materials**

- .1 Formwork Lumber: Plywood and wood formwork materials to CAN/CSA-

A23.1/A23.2. Formwork materials used on site shall be new and acceptable to the Consultant, prior to erection. Panels shall be fabricated for use as form panels, finished one side, with sealed edges and a minimum thickness of 19mm. Panels shall be smooth and free from defects which would show up on concrete surfaces exposed to view.

- .2 Form Coating: Formaseal as manufactured by Master Builders for wood forms and as recommended by manufacturer for form liner.
- .3 Form stripping agent: CPD colourless non-staining odourless or as recommended by manufacturer of form liner.
- .4 Joint Tape: non staining, water impermeable, self releasing, where required.
- .5 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface, and not leaving metal closer than 25 mm to the surface of the concrete for walls. Snap tie length shall suit wall thickness as noted on drawings.
- .6 Tie Hole Plugs: 25mm dia. tapered PVC hole plugs to be provided on all exposed walls.
- .7 Form Ties/Supports: External clamping devices to retain form tight, uniform and easily removable around all columns.

## **PART 3 - EXECUTION**

### **3.1 Erection**

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1, and to produce acceptable finish where exposed.
- .3 Construct falsework in accordance with CSA S269.1.
- .4 Obtain approval from soils testing engineer for bearing surfaces prior to erection of forms.
- .5 Obtain Consultant's approval for use of earth forms.
- .6 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .7 Align form joints and make watertight. Keep form joints to minimum.
- .8 Use (25) mm chamfer strips on external corners of beams, joints, columns, walls etc., exposed to view.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

- .10 Provide blocking and anchorage for hollow metal frames set to be cast into forms.
- .11 Clean formwork in accordance with CAN/CSA-A23.1 before placing concrete.
- .12 Forms shall remain in place for a minimum duration of 48 hours for footings, curbs, etc. and all other non-self-supporting structural components.
- .13 Forms shall remain in place for a minimum of 72 hours for all columns.
- .14 Re-use of formwork and falsework subject to requirements of CAN/CSA-A23.1.
- .15 Be responsible for the safety of the structure, both before and after the removal of forms, until the concrete has reached its specified 28 day strength.
- .16 When forms are stripped during the curing period, cure and protect the exposed concrete in accordance with Section 03 30 00.
- .17 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.
- .18 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

**END OF SECTION 03 10 00**

## **PART 1 - GENERAL**

### **1.1 General Requirements**

- .1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

### **1.2 Work in Other Sections**

- .1 Related Work Specified in Other Sections
  - Section 03 10 00 : Concrete Forming and Accessories
  - Section 03 30 00 : Cast-in-Place Concrete
  - Section 03 35 00 : Concrete Finishing

### **1.3 Reference Standards**

CSA-A23.1-19: Concrete Materials and Methods of Concrete Construction  
CSA-A23.2-19: Test Methods and Standard Practices for Concrete  
CSA A23.3-19: Design of Concrete Structures  
CSA G30.18-09 (R2019): Carbon Steel Bars for Concrete Reinforcement  
ACI 315-2004 (SP66): Detailing Manual 2014  
ACI 315R-04: Manual of Structural and Placing Drawings for Reinforced Concrete Structures  
CSA-W186-M1990 (R2016): Welding of Reinforcing Bars in Reinforced Concrete Construction

### **1.4 Shop Drawings**

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate bar sizes, spacing, location and quantities of reinforcement, mesh, mechanical splices, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; (to Reinforcing Steel Manual of Standard Practice - Metric Supplement 2004 by Reinforcing Steel Institute of Ontario).
- .3 Detail placement of reinforcing where special conditions occur.
- .4 Design and detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

### **1.5 Substitutes**

- .1 Substitution of different size bars permitted only upon written approval of the Consultant.



## **PART 2 - PRODUCTS**

### **2.1 Materials**

- .1 Reinforcing Steel: billet steel, deformed bars to CAN/CSA G30.18. Use Grade 400R bars for all reinforcing unless noted otherwise, to sizes as shown on the drawings.
- .2 Welded Wire Fabrics: Where no reinforcement is shown, provide 152 x 152 MW 18.7 x MW 18.7 (6" x 6" x 6/6) welded wire fabric at 37mm (1½ ") below the finished surface of slabs on grade or walks, or toppings 62mm (2½") in thickness or greater. Lap ends and sides of fabric in accordance with requirements of CSA Standard CAN/CSA-A23.1, but in any event, not less than 300mm (12").

## **PART 3 – EXECUTION**

### **3.1 Fabrication**

- .1 Fabricate reinforcing in accordance with CSA-A23.1.
- .2 Obtain Consultant's approval for locations of reinforcement splices other than shown on steel placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

### **3.2 Storage of Reinforcing**

- .1 Reinforcing shall be stored off the ground to keep it free from dirt and to maintain its fabricated form.

### **3.3 Field Bending**

- .1 Do not field bend reinforcement except where indicated or authorized by the Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

### **3.4 Placing**

- .1 Place reinforcing steel as indicated on reviewed shop drawings and in accordance with CSA-A23.1.
- .2 Obtain Engineer's approval of reinforcing steel and position.
- .3 Locate reinforcing bars to provide proper concrete cover. Reinforcing cover will be carefully inspected by the Consultant, and reinforcing with inadequate cover will not be acceptable.
- .4 Fold all the wires behind bars, away from form faces.

- .5 Modify bars on site to accommodate box-outs, inserts, etc., as directed by the Consultant.

### **3.5 Field Cutting of Reinforcing**

- .1 Field cut reinforcing bars only where permitted by the Consultant.

**END OF SECTION 03 20 00**

## **PART 1 - GENERAL**

### **1.1 General Requirements**

- .1 Division 1, General Requirements, is a part of this section and shall apply as if repeated here.

### **1.2 Work in Other Sections**

- .1 Related Work Specified in Other Sections
- |                  |   |                                  |
|------------------|---|----------------------------------|
| Section 03 10 00 | : | Concrete Forming and Accessories |
| Section 03 20 00 | : | Concrete Reinforcing             |
| Section 03 35 00 | : | Concrete Finishing               |
| Section 04 20 00 | : | Unit Masonry                     |
| Section 05 10 00 | : | Structural Metal Framing         |
| Section 05 50 00 | : | Metal Fabrications               |
| Section 06 10 00 | : | Rough Carpentry                  |
| Division 15      | : | Mechanical                       |
| Division 16      | : | Electrical                       |
| Division 31      | : | Earthwork                        |

### **1.3 Reference Standards**

CSA-A23.1-19 – Concrete Materials and Methods of Concrete Construction  
CSA A23.2-19 – Test Methods and Standard Practices for Concrete  
CAN/CSA-A3000-08-18 Cementitious Materials Compendium  
A3000-98 A3000-18 Cementitious Materials Compendium  
A3000-98 A3000-18 Cementitious Materials Compendium  
CSA G30.18-09 (R2019): Carbon steel bars for concrete reinforcement  
ASTM A820/A820M-16, Standard Specification for Steel Fibres for Fibre Reinforced Concrete

### **1.4 Samples**

- .1 At least (3) weeks prior to commencing work, inform the Consultant of the proposed mix design and proposed source of ready mixed concrete.
- .2 A sample of the finishes shall be prepared and remain as the minimum acceptable standard for the project.

### **1.5 Certificates**

- .1 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.
- .2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1.

### **1.6 Quality Assurance**

- .1 The Contractor shall employ an independent inspection and testing company to carry out all testing and inspection as required. The Consultant will appoint the

- inspection and testing company. The cost of inspection and testing shall be paid by the Contractor, out of the Cash Allowance carried for this testing under Division 1.
- .2 Samples and methods of moulding shall conform to the requirements of CSA-A23.2.
  - .3 Additional testing shall be made if there is a distinct change in job conditions or if required by the Consultant or the authority having jurisdiction.
  - .4 Compression tests shall be performed in accordance with CSA-A23.2 and good practice.
  - .5 Failure to meet strength requirements will result in rejection of materials, strengthening or replacement of those portions that failed to develop the specified strength.
  - .6 Concrete slump shall be tested at time that cylinders are cast and at such other times deemed necessary.
  - .7 The addition of water and admixtures on the site is hereby prohibited and unacceptable for the project.**

#### **1.7 Submittals**

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittals.

#### **1.8 Waste Management And Disposal**

- .1 Designate a cleaning area for tools to limit water use and runoff.
- .2 Carefully coordinate the specified concrete work with weather conditions.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .5 Choose least harmful, appropriate cleaning method which will perform adequately.

## PART 2 – PRODUCTS

### 2.1 Materials

- .1 Formwork: As specified in Section 03 10 00.
- .2 Reinforcing Steel: As specified in Section 03 20 00.
- .3 Water: to CSA-A23.1.
- .4 Aggregates: To CSA-A23.1. Coarse aggregates to be normal density. Use blend of 10mm and 20mm for coloured patterned concrete slabs.
- .5 Colour Admixtures: Integral coloured pigments to C-979-86. Two (2) colours to be selected by Consultants from manufacturer's standard range.
- .6 Non-Shrink Grout: Sternson M-Bed Superflow or approved equal.
- .7 Interior Cure and Seal Compound: Interior slabs shall be W. R. Meadows "Intex". No resin-based compounds will be accepted.
- .8 Exterior Cure and Seal Compound: Exterior concrete slabs and gutters shall be W. R. Meadows "Sealtight CS-309".
- .9 Expansion Joint Filler: Shall be Sealtight asphalt expansion joint filler, W. R. Meadows.
- .10 Joint and Sawcut Filler: Shall be Loadflex by Sika or Jointflex by CPD.
- .11 Joint Tape: Shall be Sealtight Gusset Tape by W. R. Meadows.
- .12 Premoulded Membrane: Shall be Sealtight 7100-312 (PMPC), W. R. Meadows.

### 2.2 Concrete Mixes

- .1 Proportion normal density concrete in accordance with CSA A23.1, to give following properties for concrete in foundation walls, footings, composite deck toppings and any other unspecified concrete:
  - .1 Cement: Type GU Portland cement, minimum 325 kg/m<sup>3</sup>
  - .2 Maximum 25% slag cement content
  - .3 Minimum compressive strength at 28 days: 25 MPa.
  - .4 Nominal size of coarse aggregate: 20 mm.
  - .5 Slump at time and point of discharge: 50 to 100 mm.
  - .6 Air content: 0 to 3%.
- .2 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give following properties: for concrete in slabs-on-grade, structural slabs and

columns:

- .1 Cement: Type GU Portland cement, minimum 325 kg/m<sup>3</sup>
  - .2 Maximum 25% slag cement content
  - .3 Minimum compressive strength at 28 days: 32 MPa.
  - .4 Nominal size of coarse aggregate: 20 mm.
  - .5 Slump at time and point of discharge: 60 to 100 mm.
  - .6 Air content: 0 - 3% maximum.
- .3 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in exterior structural slabs and sidewalks/curbs:
- .1 Cement: Type GU Portland cement, minimum 275 kg/m<sup>3</sup>
  - .2 Maximum 25% slag cement content
  - .3 Minimum compressive strength at 28 days: 32 MPa.
  - .4 Class of exposure: C-2.
  - .5 Nominal size of coarse aggregate: 20 mm.
  - .6 Slump at time and point of discharge: 60 to 100 mm.
  - .7 Air content: 5 to 8%.
- .4 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in grouted masonry blocks and concrete in metal pans.
- .1 Cement: Type GU Portland cement, minimum 275 kg/m<sup>3</sup>
  - .2 Maximum 25% slag cement content
  - .3 Minimum compressive strength at 28 days: 20 MPa.
  - .4 Nominal size of coarse aggregate: 10 mm.
  - .5 Slump at time and point of discharge: 50 to 100 mm.
  - .6 Air content: 0 - 3% maximum.
- .5 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give following properties: for concrete fill.
- .1 Cement: Type GU Portland cement, minimum 250 kg/m<sup>3</sup>
  - .2 Maximum 25% slag cement content

- .3 Minimum compressive strength at 28 days: 10 MPa.
- .4 Nominal size of coarse aggregate: 10 mm/20 mm.
- .5 Slump at time and point of discharge: 100 mm.
- .6 Air content: 0 - 4% maximum.
- .6 Do not change job mix formula without prior approval of the Consultant.
- .7 In addition to 28 day strength tests, 7 days test may be carried out. If average strength at 7 days is less than 70% of specified 28 day strength, check mix at once and adjust to ensure required strength is obtained.

### **PART 3 - EXECUTION**

#### **3.1 Workmanship**

- .1 All concrete shall be as set forth in CSA-A23.1 and shall be composed of cement, fine and coarse aggregates and water.
- .2 Concrete shall be delivered and discharged within 1½ hours after the introduction of the mixing water at the batch plant.
- .3 Mixing, placing, compaction, curing, hot and cold weather protection shall conform to CSA-A23.1. Use power vibrators in sufficient number and in location and duration to the Consultant's complete satisfaction as required.
- .4 Obtain the Consultant's approval before placing concrete. Provide 24 hour notice prior to placing of concrete.
- .5 Pumping of concrete is permitted only after approval of equipment and mix.
- .6 Ensure reinforcement and inserts are not disturbed during concrete placement in order to maintain proper coverage.
- .7 Prior to placing of concrete obtain the Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by the Consultant.

#### **3.2 Formwork**

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1.

- .3 Align form joints and make watertight. Keep form joints to minimum.
- .4 Use 25mm chamfer strips on all vertical and horizontal corners of exterior retaining walls as indicated on drawings.
- .5 All surfaces of formwork which face concrete, which will be exposed to view are to be coated with protective form coating to minimize transfer of wood grain to finished concrete.
- .6 Clean formwork in accordance with CSA-A23.1 before placing concrete.
- .7 Re-use of formwork is subject to requirements of CSA-A23.1.
- .8 When forms are stripped during the curing period, cure and protect the exposed concrete.
- .9 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.
- .10 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

### 3.3 **Inserts**

- .1 Co-ordinate and verify that the Electrical Contractor has set all ducts, boxes and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on structural or civil drawings must be approved by the Consultant.
- .2 Co-ordinate and verify that the Mechanical Contractor has set all floor drains, cleanouts, trench drains to provide a smooth, flush appearance with the **'FINISHED FLOOR SURFACE'** and to ensure a positive and uniform slope towards the drains.
- .3 Do not eliminate or displace reinforcement to accommodate inserts or hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Consultant before placing of concrete.
- .4 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete. With the Consultant's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used. Protect anchor bolt holes from water accumulations. Set bolts and fill holes with non-shrink grout or epoxy (as noted on drawings).
- .5 Set hollow metal frames, plumbed, squared and braced with blocking in locations shown on drawings.

### 3.4 **Grouting**

- .1 Grout underside of steel column bearing plates with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.



### **3.5 Finishing**

- .1 Finish all concrete surfaces in accordance with Section 03 35 00.

### **3.6 Expansion Control**

- .1 Expansion Joints: Install expansion joint material between slabs on grade and masonry walls, for interior slabs and at max. 6000mm spacing for exterior slabs and curbs, and between slabs on grade and concrete curbs.
- .2 Control Joints: Sawcut control joints at a maximum spacing of 3000mm in each direction and where noted on drawings. Cut joints within 24 hours of placing and to a depth as detailed on drawings.

### **3.7 Water/Vapour Control**

- .1 Butt joints tight together and tight to foundation wall. Seal all joints with gusset tape including foundation wall junctions.
- .2 Protect during placing of concrete to ensure the integrity of the barrier is maintained. Repair immediately any penetrations or areas damaged in accordance with the manufacturer's recommendations.

### **3.8 Curing and Protection**

- .1 Cure and protect newly finished slabs and steps in accordance with CSA A23.1.
- .2 Coat exterior slabs, curbs with curing compound and leave for 30 days. Apply sealer after curing period has expired.
- .3 Cure finished concrete surfaces in a manner which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that curing compounds are compatible with adhesives for finishes to be applied later.
- .4 For all concrete slabs that are to remain exposed, curing compound is to be applied at a rate required for use as a sealer/hardener, in accordance with the manufacturer's instructions.

### **3.9 Field Quality Control**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Consultant in accordance with CSA-A23.1.
- .2 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Inspection or testing by Consultant will not augment or replace contractor quality control nor relieve him of his contractual responsibility.

### **3.10 Tolerances**

- .1 Cast-in-Place concrete shall be constructed within the dimensional tolerances specified in CSA-A23.1, as specified elsewhere in this section. Concrete floor slabs

shall be constructed as moderately flat slabs and within the tolerances listed below.

- .2 Conform in line, level and plumbness to the following tolerances. These are maximum values.
- .3 Variation from vertical, in lines and surfaces of walls piers:  
: In height of 3m (10') - 6mm (1/4")
- .4 Variation from level or from grades shown in floors grade:  
: In any 3m (10') - 3mm (1/8")  
: In any bay up to 6m (20') - 6mm (1/4")  
: In any 12m (40') - 12mm (1/2")
- .5 Variation from straight or from correct position in walls:  
: In length up to 6m (20') - 12mm (1/2")  
: In any 12m (40') - 12mm (1/2")
- .6 Variation in size and location of sleeves, floor open and the like and in location of bolts, inserts and fastenings:  
: - 6mm (1/4")
- .7 Variation in location of bolts, inserts, sleeves and fastenings when in group:  
: - 3mm (1/8")
- .8 Variation in cross-section of slabs, walls and piers:  
: Maximum oversize - 12mm (1/2")  
: Maximum undersize - 6mm (1/4")
- .9 There shall be no variations from required level at junction of walls and floors.
- .10 Where drains occur, floors shall be properly and uniformly sloped to allow complete drainage of the area.

### 3.11 **Defective Concrete**

- .1 Concrete is defective when:
  - .1 Containing visible honeycombing or embedded debris.
  - .2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
  - .3 Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.
  - .4 Any 28 day strength test result in less than 88% of specified minimum 28 day strength.
  - .5 Cracking occurs in locations other than at control and construction joints.
  - .6 Curing is not carried out strictly according to the specifications.
- .2 Remove and reconstruct in entirety any defective concrete footing, slabs, walls as

directed by the Consultant.

**Cold Weather Protection**

- .3 Refer to CSA Standards CSA-A23.1 and CSA-A23.2 Provisions and Publications. Include for tarped heated enclosures - no non-freeze additives such as calcium will be tolerated on this project.

**END OF SECTION 03 30 00**

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating Product composition, physical and chemical properties, Product limitations, installation guidelines, and warranty details.
- 1.3 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard maintenance guidelines, including precautions for avoiding staining; sufficient quantity for inclusion in operation and maintenance manual.
- 1.4 QUALIFICATIONS
  - .1 Applicator: A firm specializing in applying concrete floor sealers, having minimum 5 years documented experience.
- 1.5 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Store Products protected from harmful environmental conditions. Conform to manufacturer's recommended temperature and humidity conditions.
  - .3 Store and handle Products protected from dirt, corrosion, oil, grease and other contaminants.
- 1.6 AMBIENT CONDITIONS
  - .1 Do not apply Products when air, material and surface temperatures are expected to fall below 4 degrees C within four hours of completed application.
  - .2 Ensure adequate temporary heating is available during cold weather work.
- 2 Products
- 2.1 MANUFACTURERS
  - .1 Manufacturers having Product considered acceptable for use:
    - .1 CPD Construction Products.
    - .2 Degussa.
    - .3 W. R. Meadows of Canada Limited.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 MATERIALS
  - .1 Concrete Floor Sealer: One-component; urethane / acrylic polymer based, high solids, liquid sealer; clear and transparent, non-yellowing formulation; chemical-resistant; maximum 200 g/L VOC content; eg. Decra-Seal W/B by W. R. Meadows of Canada Limited.
  - .2 Slip-Resistant Additive: Finely ground polymer, silica-free aggregate; eg. Sure-Step by W. R. Meadows of Canada Limited.

2.3 MIXING

- .1 Mix slip-resistant additive into sealer at manufacturer's recommended rate.
- .2 Occasionally stir mixture to keep particles well suspended within coating.

3 Execution

3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify concrete has not been previously treated with chlorinated rubber-based cure and seal compounds.
- .3 Verify new concrete has cured for minimum 28 days.

3.2 PREPARATION

- .1 Sweep and wash floors to remove debris, grease, oil and wax.
- .2 Remove stains and discolourations.

3.3 APPLICATION

- .1 Spray apply Product, completely wetting concrete surface without producing drips, puddles or rundown.
- .2 Apply Product to achieve Medium sheen finish.
- .3 Spray apply two coats to prepared concrete slab.
- .4 Allow first coat to dry before applying second coat.
- .5 Apply Product evenly, without ponding.
- .6 Avoid puddling in low areas.

3.4 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Restrict foot traffic for 12 hours.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 10 - Masonry Mortaring and Grouting.
- .2 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .3 Section 04 05 23 - Masonry Accessories.
- .4 Section 04 21 00 - Clay Unit Masonry.
- .5 Section 04 22 00 - Concrete Unit Masonry.
- .6 Section 05 10 00 - Structural Metal Framing.
- .7 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

- .1 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.
- .2 CSA S304-14: Design of Masonry Structures.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Samples: As follows:
  - .1 Two samples of each type of masonry unit specified, illustrating colour, texture and extremities of colour range;
  - .2 One sample of each type of masonry reinforcement and tie specified in Section 04 05 19;
  - .3 One sample of each type of masonry accessory specified in Section 04 05 23; and
  - .4 As required for testing purposes.

1.4 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard masonry analysis and testing reports, indicating compressive strength, initial rate of absorption, maximum water absorption, maximum saturation coefficient, and density for each type of masonry unit specified; prepared by independent agency.

1.5 QUALIFICATIONS

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

1.6 MOCK-UPS

- .1 Construct mock-up as specified in Section 01 40 00.
- .2 Mock-Up Panel: A 1 220 x 1 830 mm size mock-up panel, demonstrating veneer cladding types, textures and colours; mortar joint thickness, tooled profiles and colours. Include structural back-up materials, air/vapour barrier membrane materials, through-wall flashing and weephole vents, cavity wall insulation, wall ties and connectors, and movement joint.
- .3 Report mortar colour loading rate for acceptable panel.
- .4 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .5 Remove and replace installed Product that does not conform to accepted mock-up.

- .6 Remove mock-ups from Place of the Work upon Ready-for-Takeover.
- 1.7 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Deliver Products to Place of the Work in dry condition.
  - .3 Keep Products dry until use.
  - .4 Store Products under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
  - .5 Protect masonry units from damage.
- 1.8 AMBIENT CONDITIONS
  - .1 Conform to CAN/CSA-A371.
  - .2 Provide heated enclosures and heat as necessary during cold weather construction.
  - .3 Protect freshly laid masonry from drying too rapidly during hot weather, by means of waterproof, non-staining coverings.
- 2 Products
- 2.1 SOURCE QUALITY CONTROL
  - .1 Perform shop testing by independent inspection agency as specified in Section 01 40 00.
  - .2 Refer to individual specification Sections for Product-specific shop testing requirements.
- 3 Execution
- 3.1 QUALITY OF WORK
  - .1 Construct masonry plumb, level and true to line, with vertical joints in alignment.
  - .2 Lay out coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
  - .3 Maintain masonry courses to uniform width.
  - .4 Lay masonry in full bed of mortar, properly jointed with other work.
  - .5 Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.
  - .6 Maintain dry masonry beds and lay only dry masonry units. Do not pre-soak masonry units in cold weather.
  - .7 Fully bond intersections, and external corners.
  - .8 Do not use chipped, cracked or otherwise damaged units in exposed and loadbearing masonry walls.
  - .9 Build in items required to be built into masonry.
  - .10 Brace door frames to maintain plumb. Fill spaces between frame jambs and masonry with masonry grout.
  - .11 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

### 3.2 JOINTING

- .1 Make vertical and horizontal joints equal and of uniform thickness.
- .2 Tooled Joints: Allow joints to set just enough to remove excess water, then tool joints with round jointer to result in a smooth, tightly compressed, uniformly concave profile.
- .3 Flush Joints: Strike flush joints that will be concealed within wall or which will receive a coating of plaster, tile, insulation, resilient base, bituminous foundation protection, or other joint-concealing finish. Do not strike flush mortar joints designated to receive painted or other thin finishes.

### 3.3 CUTTING

- .1 Cut out masonry neatly for recessed or built-in objects.
- .2 Make cuts straight, clean and free from uneven edges.
- .3 Make Good masonry which has cracked or broken as a result of cutting in built-in objects.

### 3.4 PROVISIONS FOR MOVEMENT

- .1 Unless specified or shown otherwise, Provide the following space to accommodate movement:
  - .1 Deflection Space Below Shelf Angles: 10 mm.
  - .2 Between Masonry and Vertical Structural Elements: 10 mm.
  - .3 Between Top of Non-loadbearing Partitions and Structural Elements: 12 mm.
- .2 Fill space with compressible material and seal both sides as specified in Section 07 92 00. Do not use wedges.
- .3 Provide continuous movement control joints, properly sealed with backing rod and joint sealant, as specified in Section 04 05 23.

### 3.5 LOOSE STEEL LINTELS

- .1 Install loose steel lintels.
- .2 Centre lintel over opening width.

### 3.6 TEMPORARY WALL BRACING

- .1 Provide engineered temporary bracing for masonry walls to resist wind pressure and other lateral loads during and after erection until permanent lateral support is in place.

### 3.7 PROTECTING MASONRY

- .1 Refer to Section 01 76 00.
- .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind-driven rain, until masonry is completed and protected by flashings or other permanent construction.
- .3 Protect masonry and other work from marking and other damage.
- .4 Protect completed work from mortar droppings. Use non-staining coverings.

### 3.8 FIELD QUALITY CONTROL

- .1 Field Inspection: Consultant will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.
- .2 Unless specified otherwise, masonry will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges of the masonry units exceeding 10 mm or that



can be seen from a distance of 3 000 mm. Masonry units supplied with a rusticated face will be inspected for cracks and blemishes only.

- .3 Make Good rejected masonry as directed by Consultant.

### 3.9 TOLERANCES

- .1 Conform to CAN/CSA-A371.

### 3.10 CLEANING

- .1 Clean masonry as work progresses.
- .2 Allow mortar droppings on masonry to partially dry, then remove by means of brushing with a stiff fibre brush.
- .3 Post-Construction Cleaning: Test clean one-half of mock-up panel and leave for one week. Proceed with cleaning operations only if no harmful effects appear, and only after mortar and sealants have properly set and cured.
- .4 Clean masonry as follows:
  - .1 Remove large particles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
  - .2 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 Litre of clean water using stiff fibre brushes, then clean off immediately with clean water using hose.
  - .3 Repeat cleaning process as often as necessary to remove mortar and other stains.
- .5 Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 04 05 00 - Common Work Results for Masonry.
  - .2 Section 04 21 00 - Clay Unit Masonry.
  - .3 Section 04 22 00 - Concrete Unit Masonry.
  - .4 Section 08 12 13 - Hollow Metal Frames.
- 1.2 REFERENCES
  - .1 ASTM C207-18: Standard Specification for Hydrated Lime for Masonry Purposes.
  - .2 ASTM C979/C979M-16: Standard Specification for Pigments for Integrally Colored Concrete.
  - .3 CAN/CSA-A179-14: Mortar and Grout for Unit Masonry.
  - .4 CSA A3001-18: Cementitious Materials for Use in Concrete.
  - .5 CSA A3002-18: Masonry and Mortar Cement.
  - .6 CSA S304-14: Design of Masonry Structures.
  - .7 NCMA TEK 3-2A-2005: Grouting Concrete Masonry Walls.
- 1.3 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: On design mix, indicating Proportion or Property specification method used, required environmental conditions and admixture limitations.
- 1.4 SAMPLES
  - .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: Two ribbons of mortar, illustrating colour and colour range.
    - .1 Complete upon acceptance, confirmation of site-mixed colour additive proportional to site-mixed batch.
    - .2 Prepare and submit sample colour ribbons for each days work for review of consistency.
- 1.5 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit field quality control submittals as specified in Section 01 40 00.
  - .2 Verification Samples: Sample cubes for laboratory testing, to CAN/CSA-A179.
  - .3 Test Reports: Clearly indicating test result data, to CAN/CSA-A179.
- 1.6 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Deliver Products in original unbroken and undamaged packages with manufacturer's name and brand clearly indicated.
  - .3 Store Products in a weatherproof shed until ready for use.
  - .4 Store or pile sand on a plank platform and protect from dirt and rubbish.
  - .5 Store Products in a manner to prevent deterioration or contamination by foreign materials.

## 1.7 AMBIENT CONDITIONS

- .1 Maintain materials and surrounding air temperature between 5 degrees C and 50 degrees C prior to, during, and 48 hours after completion of masonry installation.
- .2 Do not use anti-freeze, liquid salts or other substances to lower freezing point of mortar or grout. Conform to CAN/CSA-A179.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of cement having Product considered acceptable for use:
  - .1 Essroc.
  - .2 Holcim.
  - .3 Lafarge Construction Materials.
  - .4 St. Marys Cement.
- .2 Manufacturers of hydrated lime having Product considered acceptable for use:
  - .1 Graymont Dolime (OH) Inc.
  - .2 Rockwell Lime Co.
- .3 Manufacturers of dry, plant-batched mortar mixtures having Product considered acceptable for use:
  - .1 Daubois.
  - .2 Graymont Dolime (OH) Inc.
  - .3 King Packaged Materials Company.
- .4 Manufacturers of mortar pigment having Product considered acceptable for use:
  - .1 Bayer Pigments.
  - .2 Elementis Pigments.
  - .3 Interstar.
  - .4 Hamburger Company.
- .5 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 MATERIALS

- .1 Portland Cement: To CSA A3001, Type GU; Grey colour.
- .2 Masonry Cement: To CSA A3002, Type N.
- .3 Hydrated Lime: To ASTM C207, Type S-Special.
- .4 Mortar Aggregate: To CAN/CSA-A179, natural sand, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.
- .5 Grout Coarse Aggregate: To CAN/CSA-A179, maximum 10 mm size; 27 percent by volume.
- .6 Grout Fine Aggregate: To CAN/CSA-A179, clean well graded sharp sand; 54 percent by volume.
- .7 Water: Potable, clean and free of deleterious amounts of acids, alkalies or organic materials.

### 2.3 ADMIXTURES

- .1 Plasticizer: Water reducing type, reducing porosity and absorption to increase bond strength.
- .2 Water Repellent: Mixture of calcium carbonate and hydrous magnesium aluminum silicate powders; eg. Hydrocide Powder by Degussa Building Systems.

- .3 Pigment: To ASTM C979/C979M; liquid-manufactured or natural oxide pigment, colours as selected by Consultant.
- 2.4 MORTAR MIXES
- .1 Mortar for Use with Loadbearing Concrete Unit Masonry: To CAN/CSA-A179, Type S using Property specification method; Portland cement-masonry cement-sand mix, having minimum compressive strength of 8.5 MPa at 28 days; complete with water repellent admixture.
  - .2 Mortar for Use with Non-Loadbearing Concrete Unit Masonry: To CAN/CSA-A179, Type N using Property specification method; masonry cement-sand mix, having minimum compressive strength of 3.5 MPa at 28 days; complete with water repellent admixture.
  - .3 Mortar for Use with Masonry Veneers: To CAN/CSA-A179, Type N using Proportion specification method; Portland cement-hydrated lime-sand mix, complete with integral colours as selected by Consultant.
- 2.5 MORTAR MIXING
- .1 Thoroughly mix ingredients in proper measured quantities needed for immediate use, to CAN/CSA-A179.
  - .2 Pigmented Mortar: Pigment dosage as selected by Consultant, but not to exceed 10 percent of cement content by mass, as defined in ASTM C979/C979M.
  - .3 Provide uniformity of mix and colour.
  - .4 Take representative samples for testing consistency of strength and colour to CAN/CSA-A179.
  - .5 Use mortar within 1-1/2 hours after mixing at temperature of 25 degrees C or higher, or 2-1/2 hours after mixing at temperatures less than 25 degrees C.
  - .6 Discard mortars exceeding time limits specified above.
- 2.6 GROUT MIXES
- .1 Grout for Use in Spaces 50 mm or Wider: To CAN/CSA-A179, Coarse Grout using Property Specification method; Portland cement-sand-coarse aggregate mix.
  - .2 Grout for Use in Spaces Narrower than 50 mm: To CAN/CSA-A179, Fine Grout using Property Specification method; Portland cement-sand mix,.
  - .3 Match grout's 28 day compressive strength to compressive strength of concrete masonry unit being filled.
- 2.7 GROUT MIXING
- .1 Thoroughly mix ingredients accurately in proper measured quantities needed for immediate use, to CAN/CSA-A179.
  - .2 Use grout within 1-1/2 hours after mixing.
  - .3 Discard grout exceeding time limit specified above.
- 3 Execution
- 3.1 EXAMINATION
- .1 Refer to Section 01 71 00.
  - .2 Request Consultant inspection of spaces to be grouted.

### 3.2 PREPARATION

- .1 Apply bonding agent to existing concrete surfaces.
- .2 Plug clean-out holes with masonry units to prevent leakage of grout materials.
- .3 Brace masonry for wet grout pressure.
- .4 Install grout dams below voids designated to be filled with grout. Keep dams 25 mm back from faces of units.
- .5 Remove excess mortar from grout spaces.

### 3.3 APPLICATION

- .1 Install mortar as specified in Sections 04 21 00, 04 22 00 and 04 73 13.16.
- .2 Install grout to NCMA TEK 3-2A.
- .3 Fill unit cores with grout fill where hollow concrete masonry units are used instead of solid concrete masonry units.
- .4 Place grout as required to maintain an adequate level of structural bearing surface with no voids and to a depth as indicated on Drawings.
- .5 Prevent grout from entering acoustically-insulated cores of acoustic concrete masonry units.

### 3.4 FIELD QUALITY CONTROL

- .1 Perform inspection and testing of mortar and grout mixes as specified in Section 01 40 00.
- .2 Test Property specification mortars for compressive strength to CAN/CSA-A179, and as follows:
  - .1 Test three 50 mm cubes at 7 days and three 50 mm cubes at 28 days.
  - .2 Mortar for Concrete Unit Masonry: Perform one test for every 500 m<sup>2</sup> of wall, but not less than one set of tests for each storey height of each building.
- .3 Test grout for slump and compressive strength to CAN/CSA-A179, and as follows:
  - .1 Slump at Time and Point of Placement: 225 mm, plus or minus 25 mm.
  - .2 Take one set of grout cylinders at least daily for each 20 m<sup>3</sup> of grout poured and whenever the mix design changes.
  - .3 Cylinder Sets: Comprised of minimum three cylinders.
  - .4 Test one cylinder at 7 days and two cylinders at 28 days.

### 3.5 NON-CONFORMING WORK

- .1 Make Good portions of the Work constructed with mortar or grout that does not meet specified criteria.
- .2 Remove and reconstruct affected walls using new Product.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 10 - Masonry Mortaring and Grouting.
- .3 Section 04 05 23 - Masonry Accessories.
- .4 Section 04 21 00 - Clay Unit Masonry.
- .5 Section 04 22 00 - Concrete Unit Masonry.
- .6 Section 05 40 00 - Cold-Formed Metal Framing.
- .7 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

- .1 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .4 ASTM A580/A580M-16: Standard Specification for Stainless Steel Wire.
- .5 ASTM A641/A641M-19: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .6 ASTM A951/A951M-22: Standard Specification for Steel Wire for Masonry Joint Reinforcement.
- .7 ASTM A1011/A1011M-18a: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra-High Strength.
- .8 CSA A370-14 (R2018): Connectors for Masonry.
- .9 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.
- .10 CSA G30.18-09 (R2014): Carbon Steel Bars for Concrete Reinforcement.
- .11 CSA S304-14: Design of Masonry Structures.

1.3 MOCK-UPS

- .1 Supply Product for construction of mock-up panel as specified in Section 04 05 00.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of horizontal joint reinforcement and anchors having Product considered acceptable for use:
  - .1 Blok-Lok.
  - .2 WireLock.

- .2 Manufacturers of wall ties having Product considered acceptable for use:
  - .1 Blok-Lok.
  - .2 Fero.

- .3 Substitution Procedures: Refer to Section 01 25 00.

## 2.2 MATERIALS

- .1 Steel Plate: To ASTM A1011/A1011M; galvanized finishes, sizes, and thicknesses as specified below.
- .2 Steel Wire: To ASTM A951/A951M; galvanized finishes and diameters as specified below.
- .3 Stainless Steel Plate: To ASTM A240/A240M, Type 304; sizes and thicknesses as specified below.
- .4 Stainless Steel Wire: To ASTM A580/A580M, Type 304; diameters as specified below.

## 2.3 HORIZONTAL JOINT REINFORCEMENT

- .1 Exterior Wall Horizontal Joint Reinforcement: To CSA A370, Ladder-type, Extra Heavy Duty; hot dipped galvanized steel wire; width to suit concrete masonry unit bed depth; BL-10 by Blok-Lok.
- .2 Interior Wall Horizontal Joint Reinforcement: To CSA A370, as follows:
  - .1 Loadbearing Walls, Multi-Wythe: Ladder-type, Extra Heavy Duty; mill galvanized steel wire; width to suit concrete masonry unit bed depths; BL-12 by Blok-Lok.
  - .2 Loadbearing Walls, Single-Wythe: Ladder-type, Extra Heavy Duty; mill galvanized steel wire; width to suit concrete masonry unit bed depth; BL-10 by Blok-Lok.
  - .3 Non-Loadbearing Walls, Single-Wythe: Ladder-type, Standard Duty; mill galvanized steel wire; width to suit concrete masonry unit bed depth; BL-10 by Blok-Lok.

## 2.4 WALL TIES

- .1 Wall Tie (Steel Stud Back-up): Adjustable, dual component, rod adjustable plate tie system; as follows:
  - .1 Flat Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension and stud width; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.
  - .2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
  - .3 Fasteners: Chromium-plated steel self-tapping TEK screws, complete with neoprene O-ring washer and hex washer head; 6.35 mm OD, 19 mm long; minimum two screws per tie.
  - .4 Manufacturer and Product Name: Fero Thermal Tie - Holed Side Mounted Rap-Tie Masonry Connector by Fero Corporation.
- .2 Wall Tie (CMU Back-up): Adjustable, dual component, shear connector system; as follows:
  - .1 Block Plate: 1.52 mm thick stainless steel plate; length to suit air space and CMU width dimension, less 6 mm; complete with a series of eight 5.8 mm OD holes punched along leading edge to receive V-Tie.
  - .2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
  - .3 Manufacturer and Product Name: Fero Thermal Tie - Block Shear Masonry Connector by Fero Corporation.
- .3 Wall Tie (C-i-P Concrete Back-up): Adjustable, dual component, rod adjustable plate tie system; as follows:
  - .1 L-Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.

- .2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
  - .3 Fastener: Tapcon-style hex head self-tapping screws, complete with blue climaseal coating; 6.35 mm OD, 83 mm long; minimum two screws per tie.
  - .4 Manufacturer and Product Name: Fero Thermal Tie - Holed Rap-Tie Masonry Connector by Fero Corporation.
- .4 Wall Tie (Structural Steel Back-up): Adjustable, dual component, rod adjustable plate tie system; suitable for welded attachment; as follows:
- .1 L-Plate: 1.52 mm thick stainless steel plate; length to suit air space dimension; complete with a series of five 5.8 mm OD holes punched along leading edge to receive V-Tie.
  - .2 V-Tie: 4.76 mm OD stainless steel wire; length to provide placement of tie legs at centerline of veneer.
  - .3 Manufacturer and Product Name: Fero Thermal Tie - Holed Rap-Tie Masonry Connector by Fero Corporation.

## 2.5 ACCESSORIES

- .1 Reinforcing Steel: To CSA G30.18, Grade 400R; new billet steel, deformed bars; sizes as indicated on Drawings.
- .2 Strap Anchors: 6.0 mm thick, 38 mm wide steel plate with 50 mm long Z-shaped bends; hot dipped galvanized; lengths to suit application; eg. BLT-11Z by Blok-Lok.
- .3 Anchor-Type Fasteners: To CSA A370, hot dipped galvanized steel, purpose made for substrate.

## 2.6 FINISHES

- .1 Hot Dipped Galvanized Coating: To ASTM A123/A123M and ASTM A153/A153M, Class B2, minimum 458 g/m<sup>2</sup> zinc coating on all surfaces, except as specified below:
  - .1 Strap Anchors: To ASTM A123/A123M, Coating Grade 75; minimum 503 g/m<sup>2</sup> zinc coating on all surfaces.
- .2 Mill Galvanized Coating: To ASTM A641/A641M, Regular; minimum 30 g/m<sup>2</sup> zinc coating on all surfaces.

## 3 Execution

### 3.1 PREPARATION

- .1 Supply metal anchors to the appropriate trades for placement. Direct correct placement.
- .2 Verify anchorages embedded in concrete or attached to structural steel members are properly placed. Embed anchorages in every second joint.

### 3.2 INSTALLATION

- .1 Install masonry connectors and reinforcement to CSA A370.
- .2 Place horizontal joint reinforcement continuous in every second bed joint, with minimum 300 mm lap splices.
- .3 Place horizontal joint reinforcement in first and second bed joints above and below openings. Extend 600 mm minimum each side of opening.
- .4 Place horizontal joint reinforcement continuous in first and second bed joints below top of walls.
- .5 Reinforce joint corners and intersections with strap anchors spaced at 400 mm OC vertically.



- .6 Place horizontal bed joint reinforcement in every bed joint of stack bonded masonry units.
- .7 Provide reinforcing supported and secured against displacement as indicated on Drawings, and as follows:
  - .1 Maintain minimum clearance of 12 mm from masonry and not less than one bar diameter between bars.
  - .2 Provide two 15M reinforcing bars grouted vertically into CMU cores both sides of masonry openings.
  - .3 Provide clean out openings at the bottom of cores containing vertical reinforcement at each grout lift or pour.
- .8 Grout reinforcing and anchorages into masonry as specified in Section 04 05 10.
- .9 Secure wall ties to structural back-up at maximum 400 x 600 mm OC.
- .10 Secure wall ties to steel stud web using minimum two fasteners.
- .11 Double quantity of wall ties within 200 mm of wall corners, wall openings and along parapet walls.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 10 - Masonry Mortaring and Grouting.
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4 Section 04 21 00 - Clay Unit Masonry.
- .5 Section 04 22 00 - Concrete Unit Masonry.
- .6 Section 05 50 00 - Metal Fabrications.
- .7 Section 07 21 00 - Thermal Insulation.
- .8 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .9 Section 07 27 00 - Air Barriers.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .11 Section 07 91 00 - Preformed Joint Seals.
- .12 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

- .1 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .4 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 BIA Technical Note on Brick Construction 18A: Accommodating Expansion of Brickwork.
- .6 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.
- .7 NCMA TEK 10-2C-2010: Control Joints for Concrete Masonry Walls - Empirical Method.

1.3 MOCK-UPS

- .1 Supply Product for construction of mock-up as specified in Section 04 05 00.

2 Products

2.1 MATERIALS

- .1 Flexible Membrane Flashing: 1.0 mm thick self-adhering SBS rubberized asphalt membrane with cross-laminated HDPE top surface, sheet width to suit application; eg. Blueskin TWF by Henry (a Carlisle Company).
- .2 Metal Drip Edge Flashing: To ASTM A240/A240M, Type 316; 0.61 mm thick stainless steel sheet.
- .3 Flashing Tape: 75 mm wide, self-adhesive sealing tape; eg. X-Seal Tape by Blok-Lok.

- .4 Cavity Firestops: To ASTM A240/A240M, Type 316; 1.2 mm thick stainless steel sheet.
- .5 Mortar Dropping Control Device: Purpose made open weave nylon and polyester mesh, top hat profile, complete with insect barrier.
- .6 Weep Vent: Open weave polyester mesh complete with insect barrier, size to suit mortar joint width and depth; colour as selected by Consultant.
- .7 Cavity Wall Filler: To ASTM A240/A240M, Type 316; 1.2 mm thick stainless steel sheet.
- .8 Nailing Inserts: To ASTM A653/A653M, Commercial Steel (CS), Types A, B, and C; 0.61 mm thick galvanized sheet steel inserts for setting in mortar joints.
- .9 Primer: As recommended by sheet membrane manufacturer.
- .10 Compressible Filler: Closed cell neoprene; eg. Neoprene Sponge by Blok-Lok.
- .11 Building Paper: No. 15 asphalt saturated felt.
- .12 Preformed Joint Seal: As specified in Section 07 91 00.
- .13 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

## 2.2 FINISHES

- .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Steel Sheet: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

## 3 Execution

### 3.1 PREPARATION

- .1 Apply primer to porous surfaces scheduled to receive self-adhering sheet membranes.

### 3.2 INSTALLATION

- .1 Install vertical cavity wall fillers at external corners to prevent wind driven moisture from crossing cavity. Seal filler to outer wythe with joint sealant.
- .2 Install nailing inserts in mortar joints at 400 mm OC each way, for attachment of wall strapping.
- .3 Provide vertical cavity firestops where indicated on Drawings, spaced at maximum 9 000 mm OC.
- .4 Provide mortar dropping control devices at base of wall cavities.
- .5 Provide weep vents in head joints immediately above through-wall flashing membranes, spaced at maximum 800 mm OC.
- .6 Provide weep vents in head joints along top of wall cavities, spaced at maximum 800 mm OC.

### 3.3 FLASHING

- .1 Provide flashings in masonry to CAN/CSA-A371.
- .2 Install flashings under exterior masonry walls bearing on foundation walls or slabs; shelf angles, and steel lintel angles at wall openings, and as indicated on Drawings.

- .3 In double-wythe masonry walls and masonry veneers, carry flashings from front edge of masonry, under outer wythes, then up backing not less than 150 mm, and as follows:
  - .1 Masonry Backing: Embed flashing 25 mm in joint.
  - .2 Concrete Backing: Insert flashing into reglets and seal joint.
  - .3 Framed and Sheathed Backing: Secure flashing to sheathing behind air barrier.
- .4 Lap joints 150 mm and seal watertight.
- .5 Form flashing over openings with end dams at both ends to prevent water from travelling horizontally past the flashing ends.
- .6 Return horizontal base flashing a minimum of 100 mm around corner to overlap abutting flashing. Seal watertight.
- .7 Connect flexible membrane flashing to metal drip edge flashing within wall construction. Extend metal drip edge flashing 10 mm beyond face of masonry veneer.

### 3.4 EXPANSION, MOVEMENT AND CONTROL JOINTS

- .1 Provide expansion joints in masonry walls, partitions and veneers as indicated on Drawings.
  - .1 Form expansion joints to sizes indicated on Drawings, leaving head joints between stacked units void of mortar and reinforcing.
  - .2 Provide preformed joint seal in exterior veneer expansion joints, as specified in Section 07 91 00.
- .2 Provide movement joints in masonry veneers to BIA Technical Note on Brick Construction 18A.
  - .1 Form movement joints by leaving head joints between stacked units void of mortar and reinforcing.
  - .2 Provide compressible filler in joint, set back from face to accommodate application of backer rod and joint sealant.
  - .3 Seal movement joints as specified in Section 07 92 00.
- .3 Provide control joints in concrete unit masonry walls and partitions to NCMA TEK 10-2C.
  - .1 Form control joints by installing a building paper bond breaker fitted to one side of the hollow contour of the block end.
  - .2 Fill the created core solid with grout.
  - .3 Rake joint at exposed faces to accommodate application of backer rod and joint sealant.
  - .4 Seal control joints as specified in Section 07 92 00.
- .4 Do not continue horizontal joint reinforcing across movement joints and control joints.
- .5 Size movement joints and control joints for sealant performance as specified in Section 07 92 00.

### 3.5 PROTECTION

- .1 Protect flashings from mortar droppings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 10 - Masonry Mortaring and Grouting.
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4 Section 04 05 23 - Masonry Accessories.
- .5 Section 04 22 00 - Concrete Unit Masonry.
- .6 Section 05 50 00 - Metal Fabrications.
- .7 Section 07 21 00 - Thermal Insulation.
- .8 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .9 Section 07 27 00 - Air Barriers.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .11 Section 07 91 00 - Preformed Joint Seals.
- .12 Section 07 92 00 - Joint Sealants.
- .13 Section 08 12 13 - Hollow Metal Frames.
- .14 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .15 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .16 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

- .1 ASTM C73-17: Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).
- .2 CSA A82-14 (R2018): Fired Masonry Brick Made from Clay or Shale.
- .3 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.
- .4 CSA S304-14: Design of Masonry Structures.

1.3 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control samples as specified in Section 01 40 00.
- .2 Verification Samples: To CSA A82.

1.4 MOCK-UPS

- .1 Supply Product for construction of mock-up panel as specified in Section 04 05 00.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 04 05 00.

1.6 AMBIENT CONDITIONS

- .1 Environmental Requirements: As specified in Section 04 05 00.

2 Products

2.1 MANUFACTURERS

- .1 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

- .1 Clay Brick: To CSA A82, Type S, Grade EG; burned clay brick with 57 mm face height, 290 mm face length, and 90 mm bed depth; surface texture on exposed sides and ends; special shapes and profiles as indicated on Drawings; Riverdale Matt by Canada Brick.
- .2 Date Stone: To ASTM C73, Grade SW; pressure formed and autoclaved calcium silicate masonry units; 194 mm face height, 803 mm face length, 92 mm bed depth; Sandblasted finish with Project's year of completion factory-incised in unit face using 140 mm high New Times Roman numbers, and filled Black; Evolution Masonry Units by Arriscraft International, Inc., colour as selected by Consultant.

2.3 ACCESSORIES

- .1 Veneer Mortar: As specified in Section 04 05 10.
- .2 Reinforcement and Anchorages: As specified in Section 04 05 19.
- .3 Accessories: As specified in Section 04 05 23.
- .4 Cavity Wall Insulation: Foamed-in-place urethane insulation, Type INS-FIP-1 as specified in Section 07 21 19.13.

2.4 SOURCE QUALITY CONTROL

- .1 Perform laboratory testing as specified in Section 01 40 00.
- .2 Test brick to CSA A82.

3 Execution

3.1 PREPARATION

- .1 Secure wall ties to structural back-up for veneer as specified in Section 04 05 19.
- .2 Install masonry flashing as specified in Section 04 05 23.
- .3 Install loose steel lintels as scheduled and as specified in Section 04 05 00.

3.2 INSTALLATION

- .1 Place masonry veneer to lines and levels indicated, as specified in Section 04 05 00.
- .2 Lay brick in half-running bond.
- .3 Maintain 10 mm wide mortar joints in both directions.
- .4 Install masonry accessories as specified in Section 04 05 23.
- .5 Provide vertical and horizontal movement control joints as specified in Section 04 05 23.

3.3 TOLERANCES

- .1 Variation from Unit to Adjacent Unit:  $\leq 1.5$  mm.
- .2 Variation of Joint Thickness:  $\leq 3$  mm per 1 000 mm.

### 3.4 FIELD QUALITY CONTROL

- .1 Refer to Section 01 40 00.
- .2 Consultant Inspection: Consultant will inspect completed masonry walls and will reject walls that have chipped, cracked, or blemished (streaked, stained or otherwise damaged) finished surfaces, as described below.
  - .1 Masonry walls will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges exceeding 10 mm or that can be seen from a distance of 3 000 mm.
  - .2 Masonry shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination from a distance of 6 000 mm.
  - .3 Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a distance of 6 000 mm.
  - .4 Craze and efflorescence will not be cause for rejection.
- .3 Make Good rejected Products as directed by Consultant.

### 3.5 CLEANING

- .1 Clean masonry as specified in Section 04 05 00.

### 3.6 PROTECTION

- .1 Protect completed installation from damage resulting from subsequent construction operations. Refer to Section 04 05 00.
- .2 Remove protection materials upon Ready-for-Takeover, or when risk of damage is no longer present.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 10 - Masonry Mortaring and Grouting.
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4 Section 04 05 23 - Masonry Accessories.
- .5 Section 04 21 00 - Clay Unit Masonry.
- .6 Section 05 50 00 - Metal Fabrications.
- .7 Section 07 21 00 - Thermal Insulation.
- .8 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .9 Section 07 27 00 - Air Barriers.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .11 Section 07 92 00 - Joint Sealants.
- .12 Section 08 12 13 - Hollow Metal Frames.
- .13 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .14 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .15 Section 08 51 13 - Aluminum Windows.
- .16 Section 09 90 00 - Painting and Coating.
- .17 Section 11 66 23 - Gymnasium Equipment.

1.2 REFERENCES

- .1 ASTM C331/C331M-17: Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
- .2 CSA A165 SERIES-14 (R2019): CSA Standards on Concrete Masonry Units.
- .3 CAN/CSA-A371-14 (R2019): Masonry Construction for Buildings.
- .4 CSA S304-14: Design of Masonry Structures.

1.3 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control samples as specified in Section 01 40 00.
- .2 Verification Samples: To CSA S304.
- .3 Certificate of Calcium Carbonate Content: Manufacturer's certificate, verifying  $\text{CaCO}_3$  content per concrete masonry unit at point of manufacture.

1.4 QUALIFICATIONS

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



1.5 MOCK-UPS

- .1 Supply Product for construction of mock-up panel as specified in Section 04 05 00.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 04 05 00.

1.7 AMBIENT CONDITIONS

- .1 Environmental Requirements: As specified in Section 04 05 00.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of carbon sequestering concrete masonry units having Product considered acceptable for use:
  - .1 Brampton Brick Limited.
  - .2 Day & Campbell Ltd.
  - .3 Permacon.
  - .4 Richvale York Block Inc.
- .2 Manufacturers of decorative concrete masonry units having Product considered acceptable for use:
  - .1 Brampton Brick Limited.
  - .2 Richvale York Block Inc.
- .3 Manufacturers of acoustic concrete masonry units having Product considered acceptable for use:
  - .1 Brampton Brick Limited.
  - .2 Day & Campbell Ltd.
- .4 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

- .1 Carbon Dioxide Sequestration Capacity:  $\geq 0.23$  kg CO<sub>2</sub> for each 200 mm concrete masonry unit, converted to reinforcing calcium carbonate (CaCO<sub>3</sub>) nano-crystals.

2.3 MATERIALS

- .1 Concrete Masonry Units (CMU): To CSA A165.1, using N aggregate; cured using CO<sub>2</sub> sequestering technology; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; capable of achieving fire ratings as noted on Drawings; solid factory-finished ends with bull nosed corners for use at exposed wall corners, special shapes as required; eg. Carboclave by Brampton Brick Limited, Types where indicated on Drawings as follows:
  - .1 Hollow: Types H/15/A/M, H/20/A/M and H/30/A/M.
  - .2 Solid (75 percent): Types S/15/A/M, S/20/A/M and S/30/A/M.
  - .3 Solid (100 percent): Types S<sub>f</sub>/15/A/M, S<sub>f</sub>/20/A/M and S<sub>f</sub>/30/A/M.
- .2 Lightweight Concrete Masonry Units (CMU-LWT): To CSA A165.1, using L<sub>2</sub>20S slag aggregate to ASTM C331/C331M; cured using CO<sub>2</sub> sequestering technology; 190 mm face height, 390 mm face length, bed depth as indicated on Drawings; capable of achieving fire ratings as noted on Drawings; solid factory-finished ends with bull nosed corners for use at exposed wall corners, special shapes as required; eg. Carboclave by Brampton Brick Limited, Types where indicated on Drawings as follows:
  - .1 Hollow: Types H/15/C/M, H/20/C/M and H/30/C/M.
  - .2 Solid (75 percent): Types S/15/C/M, S/20/C/M and S/30/C/M.
  - .3 Solid (100 percent): Types S<sub>f</sub>/15/C/M, S<sub>f</sub>/20/C/M and S<sub>f</sub>/30/C/M.

- .3 Architectural Concrete Masonry Units (CMU-ARC): To CSA A165.1, Type S<sub>r</sub>/15/A/M, using N aggregate; 190 mm face height, 390 mm face length, 140 mm bed depth; factory-finished ends for use at exposed wall corners; complete with integral water repellent; Architectural Block Smooth Face by Richvale York Block Inc., Dark Charcoal colour.
- .4 Acoustic Concrete Masonry Units (CMU-ACU): To CSA A165.1; 190 mm face height, 390 mm long, bed depth as indicated on Drawings; using N aggregate, Type H/15/A/M; dual-slotted design, with fibrous sound dampening filler; Acosta-Wall by Day & Campbell Ltd. or Boehmers Soundblox by Brampton Brick Limited.

## 2.4 ACCESSORIES

- .1 Mortar and Grout: As specified in Section 04 05 10.
- .2 Dry Pack Grout: Pre-mixed composition of non-metallic aggregate and cement with sufficient water to maintain its shape when made into a bar by hand and capable of attaining compressive strength of 35 MPa at 28 days.
- .3 Horizontal Joint Reinforcement: As specified in Section 04 05 19.
- .4 Reinforcing Steel: As specified in Section 04 05 19.
- .5 Wall Ties: As specified in Section 04 05 19.
- .6 Strap Anchors: As specified in Section 04 05 19.
- .7 Masonry Accessories: As specified in Section 04 05 23.

## 2.5 SOURCE QUALITY CONTROL

- .1 Perform laboratory testing of concrete masonry units, as specified in Section 01 40 00.
- .2 Conduct compressive strength tests and water absorption tests to CSA S304.

## 3 Execution

### 3.1 PREPARATION

- .1 Install dry-pack grout between masonry and prestressed hollow-core concrete slabs where slabs are parallel to loadbearing masonry walls.

### 3.2 INSTALLATION

- .1 Place masonry to lines and levels indicated, as specified in Section 04 05 00.
- .2 Except as specified below, lay concrete masonry units in half-running bond pattern.
  - .1 Lay CMU-ACU in stacked bond.
- .3 Maintain 10 mm wide mortar joints in both directions.
- .4 Provide purpose made pilaster units, 90 and 45 degree corner return units, bullnose units, bond beam units, lintel units as required.
- .5 Provide bullnose concrete masonry units at all exposed corners, except at the first course at floor level and at the corresponding course located at the ceiling level.
- .6 Fully bond intersections, and external corners.
- .7 Extend and laterally support non-loadbearing partitions to underside of structural deck above. Maintain a minimum deflection space at the top of partitions as follows:
  - .1 Partition parallel to structural assembly: 44 mm.
  - .2 Partition perpendicular to structural member: 19 mm.

- .3 Structural member penetrates partition: 19 mm.
- .4 Ducts or piping supported from structural assembly that penetrate the partition: 19 mm.
- .5 Fill deflection space with mineral fibre sound attenuating insulation.
  
- .8 Place horizontal joint reinforcement as specified in Section 04 05 19.
- .9 Install masonry flashings and accessories as specified in Section 04 05 23.
- .10 Install loose steel lintels as specified in Section 04 05 00.
- .11 Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled. Construct lintels using grout fill and reinforcing. Maintain minimum 200 mm bearing on each side of opening.
- .12 Reinforce bond beams and pilasters as indicated on Drawings. Place and consolidate grout fill without disturbing reinforcing.
- .13 At bearing points, fill masonry cores with grout minimum 300 mm from opening.
- .14 Provide vertical and horizontal movement and control joints as specified in Section 04 05 23.
- .15 Ensure cores of acoustical concrete masonry units remain free of mortar to maintain sound transmission and noise reduction capabilities.

### 3.3 TOLERANCES

- .1 Variation from Unit to Adjacent Unit:  $\leq 1.5$  mm.
- .2 Variation of Joint Thickness:  $\leq 3$  mm per metre.

### 3.4 FIELD QUALITY CONTROL

- .1 Refer to Section 01 40 00.
- .2 Consultant Inspection: Consultant will inspect completed masonry walls and will reject walls that have chipped, cracked, or blemished (streaked, stained or otherwise damaged) finished surfaces, as described below.
  - .1 Masonry walls will be inspected to be free of chips, cracks or other blemishes on the finished face or front edges exceeding 10 mm or that can be seen from a distance of 3 000 mm.
  - .2 Masonry shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination from a distance of 6 000 mm.
  - .3 Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a distance of 6 000 mm.
  - .4 Cracking and efflorescence will not be cause for rejection.
- .3 Make Good rejected Products as directed by Consultant.

### 3.5 CLEANING

- .1 Clean masonry as specified in Section 04 05 00.

### 3.6 PROTECTION

- .1 Protect concrete masonry units from damage resulting from subsequent construction operations. Refer to Section 04 05 00.

- .2 Remove protection materials upon Ready-for-Takeover, or when risk of damage is no longer present.

END OF SECTION

## **PART 1 - GENERAL**

### **1.1 General Requirements**

- .1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

### **1.2 Work In Other Sections**

- .1 Related Work Specified in Other Sections
- |                  |   |                        |
|------------------|---|------------------------|
| Section 03 30 00 | : | Cast-in-Place Concrete |
| Section 05 50 00 | : | Metal Fabrications     |
| Section 08 10 00 | : | Metal Doors and Frames |
| Section 09 90 00 | : | Painting and Coating   |
- .2 Products Supplied Under Work of this Section  
and Installed Under Work of Other Sections
- |                  |   |   |
|------------------|---|---|
| Section 03 30 00 | : | To install anchor bolts and loose bearings plates |
|------------------|---|---|

### **1.3 Reference Standards**

CSA S16-19: Standard and Redline - Design of Steel Structures  
CSA W59-18 (R2023): Welded Steel Construction (Metal Arc Welding)  
CSA G40.20-13 (R2023): General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel  
CSA G40.21-13 (R2023): General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel  
CSA W48-23: Filler Metals and Allied Materials for Metal Arc Welding  
CAN/CSA G164-18 (R2023): Hot Dip Galvanizing of Irregularly Shaped Articles  
ASTM F3125/F3125M-23: Standard Specification for Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated Inch Dimensions 120ksi and 150ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa Minimum Tensile Strength  
The Ontario Building Code, (O. Reg. 332/12)

- .1 Do structural steel work in accordance with CAN/CSA-S16.1 latest edition except where specified otherwise.
- .2 Do welding in accordance with CSA W59 except where specified otherwise.
- .3 All work shall conform to Ontario Building Code and any other Provincial or local application, provided that, in any case or conflict or discrepancy, the more stringent requirements shall apply and govern.
- .4 CAN/CSA-S16.1, "Limited States Design of Steel Structures" shall be the basis for design and construction of all structural steel on this project.

### **1.4 Source Quality Control**

- .1 Submit 2 certified copies of mill reports covering chemical and physical properties of steel used in this work.

- .2 Submit affidavits from the manufacturer or fabricator that materials supplied comply with this Specification.
- .3 At least one-third of the joists are to be fabricated and ready for delivery prior to calling the inspection company, thus limiting the number of visits required to three (3). All deficiencies are to be corrected prior to delivery.
- .4 The Owner will appoint an independent inspection and testing company to ensure that the Work of this Section is performed in accordance with the Specifications. The cost of all inspections/testing shall be paid for from the cash allowance allocated for this in Section 01 21 00 - Allowances.

### **1.5 Design of Details and Connections**

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16, latest edition, to resist forces, moments and shears indicated.
- .2 For non-standard connections, submit sketches and design calculations stamped and signed by qualified professional Engineer registered in the Province of Ontario.
- .3 For standard connections, select details from CISC Handbook of Steel Construction to ensure structural adequacy.
- .4 Submit shop fabrication details stamped and signed by a qualified professional licensed in the Province of Ontario.

### **1.6 Shop Drawings**

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittals.
- .2 Indicate shop and erection details including cuts, copes, connections, holes, bolts and welds. Indicate welds by welding symbols defined in CSA-W59.
- .3 Submit copy of erection drawings to the Consultant for review and reference.
- .4 Submit a copy of stamped shop drawings for the cold formed steel, including all connections.
- .5 Submit all weld procedures pertinent to the work prior to or along with the first submission of shop drawings, for subsequent review and acceptance by the Consultant.

### **1.7 Storage and Handling**

- .1 Handle all materials with the necessary care to prevent damage to fittings, finishes and alignments.
- .2 Materials damaged due to faulty storage or handling shall be repaired or replaced, without additional expense to the Owner, all to the satisfaction of the Consultant.
- .3 Replace promptly all items verified as received in a damaged condition.

## 1.8 Examination

- .1 Examine surfaces with which Work is to be anchored or connected.
- .2 Report to the Consultant, all unsatisfactory conditions likely to prevent or prejudice the proper installation of the work.
- .3 Commencement of Work implies unconditional acceptance of substrate and surface and condition to which all members are to be anchored and secured.

## 1.9 Quantity of Items

- .1 Where a component, device, item or part of material is referred to in the singular number, such reference shall mean as many as are required to complete the work

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Structural steel: to CAN/CSA-G40.21 Grade 350W for rolled sections and plates, Grade 350W for Hollow Structural sections.
- .2 Anchor bolts: to CAN/CSA-G40.21, Grade 300W.
- .3 Bolts, nuts and washers: to ASTM A325M.
- .4 Welding materials: to CSA W48 Series.
- .5 Shop paint primer: to CGSB 1-GP-40M. Refer to Formulas in Section 09 90 00.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA G164, minimum zinc coating of 600 g/m<sup>2</sup>.
- .7 Cold Formed Steel: to CSA S136
- .8 Lintels: As required to complete all work as part of this project. Steel lintels shall be approved over all openings including mechanical, electrical and architectural drawings and as shown on the drawings.

## PART 3 - EXECUTION

### 3.1 Inspection and Co-ordination

- .1 The Contractor shall field check all dimensions and elevations affecting his trade at the site. All discrepancies shall be reported to the Consultant before proceeding with the work.
- .2 The Contractor shall report in writing all defects in the work prepared under other sections of the Specifications which will affect the work of this Section. Commencement of the work will imply acceptance of previously prepared work.

- .3 Verify all requirements and dimensions of existing, proceeding and following Work before commencing fabrication.

### 3.2 **Fabrication**

- .1 Fabricate structural steel, as indicated, in accordance with CSA-S16.1 and in accordance only with reviewed and stamped shop drawings.
- .2 Supply fastenings, anchors and accessories required for fabrication and erection of Work. Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to absolute minimum and inconspicuous, spacing them evenly and setting them out neatly. Make fastenings of permanent type.
- .3 Beams shall be rolled sections, combined as noted. Beam connections shall be standard double angle clip type, developing full strength of all the members.
- .4 Clean all steel members by scraping, wire brushing or other effective means to remove loose mill scale, rust, oil or other foreign matter. Surfaces shall be thoroughly dry before painting.
- .5 Apply one (1) shop coat of paint, conforming to CGSB 1-GP-40D primer, to all surfaces except surfaces to be in contact with or encased in concrete and surfaces and edges to be field welded or high tension bolted.
- .6 Apply two (2) shop coats of paint, conforming to CGSB 1-GP-40D primer to all surfaces which will be inaccessible after assembling. Touch up all bolts, welds and surfaces of connecting members damaged during construction.
- .7 All steel exposed to weather including steel lintels in exterior walls shall be hot dip galvanized.
- .8 All members shall be assembled true and without twists or open joints. Shop connections shall be welded.
- .9 High tensile bolted connections, where used, shall be in accordance with CAN/CSA-S16 latest edition. Holes shall be accurately spaced and of size to allow insertion of bolts of 1.5 mm (1/16") diameter less than hole diameter.
- .10 Welding shall be executed so as to avoid damage or distortion to the work. Welds on exterior work shall be continuous to provide proper weathering; all welds on exposed finished work shall be ground smooth.
- .11 There shall be no burning of holes in members in the shop or field without the permission of the Consultant. If consent is given, burned members shall be finished to an acceptable appearance.
- .12 Mark materials in accordance with CAN/CSA-G40. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection. Shop mark bearing assemblies and splices for fit and match.



### **3.3 Erection**

- .1 Erect structural steel as indicated in accordance with CSA-S16 latest edition and in accordance with shop drawings.
- .2 Continuously seal members by continuous welds where indicated. Grind smooth.
- .3 Obtain written permission of the Consultant prior to field cutting or altering of structural members.
- .4 Touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .5 Erection of structural steel on site shall be properly co-ordinated by the Contractor with the work of all other trades. Coordinate the work to incorporate all electrical appurtenances, and protect same from damage during erection.
- .6 Bolted assemblies for base connections shall not be tightened until at least 72 hours after the grout pad has been placed.
- .7 All bolts shall be tightened by using a suitable torque wrench, torquing as required in CSA-S16 latest edition.
- .8 Damaged work will not be accepted on site. Damaged work arriving on site will be returned to the shop for repair and/or refinishing.
- .9 All temporary supports shall be attached to the work in such a manner so as not to mar the surface on the finished section.
- .10 All steel shall be set accurately to the lines and elevations shown on the Drawings.
- .11 Assume full responsibility for the correct plumbing, alignment and setting of all members; set all guys, braces, etc., necessary to maintain the structure during erection, and until such time as the work of other trades is in place.

### **3.4 Open Web Steel Joists**

- .1 Minimum bearing, unless otherwise detailed, shall be 63.5mm (2½") on steel and 100mm (4") on concrete or masonry. Where joists span from one side only they shall bear directly over centre of beam unless otherwise shown. Open web steel joists and their design shall conform to CAN/CSA-S16 latest edition.
- .2 Shoes are to be designed so that the allowable bearing pressure on the supporting material is not exceeded.
- .3 Provide bridging in accordance with CAN/CSA S16 latest edition.
- .4 Extend and if necessary deepen top chords of joists with cantilevered ends to carry the specified loading indicated or implied.

**END OF SECTION 05 10 00**

## **PART 1 – GENERAL**

### **1.1 General Requirements**

Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

### **1.2 Work in Other Sections**

#### Related Work Specified in Other Sections

Section 05120	:	Structural Metal Framing
Section 05500	:	Miscellaneous Metal
Section 06100	:	Rough Carpentry
Section 07600	:	Sheet Metal Flashing & Trim
Section 09900	:	Painting

### **1.3 Reference Standards**

CSA S136S1:19: North American Specification for the Design of Cold-Formed Steel Structural Members.

CSA W59-13: Welded Steel Construction (Metal Arc Welding)

CSA W47.1:09 (R2019): Certification of Companies for Fusion Welding of Steel

CSA W48-18: Filler Metals and Allied Materials for Metal Arc Welding

- .1 Work of this section shall conform to CSA-S136-16 and to meet the specified requirements of the Canadian Sheet Steel Building Institute "Standard for Steel Roof Deck" and "Standard for Steel Floor Deck".
- .2 Welding shall meet requirements of CSA-W59-13 and undertaken to meet requirements of CSA-W47.1:09 (R2019) and CSA-W55.3-08 (R2018)

### **1.4 Design Criteria**

- .1 Metal deck shall be of suitable design and thickness to safely support the indicated live and dead loading over the spans shown without exceeding the maximum working stress of 143.8 MPa.
- .2 Deflection under live load only shall be not more than 1/240th of span for roof units, and 1/360th for floor units.
- .3 Metal roof deck and composite concrete slab sections shall have a depth not less than 38mm (1½").
- .4 Metal deck units shall span over three or more supports except where structural steel layout does not permit.

### 1.5 **Qualifications**

Execute the work of this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen, and is known to have been responsible for satisfactory work similar to that specified during a period of at least five years.

### 1.6 **Shop Drawings**

Submit shop drawings in accordance with Section 01 33 00 Submittals.

### 1.7 **Product Handling**

- .1 Deliver materials as required for erection. If storage becomes necessary stack bundles of steel deck on wood blocking clear of ground and tilted slightly so as to avoid water lying on the material. Storage area to be as close to the building as is practical.
- .2 Protect deck against damage. Damaged materials shall be replaced by this Contractor without extra cost to the Owner.
- .3 Protect the work of other trades from damage during erection, welding, and cutting operations, and make good any such damage where caused.

## **PART 2 - PRODUCTS**

### 2.1 **Materials**

- .1 Metal roof deck shall be fabricated from galvalume coated steel. Heavy AZ180 for deck surfaces within the arena portions and standard AZ150 for the remainder of the steel deck conforming to ASTM A792/A792M-10(2015).
- .2 Metal roof deck for all roof areas except noted below shall be fabricated from zinc-coated steel conforming to A.S.T.M. designation A446-G5T Grade 'A' minimum steel, with a minimum decimal core thickness of 0.76 mm and a zinc coating class of G90.
- .3 Incombustible, non-hygroscopic glass fibre insulation, with a density of 1.1 lbs. per cubic foot, shaped to completely fill all flutes on the top side of acoustic deck.
- .4 Metal deck shall be manufactured by Robertson, Vic-West, or Canadian Metal Rolling Mills.

### 2.2 **Floor Deck Accessories**

- .1 Cover plates shall be of the same material gauge as decking or of greater

- thickness, if required. Closures shall be tight to prevent leakage of concrete. Form to match deck contour, minimum 6 inches wide.
- .2 Column flashing shall be provided to close spaces between floor units and columns, weld in place.
  - .3 End closures shall be provided to close open ends of cells at columns, walls and openings in floors.
  - .4 Closures shall be provided for closing voids between cells over partitions that are perpendicular to direction of cells. Closures may be rubber or steel metal. Closures above fire-resistant partitions shall be sheet metal at both sides of partition. Fibrous glass insulation shall fill spaces between pair of closures.
  - .5 Provide angles and other steel members not designated as structural steel or miscellaneous metal work, but which are required for a complete and rigid deck installation.

## **PART 3 - EXECUTION**

### **3.1 Installation**

- .1 The metal roof units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting structure. The roof units shall be placed in straight alignment for the entire length of run of cells and with close registration of the cells of one unit with those of abutting units.
- .2 Align deck end to end to provide accurate fit with corresponding sections, with sections parallel, level and straight. All laps over supporting members shall be uniform and a minimum of 100 mm length, countersunk to provide proper nesting for deck thickness greater than 1.5 mm. Touch up all welds and fasteners with paint.
- .3 Deck units shall be securely fastened to the steel framework at the ends of the units and at intermediate supports by welds not less than 20 mm diameter, spaced not more than 300 mm along the steel frame or in other manner approved by the Consultant. Where two units abut, each unit shall be welded to the steel frame. Welds shall be free of sharp points or edges.
- .4 All welds for roof deck shall be made so that the finished deck surface is capable of sustaining an upward force of 1.44 kN/m<sup>2</sup>.
- .5 The side laps of adjacent units shall be fastened between supports by clinching at intervals not exceeding 600 mm, or by 25 mm long welds at

intervals not exceeding 1 m.

- .6 Damaged, bent or dished sheets shall be rejected and removed from the site.
- .7 Install closures running parallel to flutes of deck to stiffen deck at roof edges.

### **3.2 Openings**

- .1 For openings 150 mm to 450 mm in diameter or square, provide not less than 50 mm x 50 mm x 6 mm angle reinforcing to frame across holes in direction perpendicular to flutes, and weld at least two flutes on each set of holes.
- .2 Do not cut openings until final sizes have been verified on shop drawings or until steel framing provided under other sections of work is in place.
- .3 For openings larger than 450mm in diameter or square, refer to Structural, Mechanical and Architectural drawings for sizes and locations.

### **3.3 Touch Up and Replacement**

- .1 Touch up adjacent primed surfaces burned, scratched or otherwise damaged during erection with prime paint to match shop coat, when erection is completed.
- .2 Paint over bare areas on galvanized surfaces and welds with zinc rich paint.
- .3 Replace dented, punctured or weld perforated deck where exposed to view.

**END OF SECTION 05300**

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-In-Place Concrete.
- .2 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .3 Section 04 22 00 - Concrete Unit Masonry.
- .4 Section 06 16 43 - Gypsum Sheathing.
- .5 Section 07 21 00 - Thermal Insulation.
- .6 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .7 Section 07 26 00 - Vapour Retarders.
- .8 Section 07 27 36 - Sprayed Foam Air Barrier.
- .9 Section 07 42 13 - Metal Wall Panels.
- .10 Section 07 42 93.23 - Linear Metal Soffits.
- .11 Section 08 12 13 - Hollow Metal Frames.
- .12 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .13 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .14 Section 08 51 13 - Aluminum Windows.
- .15 Section 09 21 16 - Gypsum Board Assemblies.

1.2 DEFINITIONS

- .1 Camber: Deviation from straightness of a member or any portion of a member with respect to its major axis.
- .2 Sweep: Deviation from straightness of a member or any portion of a member with respect to its minor axis.

1.3 REFERENCES

- .1 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- .2 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .3 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM A792/A792M-23: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .5 ASTM C955-18e1: Standard Specifications for Cold-Formed Steel Structural Framing Members.
- .6 ASTM C1007-20: Standard Specification for Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories.

- .7 ASTM C1513-18: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
  - .8 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
  - .9 CAN/CGSB-7.1-98: Lightweight Steel Wall Framing Components.
  - .10 CSA S16:19: Design of Steel Structures.
  - .11 CSA S136-16: North American Specification for the Design of Cold-Formed Steel Structural Members.
  - .12 CSA S304-14: Design of Masonry Structures.
  - .13 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.
  - .14 CSA W55.3-08 (R2018): Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .15 CSA W59-18: Welded Steel Construction.
  - .16 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.
- 1.4 PRODUCT DATA
- .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating mechanical fasteners, indicating sizes, load capacities and type of corrosion protection.
- 1.5 SHOP DRAWINGS
- .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, showing both design and installation requirements, and illustrating:
    - .1 Materials, sizes, locations, thicknesses exclusive of coating, and coatings.
    - .2 Connection details for attaching framing to itself and for attachment to structure. Show splice details where permitted.
    - .3 Dimensions, openings, requirements of related work and critical installation procedures. Show temporary bracing required for erection purposes.
    - .4 Design loads.
    - .5 Engineering calculations or data verifying capacity of framing members, including masonry connectors if specified, and ability of assemblies to meet design criteria.
  - .3 Shop Drawings must be stamped, signed and dated by fabricator's design engineer.
- 1.6 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: Upon request, submit representative pieces of framing component parts including mechanical fasteners if used.
- 1.7 TEST AND EVALUATION REPORTS
- .1 Submit mill test reports as specified in Section 01 40 00.

- .2 Mill Test Reports: Five certified copies, covering chemical and mechanical properties, and coating designation of steel.
- 1.8 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit test and inspection reports as specified in Section 01 40 00.
  - .2 Field Quality Control Reports: Manufacturer's field review and inspection reports.
  - .3 Independent Test Reports: Summary of inspection and test findings conducted by independent testing agency.
- 1.9 QUALIFICATIONS
  - .1 Fabricator's Design Engineer: A professional structural engineer experienced with designing, fabricating and erecting cold-formed metal framing, licenced to practice at Place of the Work.
  - .2 Installers: A firm specializing in erecting cold-formed metal framing, having minimum 10 years documented experience and a member of CSSBI.
  - .3 Welders: Workers certified by CWB to CSA W47.1 and CSA W55.3; and qualified for base material types and thicknesses being welded.
- 1.10 DELIVERY STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Store Products protected from conditions that may cause physical damage or corrosion.
  - .3 Handle and lift prefabricated panels carefully to avoid permanent distortion to any member or collateral material.
- 2 Products
- 2.1 MANUFACTURERS
  - .1 Manufacturers having Products considered acceptable for use:
    - .1 Bailey Metal Products.
    - .2 Dietrich Metal Framing.
    - .3 MiTek Canada Inc.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 DESCRIPTION
  - .1 Lateral Loadbearing Vertical Framing: Comprised of:
    - .1 Wall studs subjected to lateral loads (no axial loads other than self-weight and the weight of applied finishes).
    - .2 Steel bridging.
    - .3 Top and bottom track.
    - .4 Lintel, sill and jamb members for wall openings.
    - .5 Stud, bridging and track connections.
    - .6 Top and bottom connections to main structure including anchor clip angles, through-bolts and epoxy bolts, and detailing to accommodate floor or roof deflections.
  - .2 Loadbearing Horizontal Framing: Comprised of:
    - .1 Joists.
    - .2 Headers and trimmers for openings.
    - .3 Bridging.



- .4 Closure channels.
- .5 Connections including web stiffeners.

## 2.3 DESIGN AND PERFORMANCE CRITERIA

- .1 Base design on Limit States Design principles using factored loads and resistances.
- .2 Loads and load factors shall be in accordance with applicable regulatory requirements.
- .3 For wind load calculations, the reference velocity pressure,  $q$ , shall be based on a 1 in 50 probability of being exceeded in any one year for strength design and for deflection.
- .4 Determine resistance and resistance factors in accordance with applicable regulatory requirements and CSA S136.
- .5 Conform to requirements of fire rated assemblies tested to CAN/ULC-S101. Provide fire resistance ratings as indicated on Drawings.
- .6 Member depths are shown on Drawings. Adjust material thicknesses and spacings, as required by design criteria. Use greater or lesser depths only if approved by Consultant.
- .7 Space studs at maximum 400 mm OC. Use lesser spacings if required by design criteria.
- .8 Space roof trusses and joists as noted on Drawings. Use lesser spacings if required by design criteria.
- .9 For studs, track, and joists, conform to minimum design thicknesses listed below. Use greater design thicknesses if required by design criteria.
  - .1 64 mm Width: 0.84 mm thick.
  - .2 92 mm Width: 0.84 mm thick.
  - .3 102 mm Width: 0.84 mm thick.
  - .4 140 mm Width: 0.84 mm thick.
  - .5 152 mm Width: 0.84 mm thick.
  - .6 184 mm Width: 0.91 mm thick.
  - .7 203 mm Width: 1.12 mm thick.
  - .8 235 mm Width: 1.22 mm thick.
  - .9 254 mm Width: 1.52 mm thick.
  - .10 286 mm Width: 1.52 mm thick.
  - .11 305 mm Width: 1.52 mm thick.
  - .12 356 mm Width: 1.91 mm thick.
- .10 For wall studs supporting brick veneer, minimum design thickness exclusive of coating shall be the greater of the design thicknesses listed above or 1.12 mm.
- .11 Minimum design thickness for bridging channel shall be 1.22 mm for studs and 1.52 mm for joists. Use greater bridging channel design thickness if required by design criteria.
- .12 Minimum design thickness for clip angles shall be 1.52 mm for studs and 1.91 mm for joists. Use greater clip angle thickness if required by design criteria.
- .13 Maximum flexural deflections under specified live or wind loads shall conform to:
  - .1 Design loadbearing vertical framing supporting masonry veneer to CSA S304 with lateral stud deflections limited to  $L/720$ .
  - .2 Design loadbearing vertical framing supporting other finishes to limit lateral deflections to  $L/360$ .
  - .3 Design loadbearing horizontal framing to limit deflection to  $L/360$ .
  - .4 Building Sway (due to all effects):  $1/400$  of building height or  $1/500$  of storey height.

- .14 For lateral loadbearing vertical framing:
  - .1 Design connections to accommodate vertical deflection movement of structure, frame shortening and vertical tolerances without imposing axial loads onto framing. Leave a minimum gap of 12 mm. Larger gaps may be required to accommodate structural movement. Coordinate with Consultant.
  - .2 Limit free play and movement in connections perpendicular to plane of framing to plus or minus 0.5 mm relative to building structure.
- .15 Design cold-formed metal framing components and assemblies to accommodate specified erection tolerances of structure.
- .16 Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis.
- .17 Design and Provide bridging as follows:
  - .1 Lateral Loadbearing Vertical Framing: 1 500 mm OC maximum.
  - .2 Loadbearing Horizontal Framing: 2 100 mm OC maximum.
  - .3 Space bridging at equal intervals over the span length of the member. Closer spacings may be required to satisfy structural requirements.
- .18 Design anchorage and splice details for bridging.
- .19 Design for local loading due to anchorage of cladding and interior wall mounted fixtures where shown.
- .20 Connect cold-formed metal framing members by bolting, welding or screwing.
- .21 Provide lintel, sill and jamb members and connections in stud walls to frame openings larger than 100 mm in any dimension.
- .22 Provide headers and trimmers and connections in joist assemblies to frame openings larger than 100 mm in any dimension.

## 2.4 MATERIALS

- .1 Steel: To CSA S136; identified on Shop Drawings as to specification, grade, mechanical properties, and coating type and thickness.
- .2 Machine Bolts: To ASTM A307, Grade A; galvanized.
- .3 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.
- .4 Washers: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; galvanized hardened steel washers; circular, bevelled and clipped types as required.
- .5 Screws: To ASTM C1513; galvanized steel, self-tapping type.
- .6 Welding Materials: To CSA W59.
- .7 Welding Electrodes: 480 MPa minimum tensile strength series; e.g. E480XX or ER480S-X.
- .8 Touch-up Paint: Zinc-rich, ready-mixed paint.

## 2.5 MANUFACTURED UNITS

- .1 Loadbearing Steel Studs, Joists, Tracks, and Bracing: To ASTM C955; finishes, sizes and thicknesses as identified on accepted Shop Drawings.

## 2.6 FABRICATION

- .1 Except as noted herein, fabricate wall framing components to CAN/CGSB-7.1 and in accordance with accepted Shop Drawings.
- .2 Where specified, Provide cut-outs centred in webs of members to accommodate services and through-the-knockout style bridging. Unreinforced cut-outs shall be limited to following dimensions. Limit distance from centreline of last unreinforced cut-out to end of member to be not less than 300 mm. Consider effect of cut-outs on strength and stiffness of members.
  - .1 92 mm and 102 mm Deep Members
    - .1 Perpendicular to Length of Member: 40 mm.
    - .2 Parallel to Length of Member: 105 mm.
    - .3 Centre to Centre Spacing: 600 mm.
  - .2 152 mm Deep Members
    - .1 Perpendicular to Length of Member: 65 mm.
    - .2 Parallel to Length of Member: 115 mm.
    - .3 Centre to Centre Spacing: 600 mm.
- .3 Length tolerances for members:
  - .1 Tracks: None.
  - .2 Lateral Loadbearing Vertical Framing: Plus or minus 3 mm.
  - .3 Loadbearing Horizontal Framing: Plus or minus 3 mm.
- .4 Cross sectional geometry tolerances for members shall conform to:
  - .1 Member Depth: Minus 1 mm, plus 2 mm.
  - .2 Flange depth: Minus 1 mm, plus 2 mm; minimum 31 mm width.
  - .3 Lip Length: Plus 4 mm.
  - .4 Thickness: To CSA S136.
  - .5 Corner Angles: Plus or minus 3 degrees.
- .5 Mark steel thickness, exclusive of coating, on each member by embossing, stamping with indelible ink or by colour coding.

## 2.7 FINISHES

- .1 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .2 Galvalumed Coating on Sheet Steel: To ASTM A792/A792M, Coating Designation AZM150; hot dipped aluminum-zinc alloy coating.
- .3 Concrete Anchors: Minimum zinc coating thickness of 0.008 mm. Other coatings providing equal or better corrosion protection may be used.
- .4 Powder-actuated and Low Velocity Fasteners: Minimum zinc coating thickness of 0.008 mm. Other coatings providing equal or better corrosion protection may be used.

## 3 Execution

### 3.1 FASTENERS AND WELDS

- .1 Ensure connected parts are in contact. Provide clamping before welding or installing screws as required.
- .2 Welds: To CSA S136, CSA W59 and ANSI/AWS D1.3, as applicable.
- .3 For material less than 3 mm thick, Shop Drawings may show nominal weld leg sizes. For such material, effective throats of welds shall not be less than thickness of thinnest connected part.

- .4 Sheet metal screws shall be of minimum diameter indicated on accepted Shop Drawings, but not less than #8.
- .5 Penetration of Sheet Metal Screws Beyond Joined Materials: Not less than three exposed threads.
- .6 Sheet metal screw thread types, drilling capability and installation shall conform to manufacturer's recommendations.
- .7 Provide sheet metal screws with low profile heads where covered by sheathing materials.
- .8 Install concrete anchors in accordance with manufacturer's recommendations.

### 3.2 ERECTION

- .1 Erect cold-formed metal framing to ASTM C1007.
- .2 Methods of construction may be either piece by piece (stick-built) or by fabrication into panels (panelized) either on- or off-site.
- .3 Erect cold-formed metal framing true and plumb within specified tolerances.
- .4 Employ temporary bracing wherever necessary to withstand loads to which structure may be subject during erection and subsequent construction. Leave temporary bracing in place as long as required for safety and integrity of structure. During construction, ensure margin of safety exists in uncompleted structure consistent with requirements of applicable regulatory requirements and CSA S136.
- .5 Seat studs into top and bottom tracks. Do not allow gap between end of stud and web of track to exceed 4 mm.
- .6 Align adjacent or abutting members in same plane to within plus or minus 0.5 mm.
- .7 Space studs within 3 mm either direction of design spacing. Cumulative error in spacing shall not exceed requirements of finishing materials.
- .8 Align web cut-outs in studs and joists as required for installation of through-the-knockout style bridging and services.
- .9 Take field measurements necessary to ensure proper fit of members.
- .10 Use either saws or shears to cut members. Do not torch cut material.
- .11 Reinforce cut-outs when distance from centre line of cut-out to end of member is less than 300 mm. Submit reinforcing detail to Consultant for approval.
- .12 Locate loadbearing horizontal framing members, and their end stiffeners, directly over axial loadbearing building elements. Alternately, Provide a load distribution member to transfer loads. Do not use cold-formed metal track as a load distribution member.
- .13 Replace members with localized damage.
- .14 Unless a closer spacing is shown on accepted Shop Drawings, anchor top and bottom tracks securely to structure at maximum 800 mm OC. Place one additional anchor within 100 mm of end of each piece of track and additionally as required by accepted Shop Drawings.
- .15 Install additional vertical framing members at abutting walls, openings, terminations against other materials and on each side at corners unless explicitly detailed otherwise on accepted Shop Drawings.

- .16 Insulate jamb and header assemblies that may become inaccessible after installation. Use self-expanding foam sealant as specified in Section 07 27 36.

### 3.3 TOLERANCES

- .1 Plumbness: 1/500th of member length.
- .2 Out-of-Straightness: Including camber and sweep:
  - .1 Vertical Framing: 1/1000th of member length.
  - .2 Joists: 1/1000th of member length.
  - .3 Track: Camber not to exceed 1/1000th of member length.

### 3.4 FIELD QUALITY CONTROL

- .1 Fabricator's design engineer will undertake periodic field review during construction and shall submit reports as described above.
- .2 Fabricator's Design Engineer Review: Include review of mill tests reports, welded and screwed connections, connections to main structure, member sizes, location and material thickness, coating thickness, erection tolerances, and field cutting.
- .3 Additional field inspection and testing will be conducted by independent testing and inspection agency, as specified in Section 01 40 00.
- .4 Independent inspection and testing will include:
  - .1 Checking mill test reports are properly correlated to materials.
  - .2 Sampling fabrication and erection procedures for general conformity to specified requirements.
  - .3 Checking welding conforms to Contract Documents.
  - .4 Checking fabricated members against specified member geometries.
  - .5 Visual inspection of welded connections including sample checking of joint preparation and fit-up.
  - .6 Sample checking of screwed and bolted joints.
  - .7 Sample checking tolerances are not exceeded during fit-up or erection.
  - .8 Additional inspection and testing of welded connections as required by CSA W59.
  - .9 General inspection of field cutting and alterations required by other Sections.
  - .10 Submission of reports to Consultant, Contractor and authorities having jurisdiction; covering work inspected with details of discovered deficiencies.

### 3.5 ADJUSTING

- .1 Touch-up welds and coatings damaged by welding with zinc rich paint.
- .2 Prior to touch-ups, prepare surface in accordance with paint manufacturer's recommendations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 10 00 - Structural Metal Framing.
- .4 Section 07 84 00 - Firestopping.
- .5 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- .1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .2 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .3 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .4 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .6 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .7 ASTM A269/A269M-22: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .8 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.
- .9 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- .10 ASTM A385/A385M-22: Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
- .11 ASTM A449-14(2020): Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
- .12 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .13 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .14 ASTM A780/A780M-09(2015): Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .15 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- .16 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

- .17 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
  - .18 ASTM D6386-22: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
  - .19 ASTM D7803-19: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.
  - .20 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
  - .21 ASTM F467M-06a(2012): Standard Specification for Nonferrous Nuts for General Use (Metric).
  - .22 ASTM F468M-06(2012): Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use (Metric).
  - .23 ASTM F593-22: Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
  - .24 ASTM F594-22: Standard Specification for Stainless Steel Nuts.
  - .25 ASTM F3125/F3125M-23: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
  - .26 CSA A500-16: Building Guards.
  - .27 CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel.
  - .28 CSA G40.21-13 (R2018): Structural Quality Steel.
  - .29 CSA S136-16: North American Specification for the Design of Cold-Formed Steel Structural Members.
  - .30 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.
  - .31 CSA W47.2-11 (R2020): Certification of Companies for Fusion Welding of Aluminum.
  - .32 CSA W55.3-08 (R2018): Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .33 CSA W59-18: Welded Steel Construction.
  - .34 CSA W59.2-M1991 (R2018): Welded Aluminum Construction.
- 1.3 SHOP DRAWINGS
- .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, prepared for each required custom-fabricated metal item, illustrating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
  - .3 Shop Drawings for steel bollards, balustrades, guards, and railings must be stamped, signed and dated by fabricator's design engineer.
- 1.4 QUALIFICATIONS
- .1 Fabricator's Design Engineer: A professional structural engineer experienced in designing steel bollards, balustrades, guards, and railings; licensed to practice at Place of the Work.

- .2 Fabricator: A firm specializing in fabricating custom metal components, having minimum 3 years documented experience.
- .3 Welders: Workers certified by CWB to CSA W47.1, CSA W47.2 and CSA W55.3 as applicable.

## 2 Products

### 2.1 DESIGN CRITERIA

- .1 Design cold-formed steel fabrications to CSA S136.
- .2 Design metal guards, including balustrades, railings and handrails to CSA A500 and applicable regulatory requirements, and capable of resisting:
  - .1 Uniform Load = 0.75 kN/m in any direction.
  - .2 Vertical Load = 1.5 kN/m.
  - .3 Loads on Pickets = 0.5 kN on 100 x 100 mm area.
  - .4 Non-concurrent Loads on Handrails = 0.9 kN applied at any point in any direction.
  - .5 Lateral Force = 1.0 kN at any point without damage or permanent set.
- .3 Design galvanized metal fabrications to accommodate venting and drainage during hot dip galvanizing process, to ASTM A385/A385M.

### 2.2 MATERIALS

- .1 Galvanized Sheet Steel: To ASTM A653/A653M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, galvanized; thicknesses as indicated.
- .2 Sheet Steel: To ASTM A1008/A1008M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, thicknesses as indicated.
- .3 Steel Sections and Plates: To CSA G40.20 and CSA G40.21, Grade 300W; profiles and sizes as indicated.
- .4 Hollow Structural Steel Sections: To CSA G40.20 and CSA G40.21, Grade 350W, Class H; sizes as indicated.
- .5 Stainless Steel Sheet, Sections and Plates: To ASTM A240/A240M, Type 304L for welded applications and Type 304 for other applications; thicknesses and sizes as indicated.
- .6 Stainless Steel Tubing: To ASTM A269/A269M, Grade TP316L; thicknesses, diameters and sizes as indicated.
- .7 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304L for welded applications and Type 304 for other applications; sizes and profiles as indicated.
- .8 Extruded Aluminum: To ASTM B221M, 6063 alloy, T6 temper; profiles and sizes as indicated.
- .9 Aluminum Sheet: To ASTM B209/B209M, 3003-H14 alloy for shop-painted material and 5005-H32 alloy for anodized material; thicknesses as indicated.

### 2.3 ACCESSORIES

- .1 Stainless Steel Bolts: To ASTM F593, Group 1.
- .2 Stainless Steel Nuts and Washers: To ASTM F594, Group 1.
- .3 High-Strength Bolts: To ASTM F3125/F3125M, Type 1 for interior applications, Type 3 for exterior applications; quenched and tempered steel heavy hex structural bolts.
- .4 Medium-Strength Bolts: To ASTM A449, Type 1 for interior applications, Type 3 for exterior applications; quenched and tempered steel hex bolts.



- .5 Machine Bolts: To ASTM A307, Grade A; carbon and alloy steel, galvanized where noted.
- .6 Steel Nuts: To ASTM A563/A563M, Grade A, Heavy Hex Style for use with high strength bolts, and Hex Style for use with medium strength bolts and machine bolts; carbon and alloy steel; galvanized where noted.
- .7 Steel Washers: To ASTM F436/F436M, Type 1 for interior applications, Type 3 for exterior applications; hardened steel washers, circular, bevelled and clipped types as required.
- .8 Aluminum Bolts: To ASTM F468M, shop finished to match adjacent surfaces.
- .9 Aluminum Nuts and Washers: To ASTM F467M, including plain washers; shop finished to match adjacent surfaces.
- .10 Welding Materials: To CSA W59 and CSA W59.2.
- .11 Primer for Ferrous Metal Surfaces: Red oxide type.
- .12 Primer for Galvanized Surfaces: Zinc-rich paint type.

## 2.4 FABRICATION

- .1 Prior to fabrication, verify existing conditions and take field measurements to ensure perfect fit of fabricated items.
- .2 Fabricate cold-formed steel components to CSA S136.
- .3 Fabricate metal guards, including balustrades, railings, and handrails to CSA A500.
- .4 Shop weld steel components to CSA W59.
- .5 Shop weld aluminum components to CSA W59.2.
- .6 Fit and shop assemble components in largest practical sections to accommodate delivery to Place of the Work.
- .7 Seal joints with continuous welds.
- .8 Grind visually-exposed joints flush and smooth with adjacent finish surface.
- .9 Make visually-exposed joints butt tight, flush and hairline.
- .10 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; except where specifically noted otherwise.
- .11 Supply components required for anchorage of fabrications.

## 2.5 FINISHES

- .1 Shop Priming:
  - .1 Clean surfaces of rust, scale, grease, and foreign matter prior to shop priming.
  - .2 Do not prime surfaces designated to come into direct contact with concrete, or where field welding is required.
  - .3 Prime components using minimum two coats primer.
- .2 Galvanizing:
  - .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
  - .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
  - .3 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

- .4 Prepare hot dip galvanized coatings to ASTM D6386 for subsequent paint application.
  - .5 Prepare hot dip galvanized coatings to ASTM D7803 for subsequent powder coating application.
  - .3 Stainless Steel: To AISI No. 4 - Brushed.
  - .4 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating, No. 17.
  - .5 Monochromatic Paint Coating on Aluminum: To AAMA 2605; two-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.03 mm dry film thickness; eg. Duranar by PPG Industries, Inc.; colours as selected by Consultant.
  - .6 Metallic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, complete with metal flakes incorporated in colour coat; factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc.; colour as selected by Consultant.
  - .7 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colours as selected by Consultant.
  - .8 Monochromatic Paint Coating on Sheet Steel: Two-coat silicone modified polyester coil coating, factory-applied to 0.028 mm dry film thickness; eg. WeatherXL by The Sherwin-Williams Company, colours as selected by Consultant.
- 3 Execution
- 3.1 PREPARATION
- .1 Make provision for erection loads with temporary bracing.
  - .2 Clean and strip primed steel items to bare metal where site welding is required.
  - .3 Supply items required to be cast into concrete and or embedded in masonry with setting templates, to appropriate Sections.
- 3.2 INSTALLATION
- .1 Install components plumb and level, accurately fitted, free from distortion or defects.
  - .2 Provide fasteners and anchors necessary to secure components rigidly in place.
  - .3 Field weld steel components to CSA W59.
  - .4 Field weld aluminum components to CSA W59.2.
  - .5 Field bolt and weld to match shop bolting and welding.
  - .6 Mechanically fasten joints butted tight, flush, and hairline.
  - .7 Grind welds smooth and flush.
  - .8 After erection, prime welds, abrasions, and surfaces not yet shop primed or galvanized, except surfaces to be in direct contact with concrete.
  - .9 Make Good damaged galvanized coatings to ASTM A780/A780M.

### 3.3 SCHEDULE

- .1 The following schedule is a list of principal items only. Refer to Drawings for items not specifically scheduled.
  - .1 Sleeves and Openings: Including templates and required information, supplied to appropriate Sections.
  - .2 Attachments: Anchor bolts, washers, nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, etc. as required and secured with sufficient self-tapping shake-proof screws with flat countersunk heads.
  - .3 Brackets: Fabricated from mild steel plate, sizes and configurations as required to support countertops, shelving, seating, benches, valances, coat hooks, and other similar components; pre-drilled for fastening of other components.
  - .4 Lateral Support Brackets for Masonry Partitions: 75 x 75 mm steel angles, 6 mm thick, as follows:
    - .1 Concealed Conditions: 200 mm long and spaced at 3 000 mm OC; minimum two anchors each.
    - .2 Exposed Conditions: Continuous lengths, anchored at 1 000 mm OC.
  - .5 Steel Pipe Bollards: Engineered by fabricator; 150 mm OD galvanized steel pipe, sufficient length to be 1 000 mm above finished grade; set in 450 mm OD concrete pier set minimum 1 200 mm deep. Fill steel pipe solid with concrete and finish with rounded top. Include steel chain secured between bollards where indicated on Drawings.
  - .6 Metal Balustrades, Guards and Railings: Engineered by fabricator to meet specified design criteria; sizes and configurations as indicated on accepted Shop Drawings; fabricated using shop primed steel for interior applications and stainless steel for exterior applications.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 41 00 - Architectural Wood Casework.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

- .1 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .2 ASTM F593-22: Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- .3 ASTM F594-22: Standard Specification for Stainless Steel Nuts.
- .4 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .5 CAN/CSA O80 Series-08 (R2012) Consolidated: Wood Preservation.
- .6 CAN/CSA-O86-09 Consolidated: Engineering Design in Wood.
- .7 CSA O112.9-10: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .8 CSA O121-08 (R2013): Douglas Fir Plywood.
- .9 CSA O141-05 (R2009): Softwood Lumber.
- .10 CSA O151-09: Canadian Softwood Plywood.
- .11 NLGA Standard Grading Rules for Canadian Lumber, August 2017 Edition.
- .12 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 QUALITY ASSURANCE

- .1 Lumber Identification: Grade stamp clearly identifying assigned grade, mill of origin, moisture content at time of manufacture, species or species group, and grading authority having jurisdiction over mill of origin.
- .2 Plywood Identification: Face or edge stamp depending on appearance requirement, clearly identifying panel grade, species designation, mill identification, certifying agency, and waterproof glue bond designation.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Products under waterproof cover.
- .3 Prevent damage to Products, existing property and to the Work.
- .4 Store Products where it does not hinder progress of the Work.

2 Products

2.1 MATERIALS

- .1 Dimension Lumber: To CSA O141, S4S; SPF species, kiln dried to S-DRY moisture content; preservative treated for exterior applications where noted on Drawings, sizes as indicated on Drawings; NLGA Light Framing Grade Category, Standard and Better Common Grade Mix.
- .2 Plywood - Exterior Applications: To CSA O121, DFP species, SHG Grade, Exterior waterproof glue bond; veneer core, butt edge, unsanded faces; preservative treated, thicknesses as indicated on Drawings.
- .3 Plywood - Interior Applications: To CSA O151, CSP species, SHG Grade, Exterior waterproof glue bond; veneer core, butt edge, unsanded faces; flame retardant treated where noted, thicknesses as indicated on Drawings.

2.2 ACCESSORIES

- .1 Nails: To ASTM F1667, Type I (NL); common wire type for general use and spiral type for structural connections; sizes necessary to ensure adequate securement; and as follows:
  - .1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
  - .2 For Use with Untreated Wood: Galvanized steel.
- .2 Spikes: To ASTM F1667, Type III (SP); common wire type for general use and spiral type for structural connections; sizes necessary to ensure adequate securement; and as follows:
  - .1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
  - .2 For Use with Untreated Wood: Galvanized steel.
- .3 Staples: To ASTM F1667, Type IV (ST); common wire; leg length necessary to ensure adequate securement; and as follows:
  - .1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
  - .2 For Use with Untreated Wood: Galvanized steel.
- .4 Screws: Bugle head, power driven type, sizes necessary to ensure adequate securement; types as follows:
  - .1 For Use with Preservative Treated Wood: Type 304 or 316 stainless steel.
  - .2 For Use with Untreated Wood: Galvanized steel.
- .5 Stainless Steel Bolts: To ASTM F593, Group 1.
- .6 Stainless Steel Nuts: To ASTM F594, Group 1.
- .7 Adhesive: To CSA O112.9.
- .8 Anchors: Toggle bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete, or bolts or ballistic fasteners for anchorages to steel.
- .9 Touch-Up Wood Preservative: To CAN/CSA O80; brush-applied copper azole (CBA-A or CA-B) or alkaline copper quaternary (ACQ) preservative.
- .10 Touch-up Flame Retardant Coating: To CAN/CSA O80; brush-applied Dricon by Lonza.

2.3 FINISHES

- .1 Flame Retardant Treatment
  - .1 Flame Retardant Treatment: To CAN/CSA O80; chemically treated and pressure impregnated; as follows:
    - .1 Surface Burning Characteristics (CAN/ULC-S102): Flame Spread Index  $\leq$  25.
    - .2 Manufacturer and Product Name: eg. Dricon by Lonza.
  - .2 Flame retardant treated materials must bear a ULC classification label.

- .2 Wood Preservative Treatment:
    - .1 Wood Preservative Treatment: To CAN/CSA O80; chemically treated and pressure impregnated using copper azole (CBA-A or CA-B) or alkaline copper quaternary (ACQ) preservative.
    - .2 Preservative treated materials must bear CSA classification label.
    - .3 Make preservative treated materials available for inspection by Consultant at place of treatment, before shipment to Place of the Work.
  - .3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes C or D; hot dipped zinc alloy coating.
- 3 Execution
- 3.1 SITE APPLIED WOOD TREATMENT
- .1 Apply touch-up coatings to CAN/CSA O80.
  - .2 When wood in contact with exterior cementitious materials, roofing and related metal flashings has not been previously preservative treated, brush apply two coats of touch-up wood preservative.
  - .3 Apply two coats of touch-up wood preservative to sawn ends of preservative treated material.
  - .4 Apply two coats of touch-up flame retardant coating to sawn ends of flame retardant treated material.
- 3.2 INSTALLATION
- .1 Erect wood framing members level and plumb.
  - .2 Place horizontal members laid flat, crown side up.
  - .3 Construct framing members full length without splices.
  - .4 Secure plywood sheets perpendicular to framing members, with ends staggered and sheet edges secured directly over firm bearing.
  - .5 Provide wood blocking required for attachment of fitments and equipment by other Sections.
  - .6 Provide 19 mm thick flame retardant treated plywood backer board on flame retardant treated wood blocking for mounting electrical equipment where indicated on Drawings.
  - .7 Construct curb and cant members of single pieces per location.
  - .8 Curb roof openings except where prefabricated curbs are provided.
  - .9 Form corners by lapping side members alternately.
  - .10 Coordinate work with installation of decking and support of decking at openings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 05 40 00 - Cold-Formed Metal Framing.
- .2 Section 07 21 00 - Thermal Insulation.
- .3 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .4 Section 07 27 00 - Air Barriers.
- .5 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

- .1 ASTM C475/C475M-17: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C954-18: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .3 ASTM C1002-20: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .4 ASTM C1177/C1177M-17: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .5 ASTM C1264-19: Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.
- .6 ASTM C1280-18: Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- .7 CGC Gypsum Construction Handbook.
- .8 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .9 GA-214-2021: Levels of Finish for Gypsum Panel Products.
- .10 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .11 ULC List of Equipment and Materials.

1.3 QUALIFICATIONS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Conform to ASTM C1264.

2 Products

2.1 MANUFACTURERS

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

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

## 2.2 MATERIALS

- .1 Gypsum Sheathing Board (GSB-1): To ASTM C1177/C1177M; as follows:
  - .1 Thickness 12.7 mm.
  - .2 Edges: Square.
  - .3 Core: Silicone-treated gypsum.
  - .4 Facers: Glass fiber mesh, both sides.
  - .5 Manufacturer and Product Name: eg. DensGlass Exterior Sheathing by G-P Gypsum Corporation.
- .2 Gypsum Sheathing Board (GSB-2): To ASTM C1177/C1177M, Type X; as follows:
  - .1 Thickness: 15.9 mm.
  - .2 Edges: Square.
  - .3 Core: Silicone-treated gypsum.
  - .4 Facers: Glass fiber mesh facers, both sides.
  - .5 Flame Spread Index (CAN/ULC-S102):  $\leq 10$ .
  - .6 Manufacturer and Product Name: eg. DensGlass Fireguard Sheathing by G-P Gypsum Corporation.
- .3 Steel Drill Screws: To ASTM C954; galvanized steel, sheet metal type.
- .4 Self-Tapping Screws: To ASTM C1002, Type S, Fine Thread; galvanized steel.
- .5 Adhesive: To CAN/CGSB-71.25-M.
- .6 Joint Materials: To ASTM C475/C475M; reinforcing tape, joint compound, adhesive, water, fasteners.
- .7 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to ASTM C1280.
- .2 Install boards perpendicular to supports with ends staggered.
- .3 Secure board edges over firm bearing.
- .4 Screw fasten boards to furring or framing.
- .5 Finish boards to GA-214, Level 1.
- .6 Finished work shall be plane and free from depressions.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 06 24 00 - High Pressure Decorative Laminate.
- .3 Section 06 41 00 - Architectural Wood Casework.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 08 14 00 - Wood Doors.
- .6 Section 08 71 00 - Door Hardware.
- .7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- .1 ANSI A135.4-2004: Basic Hardboard.
- .2 ANSI A208.1-2009: Particleboard.
- .3 ANSI A208.2-2009: Medium Density Fiberboard (MDF) for Interior Applications.
- .4 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .5 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .6 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.
- .7 CSA O121-08 (R2013): Douglas Fir Plywood.
- .8 CSA O141-05 (R2009): Softwood Lumber.
- .9 CSA O151-09: Canadian Softwood Plywood.
- .10 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.
- .11 NHLA Grading Rules.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: Duplicate samples, as follows:
  - .1 Melamine Composite Panel: 300 x 300 mm size, illustrating laminate-clad face colour, pattern and texture; core materials; and quality of PVC edgebanding.
  - .2 Hardwood Plywood: 300 x 300 mm size, illustrating full panel sheet, edge and joint trim.
  - .3 MDF Trim: 300 mm long, illustrating size and shape of profiles.
  - .4 Hardwood Trim: 300 mm long, illustrating size and shape of profiles, and quality of wood grain.

1.4 QUALIFICATIONS

- .1 Trim and Finish Carpenter: A firm employing workers specializing in finish carpentry work, and having minimum 3 years documented experience.

2 Products

2.1 LUMBER

- .1 Dressed Softwood Lumber (DL-SWD): To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content, with mixed grain capable of receiving a high quality opaque finish; sizes as indicated on Drawings.
- .2 Dressed Hardwood Lumber (DL-HWD): White Birch species, to NHLA Select and Better Grade; kiln dried to maximum 7 percent moisture content, with vertical grain capable of receiving a high quality transparent finish; sizes as indicated on Drawings.
- .3 Dimension Lumber: As specified in Section 06 10 00.

2.2 PLYWOOD

- .1 Softwood Plywood (PLY-SWD): CSP to CSA O151; SEL TF Grade; SPF veneer core of minimum 9 plies; thicknesses as indicated on Drawings; capable of receiving a high quality opaque finish.
- .2 Softwood Plywood - Moisture-Resistant Core (PLY-SWD-MR): CSP to CSA O151; SEL TF Grade; composite core of moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue; thicknesses as indicated on Drawings; capable of receiving a high quality opaque finish.
- .3 Hardwood Plywood (PLY-HWD): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
  - .1 Core: Hardwood veneer core, minimum 9 plies.
  - .2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Pleasing match grain capable of receiving a high quality transparent finish.
- .4 Hardwood Plywood - Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G1S, thicknesses as indicated on Drawings; as follows:
  - .1 Core: Composite core, moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue.
  - .2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Pleasing match grain capable of receiving a high quality transparent finish.

2.3 COMPOSITE BOARDS AND PANELS

- .1 Particleboard (PB): To ANSI A208.1, Grade M-2; made from 100 percent post-industrial wood fibres; minimum 635 kg/m<sup>3</sup> density and maximum 6 percent moisture content; no added urea formaldehyde (nauf); certified EPP by Composite Panel Association; thicknesses as indicated on Drawings.
- .2 Melamine Composite Panel (MCP): Particleboard core with factory-applied low pressure laminate (LPL) thermo-fused to both faces; Premium quality; thicknesses as indicated on Drawings; colours, textures and patterns as selected by Consultant.
- .3 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; having minimum 740 kg/m<sup>3</sup> density and maximum moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.
- .4 Hardboard (HB): To ANSI A135.4, Class 1 - Tempered; inter-felted ligno-cellulosic fibers consolidated under heat and pressure; minimum 500 kg/m<sup>3</sup> density; S1S surface finish; thicknesses as indicated on Drawings.

2.4 CLOSET ACCESSORIES

- .1 Metal Tube Closet Rod System: 27 mm OD, heavy wall steel tube rod, with heavy duty metal flanges and brackets; chrome-plated finish.

- .2 Coat Hook: Two-prong heavy duty design, 4.5 mm thick flat steel bar, 108 mm high, 19 mm wide; pre-drilled for screw attachment; zinc plated finish; Model 209Z by Royal Arch Inc.

## 2.5 ACCESSORIES

- .1 Decorative Laminate: High pressure decorative laminate, Type HPDL as specified in Section 06 24 00.
- .2 Contact Adhesives: Water base type.
- .3 Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.
- .4 Nails: To ASTM F1667, Type I (NL), galvanized steel, common wire; sizes necessary to ensure adequate securement.
- .5 Staples: To ASTM F1667, Type IV (ST); galvanized steel, common wire; leg length necessary to ensure adequate securement.
- .6 Screws: Galvanized steel, tapered head suitable for counter sunk applications; sizes necessary to ensure adequate securement.
- .7 Bolts, Nuts, Washers, Lags and Blind Fasteners: Size and type to suit application; plain finish.
- .8 Primer: Alkyd primer sealer type.
- .9 Wood Filler: Solvent base, tinted to match surface finish colour.
- .10 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.

## 2.6 FINISHES

- .1 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to AWMAC NAAWS 4.0, Custom Grade.
- .2 Set and secure Products in place; straight, plumb and level.
- .3 Unless noted otherwise, install Products with nails, screws, or bolts with blind fasteners spaced at 400 mm OC, or adhesive as required by specific installation requirements.
- .4 Finish exposed edges of veneer-clad panels with 3.2 mm thick hardwood edge trim, glued and nailed.
- .5 Finish exposed edges of laminate-clad panels with 1.0 mm thick decorative laminate edgebanding, applied using hot melt adhesive.
- .6 Apply decorative laminate to core materials as specified in Section 06 24 00.
- .7 Install MCP shelf and metal tube closet rod where indicated on Drawings.
- .8 Install coat hooks where indicated on Drawings.
- .9 Install wood doors as specified in Section 08 14 00.
- .10 Install door hardware as specified in Section 08 71 00.

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

3.2 ADJUSTING AND CLEANING

.1 Set exposed fasteners.

.2 Apply wood filler over exposed nail and staple indentations. Allow to dry and sand smooth.

.3 Conceal countersunk fasteners with matching hardwood dowels, sanded smooth and flush to adjacent surface.

.4 Clean and prepare surfaces for site finishing. Coordinate with Section 09 90 00.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 41 00 - Architectural Wood Casework.
- .3 Section 08 14 00 - Wood Doors.

1.2 REFERENCES

- .1 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.
- .2 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.
- .4 CAN/CGSB-71.20-M88: Adhesive, Contact, Brushable.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate chains of laminate samples, illustrating available colours, patterns and textures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver decorative laminate with heavy kraft paper protection and store in cartons during shipping.
- .3 Protect decorative laminate surfaces during fabrication and installation stages; do not remove protective covering until final clean-up prior to final inspection.
- .4 Do not store or install Products in areas where relative humidity is less than 25 percent RH or greater than 60 percent RH at 22 degrees C.

1.5 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of two years, covering against warping, splitting, or delamination, subject to normal usage excluding excessive moisture or heat.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Arborite.
  - .2 Formica.
  - .3 Nevamar.
  - .4 Pionite.
  - .5 Wilsonart.
- .2 Substitution Procedures: Refer to Section 01 25 00.

## 2.2 MATERIALS

- .1 High Pressure Decorative Laminate (HPDL): To ANSI/NEMA LD 3; decorative surface papers impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins; colours, textures and patterns as selected by Consultant; NEMA Types, Grades and thicknesses as listed below:
  - .1 General Purpose Type: Grade HGS; 1.2 mm thick.
  - .2 Vertical Surface Type: Grade VGS; 0.7 mm thick.
  - .3 Postforming Type: Grade HGP; 1.0 mm thick.
  - .4 Vertical Postforming Type: Grade VGP; 0.7 mm thick.
  - .5 Cabinet Liner Type: Grade CLS; 0.5 mm thick.
  - .6 Backer Type: Grade BKM; 1.0 mm thick.
- .2 High Pressure Decorative Laminate - Flame-Retardant (HPDL-FR): To ANSI/NEMA LD 3; decorative surface papers impregnated with melamine resins, bonded under heat and pressure to fire-retardant kraft papers impregnated with phenolic resins; colours, textures and patterns as selected by Consultant; NEMA Types, Grades, thicknesses and surface burning characteristics as listed below:
  - .1 Vertical Surface Type: Grade VGF; 0.8 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
    - .1 Flame Spread Index = 15.
    - .2 Smoke Developed Index = 15.
  - .2 Backer Type: Grade BKV; 0.7 mm thick; surface burning characteristics (ASTM E84, Unbonded) as follows:
    - .1 Flame Spread Index = 15.
    - .2 Smoke Developed Index = 0.
- .3 Core Materials: As indicated on Drawings.
- .4 Sealer: Water-resistant type.
- .5 Draw Bolts and Splines: Suitable for new core bases, and acceptable to fabricator.
- .6 Contact Adhesive: To CAN/CGSB-71.20-M.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify cutouts in core materials are prepared for faucets, sinks, and other penetrating components.

### 3.2 PREPARATION

- .1 Make joints in core materials tight, flush, and hairline; using draw bolts and splines.
- .2 Round internal corners, chamfer edges and seal exposed edges in core materials.

### 3.3 INSTALLATION

- .1 Comply with ANSI/NEMA LD 3, Annex A and AWMAC NAAWS 4.0.
- .2 Install Products plumb, true and square, neatly scribed and fitted to adjoining surfaces.
- .3 Ensure adjacent laminate sheets match in colour, texture, and pattern.
- .4 Ensure decorative laminate and core profiles coincide to ensure full continuous support and bond over entire surface.

- .5 Use continuous lengths to minimize joints. Maintain joints minimum 600 mm from sink cutouts.
  - .6 Offset joints in decorative laminate from joints in core material.
  - .7 Apply decorative laminate to exposed edges of core material for straight self-edging strips or flat work.
  - .8 Chamfer exposed edges of decorative laminate uniformly at 20 degrees.
  - .9 Do not mitre decorative laminate edges.
  - .10 Apply backing sheets where required to conceal and balance core material.
  - .11 Apply cabinet liner sheets to interior of cabinets where indicated on Drawings.
- 3.4 FIELD QUALITY CONTROL
- .1 Gaps at corners, or between trim and core materials will be rejected by Consultant.
- 3.5 CLEANING
- .1 Refer to Section 01 74 00.
  - .2 Remove kraft paper protective covering.
  - .3 Visually inspect each installed item, wash and thoroughly polish surfaces.
- 3.6 PROTECTION
- .1 Refer to Section 01 76 00.
  - .2 Protect completed installation from damage with removable, temporary protective coverings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 24 00 - High Pressure Decorative Laminate.
- .3 Section 07 92 00 - Joint Sealants.
- .4 Section 08 14 00 - Wood Doors.
- .5 Section 08 71 00 - Door Hardware.

1.2 REFERENCES

- .1 ANSI A135.4-2004: Basic Hardboard.
- .2 ANSI A208.1-2009: Particleboard.
- .3 ANSI A208.2-2009: Medium Density Fiberboard (MDF) for Interior Applications.
- .4 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .5 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.
- .6 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .7 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .8 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.
- .9 ANSI/BHMA A156.1-2016: Butts and Hinges.
- .10 ANSI/BHMA A156.9-2015: Cabinet Hardware.
- .11 ANSI/BHMA A156.11-2014: Cabinet Locks.
- .12 ANSI/BHMA A156.26-2017: Continuous Hinges.
- .13 CSA O112.9-10: Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .14 CSA O112.10-08 (R2013): Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
- .15 CSA O121-08 (R2013): Douglas Fir Plywood.
- .16 CSA O141-05 (R2009): Softwood Lumber.
- .17 CSA O151-09: Canadian Softwood Plywood.
- .18 ANSI/HPVA HP-1-2020: American National Standard for Hardwood and Decorative Plywood.
- .19 ANSI/NEMA LD 3-2005: High Pressure Decorative Laminates.
- .20 NHLA Grading Rules.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.



- .2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, materials, component profiles and sizes, fastening methods, jointing details, finishes, accessories, locations of outlets, anchorage, and hardware.

#### 1.4 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: Duplicate samples, as follows:
  - .1 Melamine Composite Panel: 300 x 300 mm size, illustrating laminate-clad face colour, pattern and texture; core materials; and quality of PVC edgebanding.
  - .2 Hardwood Panel: 300 x 300 mm size, illustrating quality of veneer faces, edge profile, quantity of plies, joint and edge trim, and shop-applied finish.
  - .3 Hardwood Trim: 300 mm long, illustrating profile sizes and shapes, quality of wood grain, and shop-applied finish.

#### 1.5 QUALIFICATIONS

- .1 Fabricator and Installer: A firm specializing in fabricating and installing custom casework, having minimum 3 years documented experience and a member of AWMAC.

#### 1.6 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-up: Full-size, 450 mm wide sample of each type of architectural wood casework, including materials, finishes, hardware and countertops.
- .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .4 Remove and replace installed Product that does not conform to accepted mock-up.
- .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Store Products under waterproof cover both in transit and at Place of the Work in a manner to prevent damage to Products, to existing property and to the Work.
- .3 Store completed Products in a dry, clean area where it does not hinder progress of the Work.
- .4 Do not store or install Products in the Work until building is dry and heated.

### 2 Products

#### 2.1 LUMBER

- .1 Dressed Hardwood Lumber (DL-HWD): White Birch species; NHLA Select and Better Grade; kiln dried to maximum 7 percent moisture content, capable of receiving high quality transparent finish; sizes as indicated on Drawings.
- .2 Dressed Softwood Lumber (DL-SWD): To CSA O141, S4S; AWMAC Custom grade; Eastern White Pine, Douglas Fir or Spruce species, kiln dried to maximum 7 percent moisture content, with mixed grain capable of receiving high quality opaque finish; sizes as indicated on Drawings.
- .3 Dimension Lumber: As specified in Section 06 10 00; sizes as indicated on Drawings.

## 2.2 PLYWOOD

- .1 Hardwood Plywood (PLY-HWD): To ANSI/HPVA HP-1, Architectural G2S, thicknesses as indicated on Drawings; as follows:
  - .1 Core: Hardwood veneer core, minimum 9 plies.
  - .2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Book match grain capable of receiving high quality transparent finish.
- .2 Hardwood Plywood - Moisture-Resistant Core (PLY-HWD-MR): To ANSI/HPVA HP-1, Architectural G2S, thicknesses as indicated on Drawings; as follows:
  - .1 Core: Composite core, moisture-resistant particle board to ANSI A208.1, Grade M-3 - Exterior Glue.
  - .2 Face Veneers: White Birch species; Face Grade A; Plain-Sliced; of clear Book match grain capable of receiving high quality transparent finish.

## 2.3 COMPOSITE BOARDS AND PANELS

- .1 Melamine Composite Panel (MCP): Particleboard core with factory-applied low pressure laminate thermo-fused to both faces; Premium quality; colours, textures and patterns as selected by Consultant; thicknesses as indicated on Drawings.
- .2 Medium Density Fiberboard (MDF): To ANSI A208.2, Grade MD; minimum 740 kg/m<sup>3</sup> density and maximum moisture content between 4.5 - 8.0 percent; thicknesses as indicated on Drawings.
- .3 Particleboard (PB): To ANSI A208.1, Grade M-2; made from 100 percent post-industrial wood fibres; minimum 635 kg/m<sup>3</sup> density and maximum 6 percent moisture content; no added urea formaldehyde (nauf); certified EPP by Composite Panel Association; thicknesses as indicated on Drawings.
- .4 Hardboard (HB): To ANSI A135.4, Class 1 - Tempered; inter-felted ligno-cellulosic fibers consolidated under heat and pressure; minimum 500 kg/m<sup>3</sup> density; S1S surface finish; complete with factory-applied low pressure laminate thermo-fused to one face; colours, textures and patterns as selected by Consultant; thicknesses as indicated on Drawings.

## 2.4 MANUFACTURED UNITS

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

## 2.5 ACCESSORIES

- .1 Adhesive for Wet Area Exposures: To CSA O112.9.
- .2 Adhesive for Dry Area Exposures: To CSA O112.10.
- .3 Nails: To ASTM F1667, Type I (NL); galvanized steel, common wire; sizes necessary to ensure adequate securement.
- .4 Spikes: To ASTM F1667, Type III (SP); galvanized steel, common wire; sizes necessary to ensure adequate securement.
- .5 Staples: To ASTM F1667, Type IV (ST); galvanized steel, common wire; leg length necessary to ensure adequate securement.
- .6 Screws: Galvanized steel, bugle head, power driven type, sizes necessary to ensure adequate securement.
- .7 Anchors: Galvanized steel, drilled and epoxy-fastened types; sizes necessary to ensure adequate securement.

- .8 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 304; sizes and thicknesses as indicated on Drawings.
- .9 Stainless Steel Bar and Shape: To ASTM A276/A276M, Type 304; sizes and profiles as indicated on Drawings.
- .10 Decorative Laminate: High pressure decorative laminate, Type HPDL as specified in Section 06 24 00.
- .11 Solid Plastic Edgebanding: 3 mm thick PVC edgebanding with eased edge, colour and pattern to match cabinet panel faces, unless noted otherwise.
- .12 Tackable Surface: 6 mm thick linoleum-based cork sheet, Krommenie by Forbo Linoleum Inc., colour as selected by Consultant.
- .13 Joint Sealants: As specified in Section 07 92 00, types as follows:
  - .1 Dry Areas and Food Preparation Wet Areas: Interior general purpose sealant, SEAL-INT-GP.
  - .2 Other Wet Areas: Interior mildew-resistant sealant, SEAL-INT-MR.

## 2.6 CASEWORK HARDWARE

- .1 Unless specified otherwise, Provide cabinet hardware to ANSI/BHMA A156.9, Grade 1.
- .2 Casework Hinges: Fully-concealed, adjustable, articulated, screw on type metal hinges; accommodating 100 degree, 110 degree, 125 degree, and 170 degree openings, and complete with soft-closing mechanism.
- .3 Pull: Stainless steel, 10 mm OD handle, 185 mm overall length with 128 mm centre-to-centre fastening and 35 mm projection; eg. Contemporary Stainless Steel Handle Pull - 2102 by Richelieu.
- .4 Drawer Box and Slides: Full extension for 60 kg load at 500 mm; roller runners for bottom mounting, steel construction with baked enamel finish, ball bearing rollers, and complete with soft-closing mechanism.
- .5 Continuous Hinges: To ANSI/BHMA A156.26; continuous stainless steel hinges, heavy duty type, length to suit full door height; eg. Roton 790-900 by Hager, with US32D finish.
- .6 Cupboard and Drawer Lock: To ANSI/BHMA A156.11, Operational Class, Grade 1; Chrome finish, keyed to Owner's existing master keying system.
- .7 Padlock Hasp: Stainless steel, Type 304; with countersunk screw holes.
- .8 Slide Bolt For Inactive Leaf: 60 mm long barrel bolt, nickel plated.
- .9 Elbow Catch: Heavy duty type, nickel finish; eg. Model 5540180 by Richelieu.
- .10 Door Bumper: Nylon bumper; eg. Model MP303-11 by Richelieu.
- .11 Pilaster Strip: 16 mm wide, 4 mm deep perforated metal strip, zinc plated; length as required; Model 2332GXX by Richelieu.
- .12 Pilaster Clip: Heavy duty bent metal clips, zinc plated; Model CP2562G by Richelieu.
- .13 Shelf Support for Drilled Gable: 5 mm OD metal pin, plastic-clad; eg. Model 34004011 by Richelieu.
- .14 Support Housing and Bolt: Nickel-plated metal, 9.5 mm mounting centre, suitable for 19 mm thick panels; complete with matching connecting bolt; eg. Rafix-SE Housing Model 263.15.705 by Hafele.

- .15 Shelf Support: Prefinished steel construction, 500 kg capacity per pair, Hebgo brackets by Hafele, sizes as follows:
  - .1 SUPPORT-HD-1: 380 mm long, 180 mm high, 80 mm wide; Model 287.45.459.
  - .2 SUPPORT-HD-2: 480 mm long, 180 mm high, 80 mm wide; Model 287.45.468.
  - .3 SUPPORT-HD-3: 580 mm long, 220 mm high, 100 mm wide; Model 287.45.477.
  - .4 SUPPORT-HD-4: 680 mm long, 220 mm high, 100 mm wide; Model 287.45.486.
  - .5 SUPPORT-HD-5: 780 mm long, 220 mm high, 100 mm wide; Model 287.45.495.
- .16 Magnetic Catch: Magnetic catch, automatic opening.
- .17 Automatic Door Bolt: Model 245.58.754 by Hafele.
- .18 Base Cabinet Leveller: 100 mm size, adjustable to minus 5 mm and plus 10 mm; Model 637.45.326 by Hafele.
- .19 Safety Coat Hook: Magnetic safety release type, fabricated from high strength polycarbonate; release weight of 11.8 kg; Safety Release Coat Hook by HenkelHook, colours as selected by Consultant.
- .20 Fixed Coat Hook: As specified in Section 06 20 00.
- .21 Closet Rod and Flanges: As specified in Section 06 20 00.

## 2.7 TEACHER CLOSET DOOR HARDWARE

- .1 Butt Hinges: To ANSI/BHMA A156.1, Grade 1; 1-1/2 pair per leaf; 75 x 75 mm size, 5-knuckle ball bearing standard weight full mortise butt hinges, with brushed chrome finish; eg. Model FBB179 by Stanley.
- .2 Slide Bolt For Inactive Leaf: Type as specified above, two required for top and bottom attachment to inactive door leaf.
- .3 Lockable Handset: As specified in Section 08 71 00.

## 2.8 FABRICATION

- .1 Prior to fabrication, verify existing conditions and take field measurements necessary to ensure a perfect fit.
- .2 Fabricate Products to AWMAC NAAWS 4.0, Custom Grade.
- .3 Manufacture casework as individual cabinets in standard width increments, or in custom widths where indicated on Drawings.
- .4 Fabricate each module to be self-supporting with both exterior gables finished to allow removal and relocation without alterations to casework.
- .5 Pre-drill and cut mounting holes for sinks, faucets and electrical receptacles.
- .6 Finish exposed edges of veneer-faced components with 3.2 mm thick hardwood edgebanding, glued and nailed.
- .7 Finish exposed edges of laminate-faced components with solid plastic edgebanding, applied with an edge-bander using hot melt adhesive.
- .8 Secure wall case and floor case bottoms to casework with three locking mechanical fasteners at each end.
- .9 Secure fixed shelves, toe space rails, bottom rails, and top rails to casework with two locking mechanical fasteners at each end.
- .10 Limit unsupported span of shelving to AWMAC NAAWS 4.0.

- .11 Rabbet gables and insert pilaster strips for flush, recessed appearance. Screw fasten pilaster strips in place.
- .12 Construct joints to have a good fit, fully glued and rigid in final construction.
- .13 Hardware Preparation - Casework Doors: Factory install cabinet hinges, runners and hardware, anchoring components firmly into position for long life under hard use. Provide quantity of hinges per door as follows:
  - .1 Doors up to 1 000 mm High: Two.
  - .2 Doors up to 1 500 mm High: Three.
  - .3 Doors greater than 1 500 mm High: Four.
- .14 Hardware Preparation - Teacher Closet Doors: Machine cut relief for hinges, and core doors for handsets and cylinders.
- .15 Equally space banks of drawers, with minimum height of 120 mm.
- .16 Apply decorative laminate to core materials as specified in Section 06 24 00.
- .17 Factory seal cutouts and service fitting openings in countertops with moisture-resistant epoxy.
- .18 Drill holes in gables to receive adjustable shelving pins. Provide ferrow sleeves in drilled holes.
- .19 Install neoprene or rubber bumpers at top and bottom of doors and drawers.
- .20 Adjust doors and drawers to proper operation prior to installation.

## 2.9 FINISHES

- .1 Transparent Finish on Hardwood and Hardwood Veneer-clad Products: To AWMAC NAAWS 4.0, System 12 - POLYURETHANE, WATER-BASED, Custom Grade for Transparent finish; colour and sheen as selected by Consultant.
- .2 Opaque Finish on Unfaced Composite Panel and Softwood Products: To AWMAC NAAWS 4.0, System 4 - LATEX ACRYLIC, WATER-BASED, Custom Grade for Opaque finish; colour and sheen as selected by Consultant.
- .3 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.
- .4 Stainless Steel: To AISI No. 5 - Satin or No. 6 - Matte.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to AWMAC NAAWS 4.0, Custom Grade.
- .2 Where practical, assemble finished casework at mill and deliver to Place of the Work ready for installation.
- .3 Accurately fit joints and miters and set nail heads ready for finishing.
- .4 Set and secure materials and components in place, rigid, square and plumb.
- .5 Provide wood blocking, framing or furring shown on Drawings as part of casework fabrication or erection.
- .6 Accurately scribe and closely fit compounds to irregularities of adjacent surfaces.
- .7 Use draw bolts and splines to form tight, flush, hairline joints. Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.

- .8 Provide heavy duty fasteners, securely anchoring casework to floor, ceiling and wall surfaces. Use only concealed type fasteners.
- .9 Where permitted, secure concealed elements with small headed finishing nails. Countersink nail heads with nail setter.
- .10 Provide sinks, service fittings and electrical outlets. Coordinate with other Sections for connection to facility services.
- .11 Where access is required to valves and other facility service components located behind casework, Provide suitably removable wood access panels, each secured with minimum 4 brass screws.
- .12 Install laminate-clad countertops, as specified in Section 06 24 00.
- .13 Provide closers and filler strips in matching finish as required to ensure a neat and complete finished assembly.
- .14 Seal gaps and joints in wet areas with mildew-resistant joint sealer, and in non-wet areas with general purpose interior sealant. Conform to Section 07 92 00.
- .15 Install teacher closet doors and related door hardware.

### 3.2 ADJUSTING

- .1 Adjust doors and drawers to proper operation after installation.
- .2 Fill and touch up damaged finishes to match factory finish.
- .3 Replace damaged Product that can not be repaired.

### 3.3 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect completed installation from damage with protective coverings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 40 00 - Cold-Formed Metal Framing.
- .4 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .5 Section 07 26 00 - Vapour Retarders.
- .6 Section 07 27 00 - Air Barriers.
- .7 Section 07 42 13 - Metal Wall Panels.
- .8 Section 07 51 00 - Built-up Bituminous Roofing.
- .9 Section 07 81 00 - Applied Fireproofing.
- .10 Section 07 84 00 - Firestopping.
- .11 Section 08 80 00 - Glazing.
- .12 Section 09 21 16 - Gypsum Board Assemblies.
- .13 Section 09 81 00 - Acoustic Insulation.
- .14 Section 31 23 23 - Fill.
- .15 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 ASTM C518-17: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .2 ASTM C612-14(2019): Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .3 ASTM C1104/C1104M-19: Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
- .4 ASTM D1621-10: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- .5 ASTM D2842-19: Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .6 ASTM E96/E96M-23: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .7 CGSB 71-GP-24M: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
- .8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .9 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.
- .10 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .11 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.

- .12 CAN/ULC-S701.1-2017: Standard for Thermal Insulation, Polystyrene Boards.
  - .13 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
  - .14 ULC-S702.2-15: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation.
  - .15 CAN/ULC-S704.1-2017: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
  - .16 CAN/ULC-S770-15 (R2020): Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Store, handle and protect Products as specified in Section 01 60 00.
  - .2 Minimize time plastic-type insulation Products are stored or exposed to sunlight at Place of the Work.
  - .3 Store Products away from construction activity and sources of ignition.
  - .4 Protect Products from damage during handling, installation and at point of installation.
- 1.4 AMBIENT CONDITIONS
- .1 Apply Products only when surfaces and ambient temperatures are within manufacturer's prescribed limits.
- 2 Products
- 2.1 MANUFACTURERS
- .1 Manufacturers of extruded polystyrene rigid board insulation having Product considered acceptable for use:
    - .1 DuPont de Nemours, Inc.
    - .2 Owens-Corning Canada Inc.
  - .2 Manufacturers of polyisocyanurate rigid board insulation having Product considered acceptable for use:
    - .1 Atlas Roofing Corporation.
    - .2 Elevate.
    - .3 GAF Materials Corporation.
    - .4 Hunter Panels.
    - .5 IKO Industries Ltd.
    - .6 Soprema Inc.
  - .3 Manufacturers of mineral fibre batt, blanket and semi-rigid board insulation having Product considered acceptable for use:
    - .1 CertainTeed Canada, Inc.
    - .2 Knauf Insulation.
    - .3 Owens-Corning Canada Inc.
    - .4 Rockwool.
  - .4 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 REGULATORY REQUIREMENTS
- .1 Conform to applicable regulatory requirements for combustibility and surface burning characteristic requirements of polystyrene insulations.



- .2 Ensure foamed plastic insulations contain zero HFC and HCFC blowing agents, and conform to Global Warming Potential (GWP) values required by The Montreal Protocol.

## 2.3 RIGID BOARD INSULATION

- .1 Rigid Board Insulation (INS-RB-1): To CAN/ULC-S701.1, Type 4; extruded polystyrene (XPS) rigid board insulation, closed cell type, with integral high density skin; and as follows:
  - .1 Aged Thermal Resistance (ASTM C518):  $RSI \geq 0.88$  per 25 mm of thickness.
  - .2 Board Size: 600 x 2 400 mm.
  - .3 Compressive Strength (ASTM D1621): 210 kPa.
  - .4 Water Absorption (ASTM D2842):  $\leq 0.7$  percent by volume.
  - .5 Edges: Shiplap.
  - .6 Water Vapour Permeance (ASTM E96/E96M): 50 ng/Pa•s•m<sup>2</sup>.
  - .7 Thickness: As indicated on Drawings.
  - .8 Manufacturer and Product Name: eg. Styrofoam SM by DuPont de Nemours, Inc.
- .2 Rigid Board Insulation (INS-RB-2): To CAN/ULC-S701.1, Type 4; extruded polystyrene (XPS) rigid board insulation, closed cell type, with integral high density skin; and as follows:
  - .1 Aged Thermal Resistance (ASTM C518):  $RSI \geq 0.88$  per 25 mm of thickness.
  - .2 Compressive Strength (ASTM D1621): 275 kPa.
  - .3 Water Absorption (ASTM D2842):  $< 0.7$  percent by volume.
  - .4 Water Vapour Permeance (ASTM E96/E96M): 57 ng/Pa•s•m<sup>2</sup>.
  - .5 Thickness: As indicated on Drawings.
  - .6 Manufacturer and Product Name: eg. Styrofoam Highload 40 by DuPont de Nemours, Inc.
- .3 Rigid Board Insulation (INS-RB-3): To CAN/ULC-S704.1; polyisocyanurate rigid board insulation, closed cell type; and as follows:
  - .1 Long Term Thermal Resistance (CAN/ULC-S770):  $RSI \geq 0.93$  per 25 mm of thickness.
  - .2 Compressive Strength (ASTM D1621): 140 kPa.
  - .3 Faces: Glass reinforced mat facers both sides.
  - .4 Water Absorption (ASTM D2842):  $< 1$  percent.
  - .5 Edges: Square.
  - .6 Combustibility: Meets CAN/ULC-S107 and CAN/ULC-S126.
  - .7 Water Vapour Permeance (ASTM E96/E96M): 85 ng/Pa•s•m<sup>2</sup>.
  - .8 Thickness: Do not use boards less than 38 mm thick; total thickness as indicated on Drawings using a minimum of two layers.
  - .9 Manufacturer and Product Name: eg. ISO 95+GL by Firestone Building Products.

## 2.4 BATT AND BLANKET INSULATION

- .1 Batt Insulation (INS-BB-1): To CAN/ULC-S702.1, Type 1; mineral fibre non-rigid, friction fit thermal batt insulation, manufactured from glass, rock, or slag fibers; and as follows:
  - .1 Aged Thermal Resistance (ASTM C518):  $RSI \geq 0.75$  per 25 mm of thickness.
  - .2 Facing: Unfaced.
  - .3 Batt Size: 413 x 1 219 mm.
  - .4 Density (ASTM C612): 32 kg/m<sup>3</sup>.
  - .5 Combustibility (CAN/ULC-S114): Noncombustible.
  - .6 Thickness: As indicated on Drawings.
  - .7 Manufacturer and Product Name: eg. ComfortBatt by Rockwool.

## 2.5 SEMI-RIGID INSULATION

- .1 Semi-Rigid Insulation (INS-SR-1): To CAN/ULC-S702.1, Type 1; mineral fibre semi-rigid board insulation, manufactured from glass, rock, or slag fibers; and as follows:
  - .1 Aged Thermal Resistance (ASTM C518):  $RSI \geq 0.74$  per 25 mm of thickness.
  - .2 Facing: Unfaced.
  - .3 Board Size: 610 x 1 220 mm.
  - .4 Density (ASTM C612): 56 kg/m<sup>3</sup>.
  - .5 Combustibility (CAN/ULC-S114): Noncombustible.

- .6 Surface Burning Characteristics (CAN/ULC-S102):
  - .1 Flame Spread Index = 0.
  - .2 Smoke Developed Index = 0.
- .7 Water Vapour Permeance (ASTM E96/E96M): 1 807 ng/Pa•s•m<sup>2</sup>.
- .8 Moisture Resistance (ASTM C1104/C1104M): 0.01 percent.
- .9 Thickness: As indicated on Drawings.
- .10 Manufacturer and Product Name: eg. CurtainRock by Rockwool.

## 2.6 ACCESSORIES

- .1 Mechanical Fasteners: Stainless steel screw type fastener, complete with 75 mm OD moulded plastic disc washer.
- .2 Adhesive for Use with Polystyrene: To CGSB 71-GP-24M, Type 1.
- .3 Adhesive for Use with Other Materials: Mastic type, synthetic rubber base, fungi resistant, gun or trowel application.
- .4 Tape: 50 mm wide polyester self-adhering tape.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Ensure air seals and vapour retarders are in place.

### 3.2 RIGID AND SEMI-RIGID BOARDS

- .1 Unless specified otherwise, secure rigid board insulation with adhesive, applied in three continuous beads per board length.
- .2 Install insulation boards on wall surface either horizontally or vertically as required. Place membrane surface of insulation solidly against substrate and securely fasten.
- .3 Install mineral fibre semi-rigid boards to ULC-S702.2.
- .4 Do not crush insulation face when fastening with mechanical fasteners.
- .5 Stagger side and end joints.
- .6 Butt edges and ends tight to adjacent board and to protrusions.

### 3.3 BATTS AND BLANKETS

- .1 Install mineral fibre batts and blankets to ULC-S702.2.
- .2 Install batt insulation in spaces without gaps and voids.
- .3 Fit insulation tight in spaces and tight to exterior side of facility services within plane of insulation.

### 3.4 FIELD QUALITY CONTROL

- .1 Notify Consultant and independent inspection company to inspect thermal insulation before, during, and upon completion of installation.

### 3.5 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect insulation edges at end of each Working Day.

- .3 Protect insulation in areas where welding will be carried out.
- .4 Replace insulation damaged by others.
- .5 Protect insulation requiring a thermal barrier in accordance with applicable regulatory requirements.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 06 16 43 - Gypsum Sheathing.
- .4 Section 07 21 00 - Thermal Insulation.
- .5 Section 07 26 00 - Vapour Retarders.
- .6 Section 07 27 00 - Air Barriers.
- .7 Section 07 27 36 - Sprayed Foam Air Barrier.
- .8 Section 07 81 00 - Applied Fireproofing.

1.2 REFERENCES

- .1 ASTM D1621-10: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- .2 ASTM D1622/D1622M-14: Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- .3 ASTM D1623-17: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- .4 ASTM D2240-15(2021): Standard Test Method for Rubber Property-Durometer Hardness.
- .5 ASTM D2842-19: Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .6 ASTM D6226-15: Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
- .7 ASTM E96/E96M-23: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .8 CUFCA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.
- .9 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .10 CAN/ULC-S705.1-18: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.
- .11 CAN/ULC-S705.2-2020: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.
- .12 CAN/ULC-S718-2018: Standard for Site Quality Assurance Program for Spray Applied Polyurethane Foam.
- .13 CAN/ULC-S770-15 (R2020): Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 CERTIFICATES

- .1 Submit certificates as specified in Section 01 40 00.
- .2 Submit a copy of foam contractor's license under a recognized third-party quality assurance program.
- .3 Submit a copy of applicator certification issued by third-party.

#### 1.4 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard test results indicating Products meet the specified performance criteria, as prepared by an independent testing agency, and current within the past two years.
  - .1 Include results of CCMC air barrier system tests.

#### 1.5 QUALIFICATIONS

- .1 Applicator: A firm employing persons certified as approved applicators in accordance with CAN/ULC-S718.
- .2 Independent Inspection Agency: A urethane foam insulation and air barrier system inspector certified in accordance with CAN/ULC-S718.

#### 1.6 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-Up: A 3 000 x 3 000 mm size mock-up panel, demonstrating typical conditions, including window corner condition, door corner condition, inside corner and outside corner.
- .3 Conduct the following tests on mock-up panel and report results for the following criteria:
  - .1 Core density,
  - .2 Adhesion between transition sheet membrane and substrate,
  - .3 Adhesion between sprayed insulation and transition sheet membrane, and
  - .4 Cohesion or adhesion between sprayed insulation and substrate.
- .4 Verify results comply with inspector's daily report.
- .5 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .6 Remove and replace installed Product that does not conform to accepted mock-up.
- .7 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

#### 1.7 DELIVERY STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Product in original packaging, bearing manufacturer's name, quantity, expiry date, CCMC numbers, and other appropriate technical indicators and references.
- .3 Cold Weather Storage: Store Products during cold weather in heated storage area.

#### 1.8 AMBIENT CONDITIONS

- .1 Apply Product when surface and ambient air temperatures are within manufacturer's prescribed limits.
- .2 Ventilate area as specified in Section 01 50 00.
- .3 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

#### 1.9 FIELD CONDITIONS

- .1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .2 Protect workers as recommended by insulation manufacturer.

- .3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
  - .4 On a daily basis, dispose of waste foam and decontaminate empty drums. Conform to authorities having jurisdiction.
- 1.10 WARRANTY
- .1 Submit standard Consumer Warranty for Rigid Insulation from the Energy Conservation Contractors Warranty Corporation.
- 2 Products
- 2.1 MANUFACTURERS
- .1 Manufacturers having Product considered acceptable for use:
    - .1 BASF Canada.
    - .2 Elastochem Specialty Chemicals, Inc.
    - .3 Genyk Inc.
    - .4 Huntsman Building Solutions.
    - .5 Soprema Inc.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 PERFORMANCE CRITERIA
- .1 Foamed-in-Place Urethane Insulation: Meeting the following properties:
    - .1 Density (ASTM D1622/D1622M):  $\geq 28 \text{ kg/m}^3$ .
    - .2 Open Cell Content (ASTM D6226):  $\leq 10$  percent.
    - .3 Long-Term Thermal Resistance (CAN/ULC-S770):  $\text{RSI} \geq 1.80 @ 50 \text{ mm thick}$ .
    - .4 Air Permeance:  $\leq 0.02 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
    - .5 Flame Spread (CAN/ULC-S102):  $< 500$ .
    - .6 Compressive Strength (ASTM D1621, 10% parallel to rise):  $\geq 170 \text{ kPa}$ .
    - .7 Tensile Strength (ASTM D1623):  $\geq 200 \text{ kPa}$ .
    - .8 Water Absorption by Volume (ASTM D2842):  $\leq 4$  percent.
    - .9 Water Vapour Permeance (ASTM E96/E96M):  $\leq 60 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$  with outer skin in place.
    - .10 Product Global Warming Potential:  $\text{GWP} \leq 4.16 \text{ kg CO}_2 \text{ eq / m}^2 @ \text{RSI } 1$ .
  - .2 Ensure continuity of building enclosure thermal and air barriers in conjunction with materials specified in other Sections.
  - .3 Seal gaps between building enclosure components and wall and roof opening frames.
- 2.3 MATERIALS
- .1 Foamed-in-Place Insulation (INS-FIP-1): To CAN/ULC-S705.1, Type 2; two-component, closed cell polyurethane cellular plastic foam, containing zero HFC blowing agent; eg. Walltite CM01 by BASF Canada.
  - .2 Primers: As recommended for specific substrate by CUFCA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.
  - .3 Transition Sheet Membrane: Air/vapour barrier sheet membrane, as specified in Section 07 27 00.
- 3 Execution
- 3.1 EXAMINATION
- .1 Refer to Section 01 71 00.

- .2 Ensure surfaces are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
- .3 Ensure that items required to penetrate sprayed insulation are placed before installation of insulation.

### 3.2 PREPARATION

- .1 Mask and cover adjacent areas to protect from overspray.
- .2 Apply primers for special conditions as recommended by manufacturer.
- .3 Cover wide joints with transition sheet membrane as specified in Section 07 27 00.
- .4 Clean area of work prior to application of sprayed insulation.

### 3.3 APPLICATION

- .1 Spray apply Product to CAN/ULC-S705.2, and CUFGA Manual for Installers of Spray Polyurethane Foam Thermal Insulation.
- .2 Apply foamed-in-place insulation in consecutive layers of not less than 12 mm and not more than 25 mm thick each. Apply sufficient layers to achieve total thickness indicated.
- .3 Avoid formation of sub-layer air pockets.
- .4 Apply Product in overlapping layers, so as to obtain a smooth, uniform surface.
- .5 Maintain 75 mm clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources.
- .6 Do not apply Product to inside of exit openings or electrical junction boxes.

### 3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect the application (minimum twice per week) and confirm that the insulation and air barrier system is in strict accordance with CCMC requirements.
- .2 Conduct field inspection and testing in accordance with CAN/ULC-S718.
- .3 Test completed application daily for core density and cohesion/adhesion to substrate. Record results in daily report forms.
- .4 After Product has properly cured, conduct test to verify adhesion between the membrane and the substrate using CUFGA recommended equipment.
  - .1 Conduct adhesion tests on all corners and building angles, at wall-to-slab junctions, and at wall-to-roof junctions.
  - .2 Perform one test for every wall less than 30 metres in length. Perform two tests for every wall greater than 30 metres and less than 60 metres in length, with an additional test conducted for every additional 30 metres, or part thereof, in wall length.
  - .3 Where adhesion is lower than 110 kPa, adjust membrane mechanically and re-test.
- .5 Verify adhesion of transition sheet membranes at perimeters of openings. Conduct adhesion tests randomly on 15 percent of wall openings, and at every tenth column or beam.

### 3.5 TOLERANCES

- .1 Maximum Variation in Applied Thickness: Plus or minus 6 mm.

### 3.6 CLEANING

- .1 Refer to Section 01 74 00.

- .2 Remove overspray from non-prescribed surfaces without causing damage to surfaces.
- .3 Remove protective covers from adjacent surfaces.

3.7 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect completed installation from damage.
- .3 Make Good damage.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 07 21 00 - Thermal Insulation.
- .4 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .5 Section 07 27 00 - Air Barriers.
- .6 Section 07 51 00 - Built-up Bituminous Roofing.
- .7 Section 07 92 00 - Joint Sealants.
- .8 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 ASTM E96/E96M-23: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .2 CAN/CGSB-51.34-M86: Vapour Barrier, Polyethylene Sheet for Use In Building Construction.
- .3 SWI Sealant and Caulking Guide Specification.

1.3 SEQUENCING

- .1 Sequence installation of Products in conjunction with other air and vapour barrier materials and seals.

1.4 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria, and limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's instructions as specified in Section 01 33 00.
- .2 Manufacturer's Instructions: Manufacturer's standard installation guidelines, indicating preparation and installation requirements and techniques.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of bituminous membrane vapour retarders having Product considered acceptable for use:
  - .1 Carlisle Coatings and Waterproofing.
  - .2 Firestone Building Products.
  - .3 Henry (a Carlisle Company).
  - .4 IKO Industries, Ltd.

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

## 2.2 PERFORMANCE CRITERIA

- .1 Ensure continuity of building enclosure vapour retarder in conjunction with materials specified in other Sections.
- .2 Seal gaps between building enclosure components and opening frames.

## 2.3 MATERIALS

- .1 Plastic Sheet Vapour Retarder: To CAN/CGSB-51.34-M; polyethylene sheet, as follows:
  - .1 Thickness: 0.15 mm.
  - .2 Water Vapour Permeance (ASTM E96/E96M):  $\leq 2.2 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$ .
  - .3 Manufacturer and Product Name: eg. Super Six by Polytarp Products.
- .2 Bituminous Membrane Vapour Retarder: Self-adhering SBS modified asphalt membrane laminated to a tri-laminate woven high density polyethylene top surface; and as follows:
  - .1 Thickness: 0.76 mm.
  - .2 Moisture Vapour Permeance (ASTM E96/E96M):  $\leq 1.5 \text{ Ng/Pa}\cdot\text{s}\cdot\text{m}^2$ .
  - .3 Manufacturer and Product Name: eg. V-Force Vapour Barrier Membrane by Firestone Building Products.
- .3 Primer for Bituminous Membrane Vapour Retarder: Single-component, water-based primer; eg. V-Force WB Primer by Firestone Building Products.
- .4 Adhesive: Compatible with sheet barrier and substrate, permanently non-curing.
- .5 Joint Sealant: As specified in Section 07 92 00, types as follows:
  - .1 Plastic Sheets: Interior general purpose sealant, Type SEAL-INT-GP.
  - .2 Bituminous Membranes: Exterior flashing sealant, Type SEAL-EXT-FL.

## 3 Execution

### 3.1 PREPARATION

- .1 Ensure surfaces to receive vapour retarder are clean, dry and free of oil, grease, dirt, excess mortar or other contaminants.
- .2 Cure new concrete for minimum two weeks.
- .3 Prime substrate with approved primer prior to application of self-adhered bituminous membranes.

### 3.2 INSTALLATION

- .1 Install Products to SWI Sealant and Caulking Guide Specification.
- .2 Plastic Sheet Vapour Retarders
  - .1 Position joints or laps of sheets over firm bearing to achieve an effective and permanent seal.
  - .2 Seal laps, joints, and terminations with an approved sealant to ensure complete, continuous seal of building envelope.
- .3 Bituminous Membrane Vapour Retarders
  - .1 Apply self-adhered membranes over primed surface, from low points to high points, overlapping edges by 65 mm.
  - .2 Stagger end laps.
  - .3 Install membrane to avoid fishmouths and wrinkles.
  - .4 Roll membrane with a weighted roller wrapped in resilient material.

### 3.3 FIELD QUALITY CONTROL

- .1 Inspect vapour retarders prior to concealment and identify gaps, holes, and punctures.
- .2 Seal gaps, holes and punctures in vapour retarder membranes with joint sealant, as specified in Section 07 92 00.
- .3 Request Consultant inspection of vapour retarders prior to concealment. Work that has been concealed prior to Consultant inspection will be exposed while Consultant remains at Place of the Work, inspected, and then only concealed upon Consultant acceptance.

### 3.4 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean extra materials from adjacent surfaces.
- .3 Leave a suitable substrate for subsequent installations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 ASTM D1709-16ae1: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- .2 ASTM E96/E96M-23: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .3 ASTM E154/E154M-08a(2019): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.
- .4 ASTM E1643-18a: Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- .5 ASTM E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating properties and characteristics of sheet membranes, flashings, control and expansion joints, sealing at openings, projections, reglets, holes, slots, sleeves and special details.

1.4 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Complete set of after-conditioning results, as described in ASTM E1745.

1.5 QUALIFICATIONS

- .1 Installer: A firm specializing in installing below-slab vapour retarders, having minimum 5 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Protect Products from rain and damage.
- .3 Store membrane cartons on pallets and cover if left outside.

1.7 AMBIENT CONDITIONS

- .1 Do not proceed with application during rainy or inclement weather.

1.8 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of 3 years, protecting against penetration of moisture resulting in buckling, blistering, cracking or delamination of flooring products.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Stego Industries, LLC.
  - .2 W. R. Meadows of Canada Ltd.

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

### 2.2 PERFORMANCE CRITERIA

- .1 Below-Slab Vapour Retarder: Preventing moisture migration through concrete slabs-on-fill to building interior, and having the following physical properties:
  - .1 Water Vapour Permeance (ASTM E96/E96M):  $\leq 1.0 \text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$ .
  - .2 Tensile Strength (ASTM E154/E154M):  $\geq 9.1 \text{ kN/m}$ .
  - .3 Puncture Resistance (ASTM D1709, Method B):  $> 3500 \text{ g}$ .

### 2.3 MATERIALS

- .1 Below-Slab Vapour Retarder: To ASTM E1745, Classes A, B & C; 0.20 mm thick resin-based single-ply sheet membrane; eg. Perminator 10 by W. R. Meadows of Canada Ltd.
- .2 Lapping Tape: 100 mm wide, as recommended by membrane manufacturer.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Ensure surfaces are unfrozen, clean, dry, smooth and free of voids.

### 3.2 PREPARATION

- .1 Level, tamp or roll granular fill base course.

### 3.3 INSTALLATION

- .1 Apply Products to ASTM E1643.
- .2 Provide permanent, monolithic vapour seal without voids or open seams.
- .3 Completely cover concrete pour area.
- .4 Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
- .5 Lap joints minimum 150 mm and continuously seal with lapping tape.
- .6 Place membrane collar around protrusions through concrete slab, including sewer pipes, water pipes, and utility inlets to create a positive seal between protrusions and membrane. Seal in place with lapping tape.
- .7 Seal membrane to vertical surfaces with lapping tape.

### 3.4 FIELD QUALITY CONTROL

- .1 Advise Consultant prior to installation and again on completion.
- .2 Do not allow concrete pour to commence until completed installation has been reviewed and accepted by Consultant.

3.5 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect completed installation and adjacent parts of the Work until covered by subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 06 16 43 - Gypsum Sheathing.
- .4 Section 07 21 00 - Thermal Insulation.
- .5 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .6 Section 07 26 00 - Vapour Retarders.
- .7 Section 07 27 36 - Sprayed Foam Air Barrier.
- .8 Section 07 42 13 - Metal Wall Panels.
- .9 Section 07 51 00 - Built-up Bituminous Roofing.
- .10 Section 07 92 00 - Joint Sealants.
- .11 Section 08 12 13 - Hollow Metal Frames.
- .12 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .13 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .14 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

- .1 ASTM D412-16: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- .2 ASTM D882-12: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- .3 ASTM E96/E96M-23: Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .4 ASTM E154/E154M-08a(2019): Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- .5 ASTM E2178-21: Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.
- .6 SWI Sealant and Caulking Guide Specification.
- .7 CAN/ULC-S741-2008 (R2016): Standard for Air Barrier Materials - Specification.
- .8 CAN/ULC-S742-2011 (R2016): Standard for Air Barrier Assemblies - Specification.

1.3 SEQUENCING

- .1 Sequence installation in conjunction with other air and vapour barrier materials and seals.

1.4 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria, and Product limitations.

## 1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's instructions as specified in Section 01 33 00.
- .2 Manufacturer's Instructions: Manufacturer's standard installation instructions, indicating substrate preparation, and Product installation requirements and techniques.

## 1.6 QUALIFICATIONS

- .1 Applicators: A firm recognized by manufacturer as suitable for applying specified air barrier Products.

## 1.7 DELIVERY STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in undamaged containers and original packaging indicating name of manufacturer and product.
- .3 Store roll materials on end in original packaging.
- .4 Store adhesives and primers at 5 degrees C to facilitate handling.
- .5 Keep solvent away from open flame or excessive heat.
- .6 Protect rolls from direct sunlight until ready for use.

## 1.8 AMBIENT CONDITIONS

- .1 Apply sheet membranes when ambient air temperature is above 5 degrees C.
- .2 Apply membranes only during dry conditions, and to dry substrates that are free of snow, ice and water.
- .3 Apply only dry materials, during weather that will not introduce moisture into assembly.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of air barrier membranes having Product considered acceptable for use:
  - .1 Dörken Systems, Inc.
  - .2 Henry (a Carlisle Company).
  - .3 SRP Canada, Inc.
  - .4 VaproShield.
  - .5 W. R. Meadows of Canada Limited.
- .2 Manufacturers of air/vapour barrier membranes having Product considered acceptable for use:
  - .1 Carlisle Coatings and Waterproofing, Inc.
  - .2 Henry (a Carlisle Company).
  - .3 IKO Industries Ltd.
  - .4 Soprema Inc.
  - .5 Tremco.
  - .6 W. R. Meadows of Canada Limited.
- .3 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 PERFORMANCE CRITERIA

- .1 Ensure continuity of building enclosure air barrier in conjunction with adjacent Products.
- .2 Seal gaps between building enclosure components and wall and roof opening frames.



## 2.3 MATERIALS

- .1 Air Barrier Sheet Membrane: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; vapour permeable, water resistive, air barrier sheet membrane, self-adhering grade; and as follows:
  - .1 Thickness:  $\geq 0.55$  mm.
  - .2 Air Leakage (ASTM E2178):  $\leq 0.02$  L/s•m<sup>2</sup> @ 75 Pa.
  - .3 Water Vapour Permeance (ASTM E96/E96M, Method A):  $\geq 1$  655 ng/Pa•s•m<sup>2</sup>.
  - .4 Tensile Strength (ASTM D882): 182 N.
  - .5 Product and Manufacturer Name: eg. Blueskin VP 160 by Henry (a Carlisle Company).
- .2 Air/Vapour Barrier Sheet Membrane: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; SBS rubberized asphalt sheet membrane, self-adhering grade; and as follows:
  - .1 Thickness:  $\geq 1.0$  mm.
  - .2 Air Leakage (ASTM E2178):  $\leq 0.02$  L/s•m<sup>2</sup> @ 75 Pa.
  - .3 Water Vapour Permeance (ASTM E96/E96M, Method A):  $\leq 1.71$  ng/Pa•s•m<sup>2</sup>.
  - .4 Elongation (ASTM D412 - Modified): 200 percent.
  - .5 Tensile Strength (ASTM D412 - Modified): 3.45 MPa.
  - .6 Puncture Resistance (ASTM E154/E154M): 178 N.
  - .7 Product and Manufacturer Name: eg. Blueskin SA by Henry (a Carlisle Company).
- .3 Air/Vapour Barrier Sealant: To CAN/ULC-S741 and CAN/ULC-S742, Class A1; single-component, trowel- or brush-applied solvent type synthetic rubber; and as follows:
  - .1 Air Leakage (ASTM E2178):  $\leq 0.02$  L/s•m<sup>2</sup> @ 75 Pa.
  - .2 Water Vapour Permeance (ASTM E96/E96M, Method A):  $\leq 1.7$  ng/Pa•m<sup>2</sup>•s.
  - .3 Solids Content by Weight: 72 percent.
  - .4 Product and Manufacturer Name: eg. Air-Bloc 21 by Henry (a Carlisle Company).

## 2.4 ACCESSORIES

- .1 Attachments: Galvanized steel bars and anchors.
- .2 Adhesive: Compatible with sheet barrier and substrate, permanently non-curing.
- .3 Tape: 66 mm wide, self-adhesive polypropylene tape; eg. Contractor Tape by Dupont.
- .4 Primer: As recommended by self-adhering membrane manufacturer.
- .5 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.

## 3 Execution

### 3.1 PREPARATION

- .1 Ensure surfaces to receive air barrier are clean, dry and free of oil, grease, dirt, excess mortar and other contaminants.
- .2 Cure new concrete for minimum two weeks.
- .3 Fill spalled concrete or open mortar joints to an even plane.
- .4 Apply primer to porous surfaces designated to receive self-adhered sheet membranes.
- .5 Tape unfinished joints in sheathing boards.

### 3.2 INSTALLATION

- .1 Install Products to SWI Sealant and Caulking Guide Specification.
- .2 Provide air tight joints.
- .3 Seal Products completely around projections and penetrations.

- .4 Fully adhere sheet membranes to primed substrate, using consecutive weatherboard method.
- .5 Eliminate wrinkles, gaps, bubbles, air pockets and fishmouths.
- .6 Apply transition sheet membranes at openings and transitional connections.
- .7 Leave a sufficient amount of excess membrane over top of parapet walls and around wall openings for tie-in by others.
- .8 Cut membrane neatly around penetrations. Use heated trowel to soften and form membrane. Seal with air/vapour barrier sealant.
- .9 Do not leave installed membranes exposed to UV or weather for more than 42 days.

### 3.3 FIELD QUALITY CONTROL

- .1 Inspect air barriers prior to concealment and identify gaps, holes and punctures.
- .2 Seal gaps, holes and punctures with air/vapour barrier sealant.
- .3 Request Consultant inspection of air barriers prior to concealment. Work that has been concealed prior to Consultant inspection will be exposed while Consultant remains at Place of the Work, inspected, and then only concealed upon Consultant acceptance.

### 3.4 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean extra material from adjacent surfaces.
- .3 Leave suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 40 00 - Cold-Formed Metal Framing.
- .4 Section 06 16 43 - Gypsum Sheathing.
- .5 Section 07 21 00 - Thermal Insulation.
- .6 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .7 Section 07 26 00 - Vapour Retarders.
- .8 Section 07 27 00 - Air Barriers.
- .9 Section 07 42 13 - Metal Wall Panels.
- .10 Section 07 92 00 - Joint Sealants.
- .11 Section 08 12 13 - Hollow Metal Frames.
- .12 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .13 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .14 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

- .1 SWI Sealant and Caulking Guide Specification.
- .2 CAN/ULC-S710.1-2019: Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.
- .3 CAN/ULC S710.2-11: Standard for Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Application.
- .4 CAN/ULC-S711.1-2019: Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification.
- .5 CAN/ULC S711.2-11: Standard for Thermal Insulation - Bead Applied Two-Component Polyurethane Air Sealant Foam, Part 2: Application.

1.3 SEQUENCING

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

1.4 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating material characteristics, performance criteria, and Product limitations.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's instructions as specified in Section 01 33 00.
- .2 Manufacturer's Instructions: Manufacturer's standard installation instructions, indicating preparation and installation requirements and techniques.

1.6 DELIVERY STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in undamaged containers and original packaging indicating name of manufacturer and Product.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 DuPont de Nemours, Inc.
  - .2 Henkel Canada Corporation.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

- .1 Ensure continuity of building enclosure air barrier in conjunction with materials specified in other Sections.
- .2 Seal gaps between building enclosure components and opening frames.

2.3 MATERIALS

- .1 Air Sealant Foam (ASF-1): To CAN/ULC-S710.1; one-component polyurethane sealant.
- .2 Air Sealant Foam (ASF-2): To CAN/ULC-S711.1; two-component polyurethane sealant.

3 Execution

3.1 PREPARATION

- .1 Ensure surfaces designated to receive air sealant foam are clean, dry, and free of oil, grease, dirt, excess mortar, and other contaminants.

3.2 INSTALLATION

- .1 Install air sealant foam in accordance with authorities having jurisdiction.
- .2 Avoid overfilling restricted spaces.
- .3 Seal gaps between air barrier membranes and frames installed in openings.
- .4 Apply air sealant foam Type ASF-1 to cracks or openings 6 mm to 50 mm wide. Conform to CAN/ULC S710.2.
- .5 Apply air sealant foam Type ASF-2 to gaps over 50 mm wide, and to voids in hidden cavities. Conform to CAN/ULC S711.2.

3.3 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean extra material from adjacent surfaces.
- .3 Leave a suitable substrate for subsequent construction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 06 16 43 - Gypsum Sheathing.
- .4 Section 07 21 00 - Thermal Insulation.
- .5 Section 07 21 19.13 - Foamed-in-Place Urethane Insulation.
- .6 Section 07 26 00 - Vapour Retarders.
- .7 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .8 Section 07 92 00 - Joint Sealants.
- .9 Section 08 12 13 - Hollow Metal Frames.

1.2 REFERENCES

- .1 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A755/A755M-18: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- .3 CSA S136-16: North American Specification for the Design of Cold-Formed Steel Structural Members.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating:
  - .1 Large scale details of members and materials, schedule of elevations, trim and closure pieces; of subgirts, brackets and anchorage devices; of connection and jointing details; of drainage system; and interface with adjacent materials;
  - .2 Fully dimensioned layouts for positioning subgirts, brackets and anchorage devices to structures;
  - .3 Dimensions and thicknesses;
  - .4 Description of materials including catalogue numbers, products and manufacturer's names;
  - .5 Finish specifications; and
  - .6 Other pertinent data.
- .3 Submit documentation of:
  - .1 Thicknesses, profiles and descriptions of components used in assembly.
  - .2 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project, including:
    - .1 Tolerance for bowing,
    - .2 Squareness,
    - .3 Camber, and
    - .4 Thermal resistance criteria required by applicable regulatory requirements.
  - .3 Ensure calculations are stamped, signed and dated by fabricator's design engineer.

1.4 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.

- .2 Selection Samples: Duplicate samples of prefinished material for colour selection.

## 1.5 QUALIFICATIONS

- .1 Fabricator's Design Engineer: A professional structural engineer, experienced in designing metal wall panel assemblies, and licensed to practice at Place of the Work.
- .2 Fabricator and Installer: A firm specializing in fabricating and installing metal wall panels, having minimum 5 years documented experience and a member of CSSBI.

## 1.6 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-Up Panel: One 1 220 x 1 220 mm size mock-up panel, demonstrating panel profiles, textures and colours; edge seaming techniques; metal flashings; method of attachment to substrate; and including wall components such as air/vapour barrier membranes, through-wall flashing membranes, thermal insulation and method of drainage.
- .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .4 Remove and replace installed Product that does not conform to accepted mock-up.
- .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Products in original wrappings, cartons or containers clearly marked as to type, colour and manufacturer.
- .3 Stack bundles on wood blocking, clear of ground, and tilted sufficiently to ensure no water remains on material.
- .4 Open bundles on underside to allow drainage from leaks or condensation.

## 1.8 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of two years, covering damage to building and contents resulting from failure to resist penetration of water.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Agway Metals Inc.
  - .2 Flynn Canada Limited
  - .3 Vicwest Steel Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 DESIGN CRITERIA

- .1 Design assembly to accommodate wind loading, weight carrying requirements and wind deflection limitations. Conform to CSA S136.
- .2 Design assembly as a drained rain screen assembly.

- .3 Design assembly to prevent oil-canning, buckling, bending and rattling of panels under full design loads.
- .4 Deflection Limits: Maintain integrity of panels and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components, or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.
- .5 Design anchors, fasteners, subgirts, and braces to limit structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.

## 2.3 MATERIALS

- .1 Metal Wall Panels: To ASTM A755/A755M, Structural Steel (SS) Grade 230, Types 1 and 2; galvanized sheet steel, 0.61 mm thick before galvanizing; 22 mm deep profile with ribs spaced at 68 mm OC; with metallic paint coating; eg. 7/8 Corrugated by Vicwest Steel Inc.
- .2 Metal Trim and Flashings: To ASTM A755/A755M, Structural Steel (SS) Grade 230, Types 1 and 2; galvanized sheet steel, 0.61 mm thick before galvanizing; with metallic paint coating.
- .3 Subgirts: 1.22 mm thick galvanized steel shapes; Z-, J-, or Hat-Shaped profiles, sizes as required to suit application.
- .4 Panel Fasteners: Self-tapping and self-drilling types as required; hardened carbon steel shanks with heavy cadmium plating and a chromate finish; lengths to suit application; with matching coloured nylon heads where exposed to view.
- .5 Closure Strips: Preformed rubber on neoprene. Closures where materials are in continuous contact will be butyl pressure-sensitive tape.
- .6 Thermal Spacers: Thermal isolation clip capable of supporting vertical and horizontal subgirts; sizes as indicated on Drawings; eg. ISO Clip by Northern Facade.
- .7 Joint Sealants: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

## 2.4 FABRICATION

- .1 Shop fabricate material as far as possible.
- .2 Layout cutting, punching and forming at Shop Drawing stage to minimize site operations.

## 2.5 FINISHES

- .1 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .2 Metallic Paint Coating on Sheet Steel: To ASTM A755/A755M, three-coat PVDF fluoropolymer resin-based coil coating, complete with metal flakes incorporated in colour coat; factory-applied to 0.04 mm dry film thickness; eg. Fluoropon Classic Metallics by The Sherwin-Williams Company, 2624 - Bright Silver colour.

## 3 Execution

### 3.1 PREPARATION

- .1 Maintain uniform temperature in work area, adequate for work being performed, as recommended by manufacturer.
- .2 Securely install thermal spacers to substrate at spacing indicated on accepted Shop Drawings.
- .3 Secure subgirts to thermal spacers as indicated on accepted Shop Drawings.

### 3.2 INSTALLATION

- .1 Layout panels in continuous lengths with no horizontal joints.
- .2 Mechanically seam panels with a field-operated machine.
- .3 Secure metal wall panels with exposed fasteners, neatly aligned and evenly spaced.
- .4 Provide proper weatherproof seals at junctions and laps of materials.
- .5 Install and seal flashings and closures.
- .6 Cut and flash openings in cladding surfaces.
- .7 Provide collars, miscellaneous trim or flat areas necessary to accommodate openings and penetrating components.
- .8 Reinforce openings and sufficiently strengthen areas to accommodate penetrating components.

### 3.3 TOLERANCES

- .1 Offset From True Alignment:  $\leq 0.8$  mm between two adjacent panels.

### 3.4 ADJUSTING

- .1 Touch up marks and abrasions as installation proceeds.
- .2 Discard dented panels.
- .3 Defective materials or workmanship whenever found at any time prior to final acceptance of the Work will be rejected regardless of previous acceptance.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 05 30 00 - Metal Decking.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 09 21 16 - Gypsum Board Assemblies.
- .6 Section 09 51 23 - Acoustical Tile Ceilings.

1.2 REFERENCES

- .1 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .2 ASTM A641/A641M-19: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .3 ASTM C635/C635M-17: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- .4 ASTM C636/C636M-19: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- .5 CISCA Ceiling Systems Handbook, 2012 Edition.
- .6 CSA S136-16: North American Specification for the Design of Cold-Formed Steel Structural Members.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating Product characteristics, assembly details, and installation guidelines.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating:
  - .1 Large scale details of members and materials, layouts, trim and closure pieces, access panel sizes and locations, detail and location of joints and gaskets, including joints necessary to accommodate thermal movement;
  - .2 Large scale details of brackets and anchorage devices and of connection details;
  - .3 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
  - .4 Dimensions and thicknesses;
  - .5 Description of materials including catalogue numbers, products and manufacturer's names;
  - .6 Finish specifications; and
  - .7 Other pertinent data.
- .3 Submit documentation of:
  - .1 Thicknesses, profiles and descriptions of components used in assembly;

- .2 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project.
- .3 Ensure calculations are stamped, signed and dated by manufacturer's design engineer.

#### 1.5 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate 200 mm long samples, illustrating linear metal plank profile, and available colour and pattern selections.
- .3 Verification Samples: Duplicate 200 mm long samples for each linear metal plank, illustrating selected finish, fabrication and anchorage methods.

#### 1.6 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.
- .2 Extra Stock Materials: In the following quantities for each profile and colour used:
  - .1 Planks: Minimum 24 linear metres.
  - .2 Trim and Mouldings: Minimum 5 linear metres.

#### 1.7 QUALIFICATIONS

- .1 Manufacturer's Design Engineer: A professional structural engineer experienced in designing linear metal soffit systems, licensed to practice at Place of the Work.
- .2 Installer: A firm specializing in installing linear metal soffit and cladding systems, having minimum 3 years documented experience.

#### 1.8 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-Up Panel: A 1 220 x 1 220 mm size mock-up panel, demonstrating plank profiles, textures and colours; jointing and gasketing techniques; metal flashings; method of attachment to substrate.
- .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .4 Remove and replace installed Product that does not conform to accepted mock-up.
- .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in manufacturer's original unopened packages clearly marked with manufacturer's name and identification numbers.
- .3 Store Products in fully enclosed space above floor on skids to prevent warping, scratches or damage from moisture, direct sunlight and other surface contamination.
- .4 Handle Products in a manner which prevents racking, chipping of edges, distortion or other physical damage of any kind.

#### 1.10 FIELD CONDITIONS

- .1 Coordinate installation with facility services being incorporated into assembly.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Armstrong World Industries.
  - .2 CGC Inc.
  - .3 Hunter Douglas Saint-Gobain.
  - .4 Rockfon.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 DESIGN AND PERFORMANCE CRITERIA

- .1 Design assembly to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of soffit, calculated in accordance with applicable regulatory requirements. Conform to CSA S136.
- .2 Design assembly as a vented, drainable assembly.
- .3 Deflection Limits: Maintain integrity of panels and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components, or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.
- .4 Design anchors, fasteners and braces so as to limit their structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.
- .5 Plank Removal: Designed as a non-progressive system, allowing removal of any individual plank without necessitating removal of adjacent components.
- .6 Structural Movement: Design system to accommodate movement of supporting structural framing without causing bowing, buckling, delamination, oil canning, excessive stress on fasteners, or any other detrimental effects.
- .7 Thermal Movements: Design system to accommodate thermal movements from ambient and surface temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
  - .1 Temperature Change: 20 degrees C ambient, and 40 degrees C material surfaces.

### 2.3 COMPONENTS

- .1 Linear Metal Planks: 0.81 mm thick aluminum; 100 mm wide, 22 mm high; square interlocking edges; faux-woodgrain powder coated finish; eg. PlanarMacro Square Edge by Rockfon.
- .2 Filler Strips: 0.81 mm thick aluminum; 19 mm wide, 22 mm high; baked enamel finish.
- .3 Panel Splices: 0.64 mm thick aluminum; 222 mm long, profile compatible with linear planks; faux-woodgrain powder coated finish.
- .4 End Plugs: 0.64 mm thick aluminum; square edges; faux-woodgrain powder coated finish.
- .5 Perimeter Caps: 0.64 mm thick aluminum; 50 mm ID, with 41 mm top flange and 25 mm bottom flange; faux-woodgrain powder coated finish.
- .6 Wall Angles: 0.64 mm thick aluminum; 23.8 mm wide, 23.8 mm high, with hemmed edges; faux-woodgrain powder coated finish.
- .7 Symmetrical Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, slotted at appropriate intervals to receive stabilizing components; baked enamel finish.

- .8 Stabilizer Bars: To ASTM C635/C635M; 0.64 mm thick aluminum; minimum 910 mm long; baked enamel finish.
- .9 Radius Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, with integral carrier tabs; baked enamel finish.
- .10 Expansion Carrier: To ASTM C635/C635M; 1.0 mm thick roll formed aluminum; inverted U-shape, with integral carrier tabs spaced at 105 mm OC; baked enamel finish.
- .11 Hanger Wire: To ASTM A641/A641M; 2.68 mm OD galvanized carbon steel hanger wire.
- .12 Tie Wire: To ASTM A641/A641M; 1.21 mm OD galvanized carbon steel tie wire.
- .13 Nails and Staples: Manufacturer's standard corrosion-resistant type.
- .14 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

## 2.4 FABRICATION

- .1 Fabricate linear planks with edges formed to snap onto carriers with positive locking action.

## 2.5 FINISHES

- .1 Faux-Woodgrain Powder Coated Finish on Aluminum: To AAMA 2605; electrostatically applied polyurethane powder with ink-based wood grain pattern; Akzo Nobel Interpon D3000 Series, colour as selected by Consultant.
- .2 Baked Enamel Coating on Metal Components: One coat of zinc oxide primer sprayed and baked, followed by two coats of semi-gloss polyester enamel, sprayed and baked; Black colour.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify Products being installed above soffits have been completed.

### 3.2 PREPARATION

- .1 Furnish layout for inserts, clips and other support items required to be installed by others.
- .2 Field measure each area and establish layout to balance borders and minimize out-of-square conditions.

### 3.3 INSTALLATION

- .1 Layout Products in accordance with accepted Shop Drawings.
- .2 Install carrier system to ASTM C636/C636M, and CISCA installation standards.
- .3 Install symmetrical carriers at 865 mm OC, suspended from building structure with hanger wire spaced at 1 220 mm OC.
- .4 Install stabilizer bars perpendicular to symmetrical carriers, spaced at 610 mm OC.
- .5 Attach linear planks to main carrier tabs and connect with panel splices, with joints staggered in adjacent rows.
- .6 Install slip-on mouldings and end plugs on exposed plank ends.
- .7 Install wall angles on vertical surfaces intersecting ceiling system.

- .8 Install filler strips into open reveal between linear planks.
- .9 Install access panels in accordance with accepted Shop Drawings.
- .10 Install flashings to divert moisture to exterior.
- .11 Provide proper weatherproof seals at perimeter junctions. Seal joints as specified in Section 07 92 00.

### 3.4 TOLERANCES

- .1 Maximum Deviation from Alignment: 6 mm in 6 000 mm.
- .2 Maximum Deviation from Panel Flatness: 3 mm in 1 500 mm panel in any direction for assembled units (non-accumulative).

### 3.5 ADJUSTING

- .1 Ensure moving parts move freely.
- .2 Adjust components for uniform tolerance.
- .3 Replace Products that are visibly scratched or dented.
- .4 Defective Products or quality of work, whenever found at any time prior to final acceptance of the Work will be rejected regardless of previous acceptance.

### 3.6 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean exposed surfaces free of grime and dirt using manufacturer's recommended materials and methods.

### 3.7 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect completed installation from damage.
- .3 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 05 30 00 -Metal Decking.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 21 00 - Thermal Insulation.
- .4 Section 07 26 00 - Vapour Retarders.
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .6 Section 10 82 19 - Exterior Sound Screens.

1.2 REFERENCES

- .1 ASTM C1278/C1278M-17: Standard Specification for Fiber-Reinforced Gypsum Panel.
- .2 ASTM D41/D41M-11(2016): Standard Specification for Asphalt Primer Used in Roofing, Damproofing, and Waterproofing.
- .3 ASTM D1863/D1863M-05(2018): Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
- .4 ASTM D2178/D2178M-15a: Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- .5 ASTM D4586/D4586M-07(2018): Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- .6 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.
- .7 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .8 CRCA Roofing Specifications.
- .9 CSA A123.4-M1979: Bitumen for Use in Construction of Built-Up Roof Coverings and Damproofing and Waterproofing Systems.
- .10 CSA A123.21:20: Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.
- .11 CSA A123.23-15: Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced.
- .12 CSA A231.1:19: Precast Concrete Paving Slabs.
- .13 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .14 CAN/ULC-S107-2019: Standard Methods of Fire Tests of Roof Coverings.
- .15 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .16 CAN/ULC-S126-14 (R2019): Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.
- .17 CAN/ULC-S706.1-2020: Standard for Wood Fibre Insulating Boards for Buildings.

### 1.3 PREINSTALLATION MEETINGS

- .1 Conduct preinstallation meetings as specified in Section 01 31 00.
- .2 Prior to commencement of deck installation, review and document methods and procedures related to roof deck and roofing system construction , including the following:
  - .1 Participants: Authorized representatives of Owner, Contractor, Consultant, roofing Subcontractor, roofing manufacturer, and installers of roof accessories and roof-mounted equipment.
  - .2 Review methods and procedures related to roofing installation, including manufacturer's written installation instructions.
  - .3 Review construction schedule and confirm availability of Products, Subcontractor personnel, equipment and facilities.
  - .4 Review deck installation criteria and finishes for conformance with roofing system criteria, including issues of flatness and fastening.
  - .5 Review structural loading conditions and limitations of roof deck both during and after roofing application.
  - .6 Review flashing details, special roofing details, roof drainage, roof penetrations, equipment curbs, and other conditions affecting roofing installation.
  - .7 Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
  - .8 Review safety requirements, including temporary fall-arrest measures.
  - .9 Review field quality control procedures.

### 1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating degree of slope and layout of tapered insulation, flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

### 1.5 CERTIFICATES

- .1 Manufacturer Certificates: Signed by roofing manufacturer verifying installer is approved, authorized or licensed by manufacturer to install specified Products.
- .2 Installer Certificates: Signed by installer verifying they have specified qualifications.

### 1.6 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency, and current within past 5 years.

### 1.7 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit manufacturer's field inspection reports as specified in Section 01 40 00.
- .2 Manufacturer Field Inspection Reports: Manufacturer's written acceptance of roofing installation based on regular inspections.

### 1.8 QUALIFICATIONS

- .1 Applicator: A firm specializing in applying built-up bituminous roofing, having minimum 10 years documented experience and a member of OIRCA.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Do not store insulation, roofing felts or cants on roof. Keep materials elevated and under cover.
- .3 Package roofing materials and identify on attached labels name of manufacturer, brand, contents, weight as applicable and product and specification numbers.
- .4 Protect edges of roll goods from damage. Take extra precaution with base sheet.
- .5 Protect porous materials from moisture.
- .6 Protect insulation from sunlight.

1.10 AMBIENT CONDITIONS

- .1 Do not apply any roofing materials during inclement weather.
- .2 Comply with manufacturer's recommendations for minimum and maximum temperatures and humidity during application.
- .3 Do not install Products when temperatures are below -10 degrees C.
- .4 Consider effects of wind chill on adhesives, and ensure they will not prematurely set before proper adhesion takes place.
- .5 Keep water-based Products from freezing. Do not apply water-based Products if temperatures are below 5 degrees C.

1.11 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Installer's Warranty: Standard OIRCA two year extended warranty, covering labour and materials necessary to repair defective roofing system, and cover damage to building and contents resulting from failure to resist penetration of water.
- .3 Manufacturer's Warranty: A written guaranty stating manufacturer will replace, at no cost to Owner, any portion of roofing membrane experiencing actual leaks resulting from manufacturing defects for a period of 10 years after Ready-for-Takeover.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Elevate.
  - .2 Garland Company Inc.
  - .3 IKO Industries Limited.
  - .4 Johns Manville.
  - .5 Tremco Canada.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESIGN AND PERFORMANCE CRITERIA

- .1 Design roof assembly to arrest water migration from entering building through roof membrane.
- .2 CRCA Specification: SGI-1.
- .3 Dynamic Wind Uplift Resistance (CSA A123.21): As follows:



- .1 Field of Roof: 1.2 kPa.
  - .2 Edge of Roof: 1.7 kPa.
  - .3 Corners of Roof: 2.74 kPa.
- .4 Conform to CAN/ULC-S126 and CAN/ULC-S107.

## 2.3 MATERIALS

- .1 Underlay and Cover Boards: To ASTM C1278/C1278M; 12.7 mm thick fiber-reinforced gypsum board with water-resistant core; and meeting the following criteria:
  - .1 Combustibility (CAN/ULC-S114): Noncombustible.
  - .2 Surface Burning Characteristics (CAN/ULC-S102):
    - .1 Flame Spread Index  $\leq 5$ .
    - .2 Smoke Developed Index = 0.
  - .3 Manufacturer and Product Name: Securock Gypsum-Fiber Roof Board by CGC Inc.
- .2 Vapour Retarder: Bituminous membrane vapour retarder, as specified in Section 07 26 00.
- .3 Flat Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-3, minimum two layers, as specified in Section 07 21 00.
- .4 Tapered Roof Insulation: Polyisocyanurate rigid board insulation, Type INS-RB-3 as specified in Section 07 21 00; slopes and thicknesses as indicated on the tapered insulation Shop Drawings.
- .5 Bitumen: To CSA A123.4-M, Types as follows:
  - .1 Slopes Up To 1:16: Type 2.
  - .2 Slopes From 1:16 to 1:8: Type 2.
  - .3 Slopes From 1:8 to 1:4: Type 3.
  - .4 Securement of Perimeter and Flashing Membranes: Type 3.
- .6 Roofing Felts: To ASTM D2178/D2178M, Type IV; asphalt saturated glass fibre felts.
- .7 Aggregate: Washed commercial grade gravel free of dust or foreign matter, 6-10 mm OD, graded to ASTM D1863/D1863M; White colour.

## 2.4 ACCESSORIES

- .1 Insulation Adhesive: Two-component polyurethane adhesive; eg. Duotack by Soprema.
- .2 Insulation Fasteners: Premium No. 12 hex head fasteners and 75 mm OD locking plates; corrosion-resistant, twin lead threads with sharp drill point and tapered wedge entry; sufficient length to penetrate structural deck minimum 19 mm; complete with galvanized steel disc washers.
- .3 Nails: To ASTM F1667, Type I (NL); common wire, galvanized steel, large head roofing style; sufficient length to penetrate a minimum of 25 mm into substrate.
- .4 Asphalt Primer: To ASTM D41/D41M, Type II.
- .5 Asphalt Roof Cement: To ASTM D4586/D4586M.
- .6 Sealing Compound: Rubber asphalt type.
- .7 Roof Insulation Tape: Reinforced tape 150 mm wide as supplied by roofing membrane manufacturer.
- .8 Flexible Flashing - Base Sheet: To CSA A123.23, Type A, Grade 3; 2.5 mm thick modified bituminous membrane, 130 g/m<sup>2</sup>, self-adhering, self-sealing, glass fleece reinforced.

- .9 Flexible Flashing - Cap Sheet: To CSA A123.23, Type B, Grade 1; 3.8 mm thick SBS modified bituminous membrane, 170 g/m<sup>2</sup>, self-adhering, polyester reinforced; self-adhesive coating factory-applied to lower surface, ceramic mineral granules factory-embedded on upper surface, Light Grey colour.
- .10 Fibreboard Cant: To CAN/ULC-S706.1, Type I, Grade 2; asphalt-impregnated fibreboard, suitable size to create a 75 x 75 mm size cant set at a 45 degree angle.
- .11 Prefabricated Control or Expansion Joint Flashing: Sheet butyl reinforced with closed cell urethane foam backing, seamed into metal flashing flanges, including sheet butyl counter flashing each side.
- .12 Rooftop Walkway Pavers: To CSA A231.1; 610 x 610 mm size, 45 mm thick precast concrete paver units; Diamond pattern, Standard texture; Natural colour; eg. Concrete Roof Ballast Slabs by Brooklin Concrete Products.
- .13 Walkway Paver Pedestals: Prefabricated, high density polyethylene adjustable paver pedestals and levelling plates, complete with integral spacer ribs on upper surface; eg. Model 7X Pave-EI Pedestals by Envirospec, Inc.

### 3 Execution

#### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Ensure surfaces to receive roofing membrane are dry.
- .3 Examine deck to ensure structural soundness, with no significant instances of corrosion or deterioration.
- .4 Notify Consultant immediately if deck surface is corroded or deteriorated.

#### 3.2 PREPARATION

- .1 Clean deck surface to remove irregularities, old adhesive, dirt, rust, oil, and other deleterious materials that would impair application of new roofing system.
- .2 Install preformed sound-absorbing mineral fibre insulation strips in acoustic deck flutes as specified in Section 05 30 00.

#### 3.3 UNDERLAY BOARD

- .1 Securely adhere underlay boards using continuous beads of adhesive, applied at manufacturer's recommended rate of application.
- .2 Stagger underlay boards 150 mm.
- .3 Install underlay boards with long axis perpendicular to deck ribs, with end joints fully supported.
- .4 Firmly butt each board to surrounding boards. Do not jam or deform boards.
- .5 Provide filler boards at 450 mm each direction.

#### 3.4 VAPOUR RETARDER

- .1 Install roof vapour retarder membrane as specified in Section 07 26 00.
- .2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps. Seal seams.

- .3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.
- .4 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.

### 3.5 INSULATION

- .1 Immediately after installing vapour retarder, install insulation as specified in Section 07 21 00 and as described below. Ensure vapour retarder membrane is clean and dry.
- .2 Adhere minimum two layers of insulation using continuous beads of insulation adhesive, applied at manufacturer's recommended rate.
- .3 Lay subsequent layers of insulation with joints staggered 150 mm.
- .4 Lay insulation boards with edges in moderate contact without forcing.
- .5 Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- .6 Install tapered insulation boards where indicated and in accordance with accepted Shop Drawings.
- .7 When recommended by insulation manufacturer, tape joints of insulation boards.
- .8 Apply no more insulation than can be sealed with membrane in same day.

### 3.6 COVER BOARD

- .1 Adhere single layer of cover board over insulation using continuous beads of insulation adhesive, applied at manufacturer's recommended rate.
- .2 Stagger cover board seams with insulation board seams.
- .3 Install drain sumps as indicated on Drawings.
- .4 Prime cover boards.
- .5 Apply no more cover board than can be sealed with membrane in same day.

### 3.7 ROOFING MEMBRANES

- .1 Install 4 plies of roofing felts perpendicular to cover board joints, set in continuous moppings of bitumen.
- .2 Align ply felts without stretching.
- .3 Overlap starter strips 660 mm with first ply, then overlap each succeeding ply 625 mm. Place ply sheets to ensure water will flow over or parallel to, but not against, exposed edges.
- .4 Shingle in direction to shed water. Extend ply felts over and terminate beyond cants and cut evenly.
- .5 Apply bitumen in a continuous application, applied at a rate of 1.2 kg/m<sup>2</sup>.
- .6 Do not step or walk on roofing felts during or immediately after application until bitumen has set.
- .7 Ensure minimum 6 mm bitumen over flow is visible at all edge and end laps.
- .8 Install each felt layer into hot bitumen so that it is firmly and uniformly set, without voids. Thoroughly and effectively broom or roll felt layer to ensure full adhesion.

.9 Install two plies of roofing felt and bitumen glaze coat for cutoff at end of each Working Day's operation. Remove cutoff before resuming roofing.

.10 Terminate felt layers to outer edge of roof perimeter.

### 3.8 FLASHINGS AND ACCESSORIES

.1 Apply flexible flashings to seal membrane to vertical elements.

.2 Prime substrate prior to application of self-adhering membranes.

.3 Install prefabricated roofing control joints where indicated on Drawings.

.4 Coordinate installation of roof drains and related flashings.

.5 Install flexible flashing membranes in a two-ply application.

.6 Mop in and seal flanges of items penetrating roofing membrane.

### 3.9 ROOFTOP WALKWAY PAVERS

.1 Conform to layout indicated on Drawings.

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

.3 Install paver pedestals on levelling pads.

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

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

.6 Avoid lippage.

### 3.10 AGGREGATE SURFACING

.1 Apply uniform flood coat of bitumen at rate of 3.0 kg/m<sup>2</sup> and while hot, embed roofing aggregate at rate of 20 kg/m<sup>2</sup>.

.2 Evenly distribute aggregate and ensure bond with flood coat.

.3 Extend aggregate to bottom edge of cant strips.

.4 Butt aggregate to edge of rooftop pavers.

### 3.11 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as specified in Section 01 40 00.

.2 Advise Consultant and Inspector 48 hours prior to the start of roofing operations.

.3 Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect roofing application (minimum twice per week) and confirm installation is in strict accordance with manufacturer's recommendations.

.4 Contractor Inspection: Inspect completed membrane and flashing for punctures, tears and discontinuous seams. Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions, and seal watertight. Re-seal seams as necessary.

### 3.12 CLEANING

.1 Refer to Section 01 74 00.

.2 Clean drains of debris, ensuring free drainage.

- .3 Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.

3.13 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Adequately protect Products and work from damage by weather, traffic, and other causes.
- .3 At end of each Working Day, seal exposed edges of roofing membrane watertight.
- .4 Protect adjacent parts of the Work from damage.
- .5 Make Good damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 23 - Masonry Accessories.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 42 13 - Metal Wall Panels.
- .4 Section 07 42 93.23 - Linear Metal Soffits.
- .5 Section 07 51 00 - Built-up Bituminous Roofing.
- .6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

- .1 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A755/A755M-18: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- .3 ASTM B32-20: Standard Specification for Solder Metal.
- .4 ASTM D1970/D1970M-21: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- .5 ASTM F1667-21: Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .6 SMACNA Architectural Sheet Metal Manual, Seventh Edition, 2012.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets for manufactured items, indicating catalogue numbers, materials, and manufacturer's names; and including finish specifications and other pertinent data.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating:
  - .1 Fascia, trim and closure pieces;
  - .2 Anchorage devices;
  - .3 Connection and jointing details;
  - .4 Dimensions and thicknesses;
  - .5 Finishes, and
  - .6 Other pertinent data.

1.5 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: 300 mm long sample, indicating design method of locking and method of anchoring and corner section fabricated from materials specified.

## 1.6 QUALIFICATIONS

- .1 Installer: A firm specializing in fabricating and installing sheet metal flashing and trim in accordance with SMACNA standard practices and details.

## 1.7 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-Ups: Full-width, 1 220 mm long, mock-up panels for each type of sheet metal flashing, demonstrating interfaces with adjacent construction; profiles, textures, and colours; edge seaming and sealing techniques; and methods of attachment.
- .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .4 Remove and replace installed Product that does not conform to accepted mock-up.
- .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

## 1.8 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of 5 years, protecting against leakage, joint spalling and similar defects.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of membrane underlayment having Product considered acceptable for use:
  - .1 Grace.
  - .2 Henry (a Carlisle Company).
  - .3 Soprema Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 MATERIALS

- .1 Prefinished Sheet Steel: To ASTM A755/A755M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled galvanized sheet steel, 0.76 mm thick before galvanizing; with monochromatic and metallic paint coatings where noted on Drawings.
- .2 Galvanized Sheet Steel: To ASTM A653/A653M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled galvanized sheet steel, 0.61 mm thick before galvanizing.
- .3 Nails: To ASTM F1667, Type I (NL); common wire, corrosion-resistant type, material compatible with adjacent surfaces; sufficient length to penetrate a minimum of 25 mm into substrate.
- .4 Cleats: 0.76 mm thick sheet steel; minimum 38 mm wide and interlocked with metal flashing.
- .5 Starter Strips: 0.76 mm thick sheet steel; continuous lengths.
- .6 Back-up Plates: 0.91 mm thick prefinished sheet steel; minimum 300 mm wide where adjacent lengths of cap flashing meet.
- .7 Screws, Bolts and Expansion Shields: Non-ferrous metal compatible with adjacent surfaces. Exposed fastenings; same materials as metal surfaces through which they penetrate. Use cadmium plated screws with round heads suitable for soldering for galvanized work.
- .8 Solder: To ASTM B32; 50 percent block tin, 50 percent pig lead.

- .9 Flux: Commercial hydrochloric acid cut with zinc, or 10 - 20 percent solution of orthophosphoric acid in water, for use with galvanized work.
- .10 Membrane Underlayment: To ASTM D1970/D1970M; 1.0 mm thick, self-sealing, self-adhering, heat-resistant rubberized asphalt membrane, eg. Ice & Water Shield HT by Grace.
- .11 Primer: Water-based primer, eg. Perm-A-Barrier WB Primer by Grace.
- .12 Joint Sealant: Exterior flashing sealant, Type SEAL-EXT-FL as specified in Section 07 92 00.
- .13 Flashing Paint: Quick drying asphaltic base paint; eg. Primer 910-02 by Henry (a Carlisle Company).

### 2.3 MANUFACTURED UNITS

- .1 Pre-Insulated Stack Jack Flashings: 1.6 mm thick seamless, spun aluminum; 457 mm overall height with 356 mm high insulated sleeve; diameters to suit applications; complete with premoulded urethane insulation on inner side of sleeve and 102 mm wide bituminous painted deck flange; with removable 1.29 mm thick aluminum hood and perforated collar; eg. Model SJ-31 Vandal Proof Stack Jack Flashing by Thaler Roofing Specialties Products Inc.
- .2 Flashing for Flexible Conduit: Goose neck shaped aluminum flashing pipe sleeve; 305 mm high, diameters to suit application; complete with 102 mm wide bituminous painted deck flange; Model MEF-2A/2A1/2A2 Liquid Tight Flexible Conduit Flashing by Thaler Roofing Specialties Products Inc.
- .3 Flashing for "B" Vent Pipes with Split Collars: 1.6 mm thick seamless spun aluminum sleeve flashing with sloping sides to allow for air movement, 305 mm high, diameters to suit; complete with 50 mm wide perforated aluminum vent holes at top of sleeve for air circulation, 102 mm wide bituminous painted deck flange, and a 1.6 mm thick split aluminum collar, eg. Model MEF-4A "B" Vent Flashings by Thaler Roofing Specialties Products Inc.
- .4 Through Wall Scuppers: 1.6 mm thick prefinished aluminum sheet, factory welded construction; prefabricated to custom sizes as indicated on Drawings; eg. Through Wall Scupper by W. P. Hickman Company.

### 2.4 FABRICATION

- .1 Shop fabricate flashing components as much as possible to minimize site operations.
- .2 Fabricate Products to SMACNA Architectural Sheet Metal Manual.
- .3 Form sheet metal on bending brake.
- .4 Perform shaping, trimming and hand seaming on bench, where practicable, using proper sheet metal working tools.
- .5 Fabricate material in clean shops, located away from areas where carbon steel is torch cut, ground, or cut with abrasive wheels to ensure carbon steel dust will not be embedded in prefinished surfaces.
- .6 Clean tools and dies which have been used on carbon steel prior to fabrication to prevent contamination of surface with carbon steel dust.
- .7 Form sections square, true and accurate to size. Flashings shall be free from distortion, waves, twists, buckles or other defects detrimental to appearance and performance.
- .8 Allow for thermal movement when forming, installing, interlocking and soldering sheet metal components to avoid buckling, fullness of metal straining of joints or seams.
- .9 Limit maximum length of flashing pieces to 2 400 mm.



- .10 Double back exposed edges at least 12 mm for appearance and stiffness.
- .11 Fabricate flashings, copings, closures, plastic boxes, pipe sleeves and flashings for roof mounted equipment to details shown, unless otherwise indicated.
- .12 Wipe and wash clean soldered joints immediately after joint is soldered to remove acid.
- .13 Where soldered joints are absolutely necessary and where approved for use in prefinished metal, clean paint off both surfaces before soldering for minimum area necessary.

## 2.5 FINISHES

- .1 Shop Priming:
  - .1 Clean surfaces of rust, scale, grease, and foreign matter prior to shop priming.
  - .2 Do not prime surfaces designated to come into direct contact with concrete, or where field welding is required.
  - .3 Prime components with minimum two coats primer.
- .2 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .3 Monochromatic Paint Coating on Sheet Steel: To ASTM A755/A755M, two-coat silicone modified polyester (SMP) coil coating, factory-applied to 0.028 mm dry film thickness; eg. WeatherXL by The Sherwin-Williams Company, colour as selected by Consultant.
- .4 Metallic Paint Coating on Sheet Steel: To ASTM A755/A755M, three-coat PVDF fluoropolymer resin-based coil coating, complete with metal flakes incorporated in colour coat; factory-applied to 0.04 mm dry film thickness; eg. Fluoropon Classic Metallics by The Sherwin-Williams Company, 2624 - Bright Silver colour.

## 3 Execution

### 3.1 PREPARATION

- .1 Prime substrates designated to receive self-adhered membrane underlayment.
- .2 Secure membrane underlayment in place and lap joints 100 mm.

### 3.2 INSTALLATION

- .1 Install Products to SMACNA Architectural Sheet Metal Manual.
- .2 Provide flashings required for proper execution and completion of the Work in an acceptable manner, including metal flashing around mechanical and other equipment occurring on roof.
- .3 Install sheet metal flashings with joints lapped, locked, cleated with S-cleats and sealed, or soldered, as required.
- .4 Hem exposed edges 12 mm.
- .5 Type of joints used shall be adequate for various conditions, subject to approval.
- .6 Fabricate exposed fastening in such a manner to prevent water penetration at point of fastening.
- .7 Provide starter strips where indicated or required to present true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation.
- .8 Make end joints where adjacent lengths of metal flashing meet using 300 mm long back-up flashing secured in place before installing flashing.
- .9 Apply beads of sealant on face of back-up plate to seal ends of metal flashing.

- .10 Leave 12 mm wide space between end of adjacent lengths of metal flashings.
- .11 Fabricate back-up of same material and finish as metal flashing with which it is being used. Make back-up plate exact profile of flashing allowing for thickness of flashing joints.
- .12 Form metal fascia with inner edge extended over fascia top and down cant to meet roofing aggregate. Nail with roofing nails and neoprene washers at 300 mm OC. Avoid placing nails in face of fascia, through membrane or flashing.
- .13 Interlock counter flashing pieces with prefinished metal base flashing and fold locking seam into position ensuring complete sealing. Continue counter flashing down to hemmed and sprung position at base of cant and junction of aggregate.

### 3.3 ADJUSTING

- .1 Imperfections in sheet metal work (such as holes, dents, creases or oil-canning) will be rejected.
- .2 Make Good damaged sheet metal work.
- .3 Wash entire installation down, and leave in neat condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 05 10 00 - Structural Metal Framing.
- .2 Section 05 30 00 - Metal Decking.
- .3 Section 07 84 00 - Firestopping.
- .4 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 ASTM C612-14(2019): Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .2 ASTM C847-18: Standard Specification for Metal Lath.
- .3 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.
- .5 ASTM E605/E605M-19: Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
- .6 ASTM E736/E736M-19: Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
- .7 ASTM E759/E759M-92(2020): Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
- .8 ASTM E760/E760M-92(2020): Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
- .9 ASTM E761/E761M-92(2020): Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
- .10 ASTM E859/E859M-93(2020): Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
- .11 ASTM E937/E937M-93(2020): Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
- .12 ASTM E1513/E1513M-93(2020): Standard Practice for Application of Sprayed Fire-Resistive Materials (SFRMs).
- .13 AWCI Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials.
- .14 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.
- .15 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .16 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .17 ULC List of Equipment and Materials.

### 1.3 SEQUENCING

- .1 Perform fire protection work on a given floor prior to proceeding with fire protection work on next floor.
- .2 Coordinate and schedule fire protection work to avoid delays in progress of the Work.
- .3 Do not install board fire protection on structural members until piping and other construction behind fire protection has been completed, uninterrupted coverage can be provided and need for subsequent cutting and patching can be eliminated.

### 1.4 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, certifying compliance with specified performance criteria.

### 1.5 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past 5 years.

### 1.6 QUALIFICATIONS

- .1 Installer: A firm specializing in applying spray-applied fire resistive coatings, licensed or certified as an installer by Product manufacturer.

### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products to Place of the Work in manufacturer's unopened packages, fully identified as to name, type and other identifying data. Packaging shall bear the UL labels for fire hazard and fire-resistance classifications.
- .3 Store Products above ground, in a dry location, protected from weather. Remove damaged packages found unsuitable for use from Place of the Work.

### 1.8 AMBIENT CONDITIONS

- .1 When prevailing outdoor temperature at Place of the Work is less than 4 degrees C, maintain minimum substrate and ambient air temperature of 4 degrees C prior to, during and minimum 24 hours after application of spray-applied fire resistive material.
- .2 When required to maintain progress of the Work, Provide heated protective enclosures to maintain temperatures. Refer to Section 01 56 00.
- .3 Provide adequate ventilation of not less than 4 air changes per hour to allow proper drying of spray-applied fire resistive material during and subsequent to application.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 AD Fire Protection Systems.
  - .2 Cafco Industries Inc.
  - .3 Grace Canada Inc.

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

## 2.2 PERFORMANCE CRITERIA

- .1 Spray-Applied Fire Resistive Coating
  - .1 Deflection (ASTM E759/E759M): Material shall not crack or delaminate when non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.
  - .2 Bond Impact (ASTM E760/E760M): Material shall not crack or delaminate from concrete topped galvanized deck to which it is applied.
  - .3 Cohesion / Adhesion (ASTM E736/E736M): Material applied over uncoated or galvanized steel shall have an average bond strength greater than 7.2 kPa.
  - .4 Air Erosion (ASTM E859/E859M):  $\leq 0.27 \text{ g/m}^2$ .
  - .5 Compressive Strength (ASTM E761/E761M): Material shall not deform more than 10 percent when subjected to a crushing force of 68.9 kPa.
  - .6 Corrosion Resistance (ASTM E937/E937M): Material shall not promote corrosion of steel.
  - .7 Combustibility (CAN/ULC-S114): Noncombustible.
  - .8 Surface Burning Characteristics (ASTM E84 or CAN/ULC-S102): Class A
    - .1 Flame Spread Index = 0.
    - .2 Smoke Developed Index = 0.
  - .9 Density (ASTM E605/E605M): Material shall meet minimum individual and average density values as listed in appropriate UL/ULC design or as required by authority having jurisdiction, or shall have a minimum average density of  $240 \text{ kg/m}^3$ .
- .2 Conform to procedures for conducting tests and reporting tested values to CAN/ULC-S101.

## 2.3 MATERIALS

- .1 Spray-Applied Fire Resistive Material (SFRM): Inorganic Portland cement-based dry mix spray-applied fire resistive material; eg. Cafco Blazeshield II by Cafco Industries Inc.
- .2 Refractory Mineral Wool Board Fire Protection: To ASTM C612, Class 4; rigid boards produced from asbestos free materials by combining refractory mineral wool manufactured from slag with thermosetting resin binders; and having the following physical properties:
  - .1 Thermal Resistance:  $\text{RSI} \geq 0.76 @ 24 \text{ degrees C}$ .
  - .2 Surface Burning Characteristics (ASTM E84):
    - .1 Flame Spread Index  $\leq 15$ .
    - .2 Smoke Developed Index  $\leq 5$ .
  - .3 Density:  $\geq 144 \text{ kg/m}^3$ .
  - .4 Manufacturer and Product Name: eg. Cafco-board Mineral Wool Board Fire Protection by Cafco Industries Inc.
- .3 Fastening Accessories: For each fire resistive assembly in which mineral wool board fire protection serves as rigid fire protection, Provide board fastening system complying with applicable UL design or other acceptable testing and inspecting organization's report.
- .4 Metal Lath: To ASTM C847;  $1.4 \text{ kg/m}^2$  steel lath, galvanized.
- .5 Water: Potable.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Ensure surfaces to receive fire protection are free of oil, grease, loose mill scale, dirt, paints and primers (other than those listed and tested), and other foreign materials that could impair satisfactory bonding to substrate.

- .3 Ensure clips, hangers, supports, sleeves and other attachments to substrate are installed prior to application of spray-applied fire resistive materials.
- .4 Ensure installation of ducts, piping, conduit or other suspended equipment shall not occur until application of sprayed fire protection is complete in affected area.

### 3.2 PREPARATION

- .1 Prepare substrates to ULC Sprayed-Applied Fire-Resistive Materials New Requirements for the Use of Sprayed-Applied Fire-Resistive Materials on Primed Steel Surfaces.
- .2 Provide bonding agents and metal lath as required.

### 3.3 APPLICATION

- .1 Apply Products to ASTM E1513/E1513M.
- .2 Apply Products to required thicknesses and densities necessary to achieve fire resistance ratings indicated on Drawings.
- .3 Do not apply Products to steel floor decks prior to application of concrete.
- .4 Do not apply Products to underside of roof deck until roof is completely installed and tight, penthouses are complete, mechanical units have been placed, and roof traffic has ceased.
- .5 Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to be sprayed.
- .6 Apply bonding materials as per identified ULC fire resistance design and manufacturer's written recommendations.
- .7 Topcoat materials shall be type recommended and approved by manufacturer of each spray-applied fire resistive material required by Contract Documents.
- .8 Install mineral wool board fire protection to comply with requirements for thicknesses, number of layers, construction of joints and corners, and fastening methods referenced in appropriate fire resistance design assembly noted in Contract Documents.
- .9 Coordinate installation of board fire protection with other construction to minimize cutting into, or removal of, already installed board material.

### 3.4 FIELD QUALITY CONTROL

- .1 Refer to Section 01 40 00.
- .2 Test spray-applied fire resistive material for thickness and density to ASTM E605/E605M or AWCI Standard Practice for the Testing and Inspection of Field-Applied Sprayed Fire-Resistive Materials.

### 3.5 ADJUSTING

- .1 Make Good damaged fire protection.

### 3.6 PROTECTION

- .1 Protect completed installation as specified in Section 01 76 00.
- .2 Provide final protection and maintain conditions in a manner acceptable to Consultant and authorities having jurisdiction.

- .3 Ensure installed Products are not damaged at time of final inspection.
- .4 Make Good damaged Products before Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 50 00 - Metal Fabrications.
- .4 Section 07 81 00 - Applied Fireproofing.
- .5 Section 07 92 00 - Joint Sealants.
- .6 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .7 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 ASTM C303-21: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
- .2 ASTM C1104/C1104M-19: Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
- .3 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.
- .5 ASTM E814-23a: Standard Test Method for Fire Tests of Penetration Fire Stop Systems.
- .6 ASTM E2174-20a: Standard Practice for On-Site Inspection of Installed Firestop Systems.
- .7 ASTM E2393-20a: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .8 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.
- .9 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .10 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .11 CAN/ULC-S115-2018: Standard Method of Fire Tests of Firestop Systems.
- .12 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).
- .13 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .14 ULC List of Equipment and Materials.

1.3 PREINSTALLATION MEETINGS

- .1 Prior to commencement of firestopping, arrange and conduct a preinstallation meeting as specified in Section 01 31 00.
- .2 Preinstallation Meeting: Discuss proposed methods and materials to be used in instances.



- .3 Representatives of Owner, Consultant, Contractor, Subcontractor, manufacturer and authority having jurisdiction are to be in attendance.
- .4 Do not conduct meeting unless identified parties are present.
- 1.4 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Sealant manufacturer's standard installation instructions and standard drawings, indicating ULC or WHI test designations.
- 1.5 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating sizes of openings, nature of penetrations, and tested method of firestop and smoke seal protection being proposed.
    - .1 Shop Drawings are to be sealed, signed and dated by manufacturer's design engineer.
    - .2 Submit Shop Drawings to Consultant and to authority having jurisdiction for review and acceptance.
- 1.6 CERTIFICATES
  - .1 Submit certification as specified in Section 01 33 00.
  - .2 Certificate: Sealant manufacturer's letter of certification verifying Products meet or exceed specified requirements.
- 1.7 TEST AND EVALUATION REPORTS
  - .1 Submit test reports as specified in Section 01 33 00.
  - .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past two years.
- 1.8 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit manufacturer's field inspection reports as specified in Section 01 40 00.
  - .2 Manufacturer's Field Inspection Reports: Manufacturer's written acceptance of installation based on regular inspections.
- 1.9 QUALIFICATIONS
  - .1 Manufacturer's Design Engineer: A professional engineer having minimum 10 years documented experience designing firestop and smoke seals, licensed to practice at Place of the Work.
  - .2 Installer: A firm specializing in installing firestopping and smoke seals, approved or certified as an installer by manufacturer.
- 1.10 MOCK-UPS
  - .1 Construct mock-ups as specified in Section 01 40 00.
  - .2 Mock-ups: One example of each fire-resistant joint and penetration fire stop required on Project, including representative substrates and penetrating components, for each fire rating required at each type of wall, floor and roof construction.
  - .3 Comply with project requirements as to thickness and density of application to achieve required fire rating.

- .4 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .5 Remove and replace installed Product that does not conform to accepted mock-up.
- .6 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

#### 1.11 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products to Place of the Work in original unopened packages.
- .3 Store Products in an enclosed shelter, preventing damage to containers.

#### 1.12 AMBIENT CONDITIONS

- .1 Do not apply sealants when temperature of substrate material and surrounding air is below 5 degrees C.
- .2 Maintain sealant at minimum 18 degrees C for best workability.

### 2 Products

#### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 3M Company Canada.
  - .2 AD Fire Protection.
  - .3 Hilti Canada.
  - .4 Nuco Inc.
  - .5 Specified Technologies Inc.
  - .6 Tremco.
  - .7 The Rectorseal Corporation.

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

#### 2.2 DESIGN AND PERFORMANCE CRITERIA

- .1 Seal empty holes and penetrations at floors, fire rated walls and smoke barrier walls.
- .2 Seal holes accommodating penetrating items such as cables, cable trays, pipes, ducts and conduits.
- .3 Design firestopping system to maintain integrity of time rated construction by providing a seal against spread of heat, flame and smoke.
- .4 Systems shall be ULC or ULI classified or listed by WHI for appropriate required time rating.
- .5 Provide firestopping and smoke sealing systems to CAN/ULC-S115 and as described below:
  - .1 Asbestos free materials and systems fully capable of maintaining an effective barrier against gases, flame and smoke in compliance with CAN/ULC-S115, not exceeding opening sizes stated.
  - .2 Service Penetration Assemblies: Certified by CAN/ULC-S115 and used by ULC Guide 40 U19. Service components listed as certified in this guide are noted under Label Service of ULC.
- .6 Fire resistance rating of firestopping assembly must meet or exceed fire resistance rating of floor or wall being penetrated.
- .7 Provide elastomeric seal at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control. Do not use cementitious or rigid seals at such locations.

- .8 Damming and back up materials, supports and anchoring devices shall be to manufacturer's recommendations, and in strict accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .9 Firestopping compounds shall not contain volatile solvents or require special application to protect plastic pipe from firestopping compound.

### 2.3 MATERIALS

- .1 Primer: As recommended by sealant manufacturer for specific material, substrate and end use.
- .2 Firestop Accessories: Firestop foams, boards, blocks, collars, wraps, puttys and plugs; to CAN/ULC-S115; ULC labelled; types as listed in tested assemblies.
- .3 Firestop Insulation: To CAN/ULC-S702.1, Type 2; mineral fibre manufactured from rock or slag, suitable for manual application; and having the following physical properties when tested to the identified standard:
  - .1 Density (ASTM C303):  $\geq 72 \text{ kg/m}^3$ .
  - .2 Combustibility (CAN/ULC-S114): Noncombustible.
  - .3 Melt Temperature:  $> 1\ 175$  degrees C.
  - .4 Surface Burning Characteristics: To CAN/ULC-S102, as follows:
    - .1 Flame Spread Index  $\leq 0$ .
    - .2 Smoke Developed Index  $\leq 0$ .
  - .5 Moisture Sorption (ASTM C1104/C1104M): 0.04 percent.
  - .6 Smoulder Resistance (CAN/ULC-S129): 0.01 percent.
- .4 Firestop Sealants: To CAN/ULC-S115; ULC labelled; non-sagging type for vertical applications; types as listed in tested assemblies.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Confirm compatibility of surfaces to receive sealant materials.
- .3 Verify surfaces of openings are sound, clean, dry and ready to receive application of sealant.
- .4 Verify penetrating elements are securely fixed and properly located.

### 3.2 PREPARATION

- .1 Protect adjacent surfaces and equipment from damage.
- .2 Clean contact surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of sealant.
- .3 Remove incompatible materials which affect bond by scraping, brushing, water or solvent cleaning, or sandblasting.

### 3.3 APPLICATION

- .1 Install firestop insulation in compacted thicknesses required by ULC design. Compress insulation approximately 33 percent.
- .2 Apply sealant in strict accordance with ULC certification.
- .3 Coordinate and cooperate with adjacent, contiguous and related Subcontractors to ensure a proper and timely installation.

- .4 Seal holes and voids made by penetrating items to ensure an effective fire and smoke barrier.
- .5 Seal intersections and penetrations of floors, ceilings, walls and columns.
- .6 Seal around cutouts for facility services.
- .7 Wrap non-insulated heated pipes that may be subject to movement with non-combustible smooth material to permit pipe to move without damaging firestopping and smoke seal.
- .8 Maintain integrity of insulation and vapour retarders on insulated pipes and ducts at fire separation.
- .9 Where floor openings exceed 100 mm in width and may be subjected to traffic or loading, install cover plate systems capable of supporting same loading as floor.

### 3.4 FIELD QUALITY CONTROL

- .1 Perform field testing and inspection as specified in Section 01 40 00.
- .2 Inspect penetration firestop systems to ASTM E2174.
- .3 Inspect fire-resistant joint systems to ASTM E2393.
- .4 Examine finished penetrations to ensure proper installation before concealing or enclosing any areas of work.
- .5 Keep areas of work accessible until inspection has been completed.
- .6 Manufacturer's Field Service: Inspect and confirm completed installation is in strict accordance with ULC requirements.
- .7 Correct defective work and re-inspect to verify compliance with requirements.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Immediately remove spots, smears, stains, residues, adhesives, and other disfigurements from installation, including from adjacent surfaces.
- .3 Do not use Products containing volatile solvents.
- .4 Leave the Work in a clean and satisfactory condition.

### 3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect firestopping assemblies from damage.
- .3 Make Good damaged firestopping assemblies before Ready-for-Takeover.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 04 05 23 - Masonry Accessories.
  - .2 Section 07 92 00 - Joint Sealants.
  - .3 Section 07 95 13 - Expansion Joint Cover Assemblies.
- 1.2 REFERENCES
  - .1 ASTM E1612/E1612M-94(2022): Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures.
  - .2 ASTM E1783/E1783M-96(2017): Standard Specification for Preformed Architectural Strip Seals for Buildings and Parking Structures.
  - .3 ASTM E2393-20a: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- 1.3 PREINSTALLATION MEETINGS
  - .1 Refer to Section 01 31 00.
  - .2 Preinstallation Meeting: One week prior to commencement of installation, conduct a preinstallation meeting with Contractor, Consultant, installing Subcontractor and affected Subcontractors to review and discuss installation methods, conditions, adjacent construction and anticipated structural movements.
- 1.4 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, profiles, sizes, details, affected adjacent construction, anchorage, finishes, splices and accessories.
- 1.5 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating pertinent dimensions, construction, opening dimensions and ULC listing numbers.
- 1.6 SAMPLES
  - .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: One full-size, 300 mm long sample of each specified Product.
- 1.7 MANUFACTURER'S INSTRUCTIONS
  - .1 Submit manufacturer's instructions as specified in Section 01 33 00.
  - .2 Manufacturer's Instructions: WHMIS safety data sheets (SDS).
- 1.8 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions, sufficient quantity for inclusion in operation and maintenance manual.

1.9 QUALIFICATIONS

- .1 Applicators: A firm specializing in applying preformed joint seals, having minimum 5 years documented experience.

1.10 CERTIFICATIONS

- .1 Submit manufacturer certifications as specified in Section 01 33 00.
- .2 Certifications: Independent written documentation verifying Products are:
  - .1 Capable of withstanding 65 degrees C for 3 hours while compressed down to minimum movement capability without evidence of bleeding of impregnation medium from material.
  - .2 Capable of self-expansion to maximum movement capability dimension after being subjected to heat stability test and allowed to cool to room temperature.
  - .3 Free of waxes and wax compounds using FTIR and DSC testing.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in original, intact and labelled containers.
- .3 Handle and protect Products to prevent damage and deterioration.

1.12 AMBIENT CONDITIONS

- .1 Apply Products only when ambient air and substrate temperatures are 5 degrees C and rising.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Emseal Joint Systems, Ltd. (A Sika Company).
  - .2 Master Builders Solutions Canada, Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

- .1 Foundation Wall Expansion Joint Seal: To ASTM E1612/E1612M; pre-compressed, silicone and impregnated cellular foam core, with factory-applied silicone bellows, complete with epoxy adhesive and silicone sealant bands; as follows:
  - .1 Total Joint Movement Capability: Plus 30 percent, minus 25 percent nominal material size.
  - .2 Joint Seal Width: As indicated on Drawings.
  - .3 Manufacturer and Product Name: eg. DSM System by Emseal Joint Systems, Ltd. (A Sika Company).
- .2 Fire-Rated Vandal-Resistant Wall Expansion Joint Filler: To ASTM E1612/E1612M; 100 mm deep, suitable size for joint width indicated on Drawings; watertight, vandal-resistant sealant system, comprised of fire retardant impregnated expanding foam backing and hardened tamper-resistant bellows on both sides; accommodating joint movement of plus or minus 25 percent; fire rated for 2 hours when tested to UL2079; White colour one side and Intumescent Red colour on opposite side; eg. Emshield SecuritySeal SSW2 by Emseal Joint Systems, Ltd. (A Sika Company).

- .3 Masonry Veneer Wall Expansion Joint Filler: To ASTM E1783/E1783M; binary sealant system, comprised of factory-applied low modulus silicone, acrylic-impregnated expanding foam sealant and closed-cell EVA foam; accommodating joint movement of plus or minus 25 percent, suitable size for joint width indicated on Drawings; eg. Colorseal by Emseal Joint Systems, Ltd. (A Sika Company), colours as selected by Consultant.
- .4 Secondary Joint Backing: Preformed expanding foam, accommodating movement of plus and minus 25 percent; size to suit joint size; Backerseal by Emseal Joint Systems, Ltd. (A Sika Company).

### 3 Execution

#### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify surfaces are free of oil, grease, laitance, water repellents, dirt, rust and other foreign substances.
- .3 Ensure sufficient joint opening depth to receive full depth of specified joint filler.

#### 3.2 PREPARATION

- .1 Clean joint opening of contaminants and impurities.
- .2 Repair spalled, irregular and unsound joint surfaces.
- .3 Remove protruding roughness to ensure joint sides are smooth.

#### 3.3 INSTALLATION

- .1 Align work plumb, level and accurately fitted, and free from distortion or defects.
- .2 Ensure Products are centred over expansion joint.
- .3 Set Products to proper width for the ambient air temperature at the time of setting.
- .4 Install horizontal expansion joint fillers slightly recessed from slab surface.
- .5 Install vertical expansion joint fillers in joint, flush with or near to surface, into wet adhesive and allow to expand to fill joint.
- .6 Mitre expansion joint seals where material will be joined and wipe silicone onto mitred face.
- .7 Apply continuous band of silicone between substrate and silicone bellows.

#### 3.4 FIELD QUALITY CONTROL

- .1 Refer to Section 01 40 00.
- .2 Inspect installed fire resistive joint systems to ASTM E2393.

#### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Remove joint seal materials from adjacent surfaces.
- .3 Leave work area broom clean.

3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Allow completed installation to cure for minimum 48 hours, longer if temperatures fall below 9 degrees C during curing period, before allowing traffic across joint.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 05 23 - Masonry Accessories.
- .3 Section 06 20 00 - Finish Carpentry.
- .4 Section 06 41 00 - Architectural Wood Casework.
- .5 Section 07 26 00 - Vapour Retarders.
- .6 Section 07 27 00 - Air Barriers.
- .7 Section 07 27 36 - Sprayed Foam Air Barrier.
- .8 Section 07 42 13 - Metal Wall Panels.
- .9 Section 07 42 93.23 - Linear Metal Soffits.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .11 Section 07 84 00 - Firestopping.
- .12 Section 08 12 13 - Hollow Metal Frames.
- .13 Section 08 41 13 - Aluminum-Framed Entrances and Storefront.
- .14 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .15 Section 08 51 13 - Aluminum Windows.
- .16 Section 08 80 00 - Glazing.
- .17 Section 09 21 16 - Gypsum Board Assemblies.
- .18 Section 09 30 00 - Tiling.
- .19 Section 09 51 23 - Acoustical Tile Ceilings.
- .20 Section 22 44 13 - Plumbing Fixtures Combined with Drawing Schedules.

1.2 REFERENCES

- .1 ASTM C919-19: Standard Practice for Use of Sealants in Acoustical Applications.
- .2 ASTM C920-18: Standard Specification for Elastomeric Joint Sealants.
- .3 ASTM C1193-16: Standard Guide for Use of Joint Sealants.
- .4 ASTM C1521-19(2020): Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- .5 CAN/CGSB-19.13-M87: Sealing Compound, One Component, Elastomeric, Chemical Curing.
- .6 CAN/CGSB-19.17-M90: One Component Acrylic Emulsion Base Sealing Compound.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate samples of each specified joint sealant, illustrating available colour selections.

1.4 MANUFACTURER REPORTS

- .1 Submit manufacturers' reports as specified in Section 01 40 00.
- .2 Manufacturers' Reports: Manufacturer field review reports, as specified below.

1.5 QUALIFICATIONS

- .1 Applicators: Workers experienced with applying joint sealants, having minimum 3 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in manufacturer's sealed packages.
- .3 Store Products in warm, dry conditions.

1.7 AMBIENT CONDITIONS

- .1 Do not install solvent curing sealants in enclosed building spaces.
- .2 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of 5 years, including coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of either adhesion or cohesion, or do not cure.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of exterior weatherseal sealants, exterior high-movement sealants, glazing sealants, interior general purpose sealants and interior mildew-resistant sealants having Product considered acceptable for use:
  - .1 Dow Chemical Company.
  - .2 General Electric.
  - .3 Master Builders Solutions Canada, Inc.
  - .4 Tremco.
- .2 Manufacturers of exterior flashing sealants having Product considered acceptable for use:
  - .1 Henry (a Carlisle Company).
  - .2 Tremco.
  - .3 W. R. Meadows of Canada Limited.
- .3 Manufacturers of interior tiling sealants having Product considered acceptable for use:
  - .1 Mapei.
- .4 Substitution Procedures: Refer to Section 01 25 00.

2.2 PERFORMANCE CRITERIA

- .1 Seal gaps between dissimilar Products, visible or otherwise.
- .2 Protect building components from air infiltration and moisture penetration.

## 2.3 MATERIALS

- .1 Exterior Weatherseal Sealant (SEAL-EXT): To ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A and O; one-part, moisture curing, low modulus polyurethane sealant; accommodating joint movement of plus or minus 35 percent, with a 30- to 90-minute skin time; eg. Dymonic FC by Tremco, colours as selected by Consultant.
- .2 Exterior High-Movement Sealant - (SEAL-EXT-HM): To ASTM C920, Type S, Grade NS, Class 50, Use NT, T, M, A, O, and I; one-part medium modulus, low VOC, UV stable, non-sag polyurethane sealant; accommodating joint movement of plus 100 percent and minus 50 percent, with a 120-minute skin time; eg. Dymonic 100 by Tremco, colours as selected by Consultant.
- .3 Exterior Flashing Sealant (SEAL-EXT-FL): To ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A and O; one-part, moisture curing, low modulus polyurethane sealant; accommodating joint movement of plus or minus 25 percent; eg. Dymonic by Tremco, colour as selected by Consultant.
- .4 Glazing Sealant (SEAL-GLZ): To CAN/CGSB-19.13-M, Type MG-2-25-A-L; one-part, moisture curing, acetoxysilicone sealant; eg. Proglaze by Tremco, Clear colour.
- .5 Interior General Purpose Sealant (SEAL-INT-GP): To CAN/CGSB-19.17-M; one-part, siliconized acrylic latex, mildew-resistant, accommodating joint movement of plus or minus 12-1/2 percent; eg. Tremflex 834 by Tremco, colours as selected by Consultant.
- .6 Interior Mildew-Resistant Sealant (SEAL-INT-MR): To ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; one-part, acetoxysilicone sealant, complete with integral fungicide; eg. Tremsil 200 by Tremco, colours as selected by Consultant.
- .7 Interior Floor Tiling Sealant (SEAL-INT-FT): Premium grade, sanded siliconized acrylic; Keracaulk S by Mapei, colours to match adjacent tile grout colours.
- .8 Interior Wall Tiling Sealant (SEAL-INT-WT): Premium grade, unsanded siliconized acrylic; Keracaulk U by Mapei, colours to match adjacent tile grout colours.

## 2.4 ACCESSORIES

- .1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- .2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- .3 Backer Rod: Open cell polyethylene foam core wrapped in a closed cell polyethylene skin.
- .4 Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

## 3 Execution

### 3.1 PREPARATION

- .1 Clean and prime joints to requirements of manufacturer's instructions.
- .2 Remove loose materials and foreign matter which might impair adhesion of sealant.

### 3.2 APPLICATION

- .1 Install joint sealants to ASTM C1193.
- .2 Install acoustical sealants to ASTM C919.

- .3 Apply sealant with pressure gun having proper size nozzle and extrusion nozzle where required.
- .4 Use sufficient pressure to fill joints solid to joint filler.
- .5 Shape nozzle to finish sealant in a neat concave bead.
- .6 Apply sealant sufficiently in from normal face of joints to form a positive shadow line.
- .7 Tool sealant smooth and slightly concave, free from ridges, wrinkles, air pockets and embedded impurities.
- .8 Ensure proper configuration and depth achieved. Depth of sealant at point of adhesion shall be not more than one-half the width.
- .9 Install exterior high-movement sealant (SEAL-EXT-HM) in areas where anticipated differential movement exceeds the movement capabilities of other specified exterior weatherseal sealants.

### 3.3 FIELD QUALITY CONTROL

- .1 Inspect completed sealant joints for adhesion and cohesion to ASTM C1521.
- .2 Inspect completed sealant joints for holes, gaps, and areas where leaks could become present.
- .3 Reject failed joints, joints filled with only a skin bead, and joints having an insufficient volume of sealant.
- .4 Remove material from rejected joints, clean, and re-seal to attain proper width-to-depth joint coverage.

### 3.4 MANUFACTURER SERVICES

- .1 Arrange for sealant manufacturer's representative to be present prior to commencement of sealant installation.
- .2 Consult with manufacturer's representative as to joint conditions.
- .3 Arrange for manufacturer's representative to regularly inspect joint sealant application (minimum twice per week).
- .4 Submit written field review reports, confirming sealant installation is in strict accordance with manufacturer's recommendations.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Remove excess sealant and droppings using cleaner which will not damage adjacent surfaces.
- .3 Make Good surfaces defaced or disfigured as a result of sealant application.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 07 51 00 - Built-up Bituminous Roofing.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Section 07 84 00 - Firestopping.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .2 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .4 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .5 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .6 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .7 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.
- .8 ASTM E814-23a: Standard Test Method for Fire Tests of Penetration Fire Stop Systems.
- .9 CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel.
- .10 CSA G40.21-13 (R2018): Structural Quality Steel.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, component profiles and sizes, and applicable UL Classifications or WH Listings.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, affected adjacent construction, anchorage, finishes, splices and accessories.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store Products as specified in Section 01 60 00.
- .2 Provide temporary protective cover to finished metal surfaces.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 The C/S Group.
  - .2 Inpro Architectural Products.
  - .3 MM Systems Corporation.
  - .4 Watson Bowman Acme Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 DESIGN AND PERFORMANCE CRITERIA

- .1 Design joint covers to permit restrained movement of expansion joint without disengagement of cover. Consider special movement conditions.
- .2 Fire Rated Joint Covers:
  - .1 UL classified or WH listed.
  - .2 Tested to ASTM E119 and ASTM E814, including hose stream test at full rated period.
  - .3 Design expansion joint covers with fire rating not less than fire rating of adjacent construction.
  - .4 Design expansion joint covers from inorganic materials, that will not create smoke or contribute fuel during a fire.
- .3 Allowable Loads:
  - .1 Normal Position:
    - .1 Uniform Load: 9.58 kPa.
    - .2 Concentrated Load: 8.90 kN.
    - .3 Deflection:  $\leq 3$  mm.
  - .2 Fully Open Position:
    - .1 Uniform Load: 9.58 kPa.
    - .2 Concentrated Load: 8.90 kN.
    - .3 Stress:  $\leq 193\ 053$  kPa.
    - .4 Deflection:  $\leq 3$  mm.
- .4 Spherical and pin type centering bars must be fully engaged with base member.

### 2.3 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063-T5 or 6061-T651 alloys.
- .2 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.
- .3 Steel Sections and Plates: To CSA G40.20 and CSA G40.21.
- .4 Stainless Steel: To ASTM A240/A240M, Type 304.

### 2.4 ACCESSORIES

- .1 Water Barrier: Flexible polyvinyl chloride, EPDM.
- .2 Fire Barrier: Ceramic fiber insulation.

- .3 Flame Sealant: As specified in Section 07 84 00.
- .4 Centering Bars: C-1074 tempered steel with protective coating.
- .5 Fasteners: As recommended by joint cover manufacturer.

## 2.5 FABRICATION

- .1 Shop assemble components and package with anchors and fittings. Supply components in single lengths where possible; minimize site splicing.
- .2 Fabricate special transitions, corner fittings and end closures.
- .3 Mitre and weld joints.
- .4 Flexible Floor Joint Covers:
  - .1 Fasten cover plates through center of spring steel centering bars.
  - .2 Centering Bars: Complete with a corrosion-resistant coating; attached to nylon spheres or steel pins, which are retained in tracks of extruded base members. Set centering bars diagonally at 250 mm OC maximum.
  - .3 Cover Plates: Aluminum with smooth or recessed surface.
- .5 Fabricate roof joint covers with sealing washers and gaskets, splice covers, counterflashing flanges and end closures.
- .6 Fabricate fire rated joint covers with fire barrier and flame sealant to ensure required fire rating is met.

## 2.6 FINISHES

- .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.
- .4 Stainless Steel: To AISI No. 4 - Brushed.
- .5 Mill Finish on Aluminum - Floor and Roof Applications: Manufacturer's standard mill finish.
- .6 Anodized Coating on Aluminum - Wall and Ceiling Applications: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating, No. 17.
- .7 Expandable Gasket: Colours as selected by Consultant.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products plumb, level and accurately fitted.
- .2 Install Products flush with adjacent surfaces and free from distortion or defects.
- .3 Rigidly anchor work to substrate.
- .4 Set expansion joint system to proper width for the ambient air temperature at the time of setting.

- .5 Provide water barriers at exterior joints and where otherwise indicated on Drawings.
- .6 Provide drainage fittings where required.
- 3.2 ADJUSTING
  - .1 Adjust joint cover to freely accommodate joint movement.
- 3.3 CLEANING
  - .1 Refer to Section 01 74 00.
  - .2 Remove manufacturer's standard protective wrap only after work in adjacent areas has been completed.
  - .3 Clean exposed surfaces with a suitable cleaner that will not harm factory-applied finishes.
- 3.4 SCHEDULE
  - .1 Floor-to-Floor Joint Cover: 25 mm wide; eg. Flush Thinline GFT-100 with Reflex RFX-1F by C/S Group.
  - .2 Floor-to-Wall Joint Cover: 25 mm wide; eg. Flush Thinline GFTW-100 with Reflex RFX-1F by C/S Group.
  - .3 Wall-to-Wall Joint Cover: 25 mm wide; eg. Flush Thinline FWF-100 with Reflex RFX-1W by C/S Group.
  - .4 Wall-to-Wall Corner Joint Cover: 25 mm wide; eg. Flush Thinline FWFC-100 with Reflex RFX-1W by C/S Group.
  - .5 Ceiling-to-Ceiling Joint Cover: 25 mm wide; eg. Flush Thinline FCF-100 with Reflex RFX-1W by C/S Group.
  - .6 Ceiling-to-Ceiling Corner Joint Cover: 25 mm wide; eg. Flush Thinline FCFC-100 with Reflex RFX-1W by C/S Group.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 10 - Masonry Mortaring and Grouting.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 07 26 00 - Vapour Retarders.
- .4 Section 07 27 00 - Air Barriers.
- .5 Section 07 27 36 - Sprayed Foam Air Barrier.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 08 13 13 - Hollow Metal Doors.
- .8 Section 08 14 00 - Wood Doors.
- .9 Section 08 71 00 - Door Hardware.
- .10 Section 08 80 00 - Glazing.
- .11 Section 09 21 16 - Gypsum Board Assemblies.
- .12 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- .1 AAMA/WDMA/CSA 101/I.S. 2/A440-22: North American Fenestration Standard / Specification for Windows, Doors and Skylights.
- .2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .4 CSA W59-18: Welded Steel Construction.
- .5 CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- .6 CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).
- .7 CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- .8 CSDMA Recommended Dimensional Standard for Steel Doors and Frames.
- .9 CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- .10 NFPA 80-2007: Fire Doors and Other Opening Protectives.
- .11 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
- .12 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- .13 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
- .14 CAN/ULC-S105:2016 (R2020): Standard Specification for Fire Door Frames Meeting Performance Required by CAN/ULC-S104.

- .15 CAN/ULC-S106-15 (R2020): Standard Method for Fire Tests of Window and Glass Block Assemblies.
- .16 ULC List of Equipment and Materials.
- 1.3 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets indicating frame components, available ratings, sizes and thicknesses.
- 1.4 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating opening sizes, frame configurations, fire ratings, anchor types and spacings, locations of cut outs, reinforcing, and shop finishes.
- 1.5 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Store Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 1.6 WARRANTY
  - .1 Submit extended warranty in accordance with General Conditions of the Contract.
  - .2 Extended Warranty: For a period of two years, covering against twisting, buckling, weld failure and corrosion.
- 2 Products
- 2.1 MANUFACTURERS
  - .1 Manufacturers having Product considered acceptable for use:
    - .1 All Steel Doors 2000 Limited.
    - .2 Artek Door (1985) Limited.
    - .3 Baron Metal Industries Inc.
    - .4 Daybar Industries Limited.
    - .5 Fleming Door Products Ltd.
    - .6 Gensteel Doors.
    - .7 Metal Door Limited.
    - .8 Trillium Steel Doors Limited.
    - .9 Vision Hollow Metal Limited.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 REGULATORY REQUIREMENTS
  - .1 Fire Rated Frame Assemblies: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104 and CAN/ULC-S106.
- 2.3 PERFORMANCE CRITERIA
  - .1 Exterior Hollow Metal Frames: To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
    - .1 Air Leakage of Glazed Frames (ASTM E283):  $\leq 1.0 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
    - .2 Assembly Thermal Transmittance (ANSI/NFRC 100):  $U \leq 2.15 \text{ W/m}^2 \text{ degrees C}$ .
    - .3 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} \leq 0.40$ .

## 2.4 MATERIALS

- .1 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Type B; cold-rolled sheet steel, with regular and paintable galvanneal coatings as noted; thicknesses as indicated.
- .2 Bituminous Coating: Fibrous asphalt emulsion.
- .3 Air Sealant Foam: As specified in Section 07 27 36.
- .4 Touch-up Primer: Zinc-rich alkyd primer.
- .5 Welding Materials: To CSA W59.
- .6 Joint Sealant: As specified in Section 07 92 00, types as follows:
  - .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
  - .2 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.

## 2.5 MANUFACTURED UNITS

- .1 Exterior Hollow Metal Multi-Opening Frame: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; two-piece construction with continuous thermal break; sizes and configurations as indicated on Drawings; eg. Therma-Series Frame by Fleming Door Products Ltd.
- .2 Interior Hollow Metal Door Frame: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes as indicated on Drawings; eg. F-Series Frame by Fleming Door Products Ltd.
- .3 Interior Hollow Metal Double Egress Door Frame: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes as indicated on Drawings; eg. DE-Series Frame by Fleming Door Products Ltd.
- .4 Interior Hollow Metal Multi-Opening Frame: Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes and configurations as indicated on Drawings; eg. MN- or ST-Series Frame by Fleming Door Products Ltd.

## 2.6 ACCESSORIES

- .1 Reinforcements: Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
  - .1 Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
  - .2 Hinge Reinforcements: 3.51 mm.
  - .3 Door Closer and Holder Reinforcements: 2.74 mm.
- .2 Anchors: Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
  - .1 T-Strap Type: 1.30 mm.
  - .2 Stirrup-strap Type: 50 x 250 mm size, 1.60 mm thick.
  - .3 Jamb Floor Type: 1.60 mm thick.
  - .4 Stud Type: 1.00 mm thick.
- .3 Jamb Spreaders: 1.00 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.
- .4 Mortar Guard Boxes: 0.84 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.
- .5 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper-proof screws.
- .6 Threshold Saddles: Thermally broken aluminum threshold; 273x3AFG Thermal Barrier Saddle by Pemko.

- .7 Bumpers: Resilient rubber.
- .8 Thermal Break: Rigid neoprene or polyvinyl chloride (PVC) extrusion.

## 2.7 FABRICATION

- .1 Fabricate frames as welded units.
- .2 Conform to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- .3 Fabricate fire-rated frames to CAN/ULC-S105.
- .4 Provide fire labels to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- .5 Fabricate frames with fixed mullions, to profiles shown, with hardware reinforcement plates welded in place.
- .6 Welding
  - .1 Perform welding to CSA W59.
  - .2 Fill open joints, seams, and depressions with filler or by continuous brazing or welding.
  - .3 Grind exposed welds smooth and flush, to true sharp arrises and profiles.
  - .4 Sand welds to a smooth, true, uniform finish.
- .7 Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame.
- .8 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.
- .9 Reinforce frames wider than 1 220 mm with roll formed steel channels fitted tightly into frame head, flush with top.
- .10 Fit frames with channel or angle spreaders, minimum two per frame, to ensure proper frame alignment. Install stiffener plates to spreaders between frame trim where required to prevent bending of trim and to maintain alignment when setting and during construction.
- .11 Provide adjustable T-strap anchors in frames to be installed in masonry openings, spaced at 600 mm OC.
- .12 Where frames are required to terminate at finished floor, Provide plates for anchorage to floor slab.
- .13 Prepare interior door frames for single stud door silencers, as follows:
  - .1 Single Door Frames: Three on strike jamb.
  - .2 Double Egress Door Frames: Two on head for each door leaf.
- .14 Fabricate frames and screens to accommodate scheduled glazing. Secure glazing stops to frames with counter sunk oval head sheet metal screws.
- .15 Prepare frames for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components.
- .16 Thermally-Broken Frames:
  - .1 Provide wall and floor anchors suitable for installation, purpose made not to permit thermal conductivity.
  - .2 Do not fix sections together with screws, grommets or other thermally conductive fastening device.
  - .3 Provide full frame width drip caps.
  - .4 Conform to accepted Shop Drawings.

2.8 FINISHES

- .1 Paintable Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.
- .2 Regular Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

3 Execution

3.1 INSTALLATION

- .1 Install Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- .2 Install Products plumb, square, aligned, without twist, and at correct elevation.
- .3 Install threshold saddles across bottom of exterior door frames.
- .4 Coordinate with masonry and wallboard construction for anchor placement.
- .5 Fill designated frames set in masonry walls and partitions solid with non-shrink grout or mortar, as specified in Section 04 05 10.
- .6 Connect exterior frames to air/vapour barrier transition sheet membranes to achieve airtight seal.
- .7 Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.
- .8 Seal gaps between frames and walls with joint sealant, as specified in Section 07 92 00.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 08 12 13 - Hollow Metal Frames.
  - .2 Section 08 71 00 - Door Hardware.
  - .3 Section 08 80 00 - Glazing.
  - .4 Section 09 90 00 - Painting and Coating.
- 1.2 REFERENCES
  - .1 AAMA/WDMA/CSA 101/I.S. 2/A440-22: North American Fenestration Standard / Specification for Windows, Doors and Skylights.
  - .2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .4 CSA W59-18: Welded Steel Construction.
  - .5 CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
  - .6 CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).
  - .7 CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
  - .8 CSDMA Recommended Dimensional Standard for Steel Doors and Frames.
  - .9 CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
  - .10 NFPA 80-2007: Fire Doors and Other Opening Protectives.
  - .11 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
  - .12 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
  - .13 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
  - .14 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
  - .15 CAN/ULC-S705.1-18: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.
  - .16 ULC List of Equipment and Materials.
- 1.3 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, component sizes and thicknesses, and available finishes.
- 1.4 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.

- .2 Shop Drawings: Project-specific drawings, illustrating door elevations and sizes, internal reinforcement, fire ratings, closure method, size and location of cut outs, and shop finishes.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Store hollow metal doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

## 1.6 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of two years, covering against twisting, buckling, delamination of steel stiffeners, weld failure and corrosion.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 All Steel Doors 2000 Limited.
  - .2 Artek Door (1985) Limited.
  - .3 Baron Metal Industries Inc.
  - .4 Daybar Industries Limited.
  - .5 Fleming Door Products Ltd.
  - .6 Gensteel Doors.
  - .7 Metal Door Limited.
  - .8 Trillium Steel Doors Limited.
  - .9 Vision Hollow Metal Limited.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 REGULATORY REQUIREMENTS

- .1 Fire Rated Doors: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

### 2.3 PERFORMANCE CRITERIA

- .1 Exterior Hollow Metal Doors: To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
  - .1 Air Leakage of Glazed Doors (ASTM E283):  $\leq 5.1 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
  - .2 Assembly Thermal Transmittance (ANSI/NFRC 100):
    - .1 Glazed Doors:  $U \leq 3.94 \text{ W/m}^2 \text{ degrees C}$ .
    - .2 Opaque Doors:  $U \leq 2.56 \text{ W/m}^2 \text{ degrees C}$ .
  - .3 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} \leq 0.40$ .

### 2.4 MATERIALS

- .1 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Type B; cold-rolled sheet steel, with regular and paintable galvalneal coatings as noted; thicknesses as indicated.
- .2 Foamed-in-Place Insulation: To CAN/ULC-S705.1; injected polyurethane foam having LTRR thermal resistance of  $\text{RSI} \geq 0.9 @ 25 \text{ mm thick}$ .
- .3 Semi-Rigid Board Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre semi-rigid board having aged thermal resistance of  $\text{RSI} \geq 0.68 @ 25 \text{ mm of thick}$ .
- .4 Touch-up Primer: Zinc-rich alkyd primer.

- .5 Welding Materials: To CSA W59.

## 2.5 MANUFACTURED UNITS

- .1 Exterior Hollow Metal Flush Doors: 45 mm thick, constructed as follows:
  - .1 Door Faces: Sheet steel panels, 1.30 mm nominal coated thickness, flush design, paintable galvanneal finish.
  - .2 Vertical Steel Stiffeners: Sheet steel profiles, 0.76 mm nominal coated thickness, 22 mm deep, interlocking design, regular galvanneal finish.
  - .3 Door Edges: Mechanically interlocked.
  - .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - .5 Core: Foamed-in-place insulation.
  - .6 Manufacturer and Product Name: eg. Trio-E by Fleming Door Products Ltd.
- .2 Interior Hollow Metal Flush Doors - Fire Rated: 45 mm thick, fire rating as scheduled; constructed as follows:
  - .1 Door Faces: Sheet steel panels, 1.60 mm nominal coated thickness, flush design, paintable galvanneal finish.
  - .2 Vertical Steel Stiffeners: Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvanneal finish.
  - .3 Door Edges: Continuously welded.
  - .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - .5 Core: Semi-rigid board insulation.
- .3 Interior Hollow Metal Flush Doors - Non-Rated: 45 mm thick; constructed as follows:
  - .1 Door Faces: Sheet steel panels, 1.60 mm nominal coated thickness, flush design, paintable galvanneal finish.
  - .2 Vertical Steel Stiffeners: Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvanneal finish.
  - .3 Door Edges: Continuously welded.
  - .4 Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - .5 Core: Semi-rigid board insulation.

## 2.6 ACCESSORIES

- .1 Reinforcements: Commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
  - .1 Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
  - .2 Hinge Reinforcements: 3.51 mm.
  - .3 Door Closer and Holder Reinforcements: 2.74 mm.

## 2.7 FABRICATION

- .1 Conform to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- .2 Fabricate fire-rated doors to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- .3 Provide continuous faces free from joints, tool markings and abrasions; with hardware reinforcement plates welded in place.
- .4 Welding
  - .1 Perform welding to CSA W59.
  - .2 Fill open joints, seams, and depressions with filler, or by continuous brazing, or welding.
  - .3 Grind exposed welds smooth and flush, to true sharp arrises and profiles.
  - .4 Sand welds to a smooth, true, uniform finish.



- .5 Fabricate doors to accommodate scheduled glazing. Secure glazing stops to doors with counter sunk oval head sheet metal screws.
- .6 Prepare doors for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components.
- .7 Reinforce and stiffen designated doors with vertical steel stiffeners spaced at 152 mm OC, continuous for full height of door, laminated as follows:
  - .1 Exterior Doors: To inner door face.
  - .2 Interior Doors: To both door faces.
- .8 Completely fill door cores with specified core materials.
- .9 Reinforce door edges with channel reinforcing.
- .10 Bevel stiles minimum 3 mm.
- .11 Tack Welded Door Edges: Tack weld door edge seams at 150 mm OC and fill remaining seam with body filler.
- .12 Continuously Welded Door Edges: Continuously weld door edge seams to a smooth, seamless appearance.
- .13 Mechanically Interlocked Door Edges: Mechanically interlock door edge seams with hemmed vertical edges.
- .14 Provide flush top edge and bottom closures on exterior doors, sealed watertight.

## 2.8 FINISHES

- .1 Paintable Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.
- .2 Regular Galvanneal Coating: To ASTM A653/A653M, Coating Designation ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

### 3.2 TOLERANCES

- .1 Diagonal Distortion:  $\leq 1.5$  mm measured with straight edge, corner to corner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 24 00 - High Pressure Decorative Laminate.
- .3 Section 06 41 00 - Architectural Wood Casework.
- .4 Section 08 12 13 - Hollow Metal Frames.
- .5 Section 08 71 00 - Door Hardware.
- .6 Section 08 80 00 - Glazing.
- .7 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- .1 ANSI A135.4-2004: Basic Hardboard.
- .2 ANSI A208.1-2009: Particleboard.
- .3 AWMAC NAAWS 4.0-2021: North American Architectural Woodwork Standards.
- .4 CSA O141-05 (R2009): Softwood Lumber.
- .5 ANSI/DHI A115.IG-1994: Installation Guide for Doors and Hardware.
- .6 NFPA 80-2007: Fire Doors and Other Opening Protectives.
- .7 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
- .8 CAN/ULC-S113:2016 (R2020): Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies.
- .9 ULC List of Equipment and Materials.
- .10 ANSI/WDMA I.S. 1A-13: Industry Standard for Interior Architectural Wood Flush Doors.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating door elevations, stile and rail reinforcement, cutouts and internal blocking.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Pile Products flat on level supports to prevent warping.
- .3 Protect face of first unit by placing plywood or cardboard between supports and unit face. Cover top unit in similar manner.
- .4 Store Products in a dry, well-ventilated area.
- .5 Seal top and bottom edges of Products stored for an extensive period of time.

1.5 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.

- .2 Extended Warranty: For a period of 3 years, covering against warping beyond installation tolerances, and delamination or degradation of faces.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Door-Lam.
  - .2 Jeld-Wen, Inc.
  - .3 Lambton Door.
  - .4 Marshfield Door Systems.
  - .5 Masonite International Corporation.

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

### 2.2 REGULATORY REQUIREMENTS

- .1 Fire Rated Doors: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

### 2.3 MATERIALS

- .1 Lumber: To CSA O141; SPF species, kiln dried to maximum 7 percent moisture content.
- .2 Particleboard: To ANSI A208.1; 448 kg/m<sup>3</sup> solid particleboard.
- .3 Fire Rated Board: Solid non-combustible, inorganic composite board; ULC labelled.
- .4 Agrifiber Board: To ANSI A208.1; core material fabricated from residual material from a grain crop, similar in composition to particleboard; ULC labelled.
- .5 Decorative Laminate: To ANSI/NEMA LD3; colours, textures and patterns as selected by Consultant; and as follows:
  - .1 Non-Rated Doors: High pressure decorative laminate Type HPDL, Vertical Surface type, as specified in Section 06 24 00.
  - .2 Fire Rated Doors: Flame-retardant high pressure decorative laminate Type HPDL-FR, Vertical Surface type, as specified in Section 06 24 00.

### 2.4 MANUFACTURED UNITS

- .1 Solid Core Flush Wood Doors - Fire Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 45-, 60- or 90-minute rating as scheduled; 3-ply construction, as follows:
  - .1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
  - .2 Core: Fire rated board.
  - .3 Face Assembly Adhesive: Type I - Waterproof.
  - .4 Core Assembly Adhesive: Type II - Water-resistant.
  - .5 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
  - .6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, door face edge shows.
  - .7 Door Faces: Decorative laminate.
- .2 Solid Core Flush Wood Doors - 20-Minute Fire Rated: To CAN/ULC-S113 and ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 3-ply construction, as follows:
  - .1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
  - .2 Core: Agrifiber board.
  - .3 Face Assembly Adhesive: Type I - Waterproof.
  - .4 Core Assembly Adhesive: Type II - Water-resistant.

- .5 Glass Stop: Matching wood, flat bead type; designed to ULC requirements.
  - .6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, door face edge shows.
  - .7 Door Faces: Decorative laminate.
- .3 Solid Core Flush Wood Doors - Non-Rated: To ANSI/WDMA I.S. 1A, Extra Heavy Duty; 44 mm thick; 3-ply construction, as follows:
- .1 Perimeter Construction: Solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
  - .2 Core: Particleboard.
  - .3 Face Assembly Adhesive: Type I - Waterproof.
  - .4 Core Assembly Adhesive: Type II - Water-resistant.
  - .5 Glass Stop: Matching wood, flat bead type.
  - .6 Edges: To AWMAC NAAWS 4.0, Type D - Solid Wood edgeband, door face edge shows.
  - .7 Door Faces: Decorative laminate.

## 2.5 FABRICATION

- .1 Fabricate Products to AWMAC NAAWS 4.0, Custom Grade.
- .2 Provide and prepare sufficient amount of blocking in edges to accommodate installation of scheduled hardware.
- .3 Fabricate fire-rated Products with sufficient wood blocking to fasten scheduled hardware.
- .4 Fabricate paired doors with no bevel on meeting edges.
- .5 Prepare doors to receive scheduled door hardware. Machine cut relief for hinges and closures. Core doors for handsets and cylinders. Coordinate with Section 08 71 00.
- .6 Provide and prepare openings for glazing.
- .7 Apply decorative laminate to AWMAC NAAWS 4.0 and as specified in Section 06 24 00.

## 2.6 FINISHES

- .1 Apply one coat uncut shellac to door cutouts.

## 3 Execution

### 3.1 PREPARATION

- .1 Arrange with Section 09 90 00 to finish glass stops, top rails, bottom rails and stile edges to match decorative laminate door faces prior to door, glazing and hardware installation.

### 3.2 INSTALLATION

- .1 Install Products to ANSI/DHI A115.IG.
- .2 Do not trim fire rated wood doors.
- .3 Trim non-rated wood doors only as necessary, and as follows:
  - .1 Door Width:  $\leq 5$  mm.
  - .2 Door Height: Trimmed equally on top and bottom edges, to a combined maximum of 10 mm.
- .4 Prepare doors to receive door hardware to AWMAC NAAWS 4.0.

### 3.3 TOLERANCES

- .1 Distortions measured with straight edge over not more than 1 066 x 2 134 mm surface area, as follows:
  - .1 Diagonal Distortion:  $\leq 6$  mm measured from corner to corner.
  - .2 Vertical Distortion:  $\leq 6$  mm measured from top to bottom.
  - .3 Width Distortion:  $\leq 6$  mm measured from edge to edge.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 05 50 00 - Metal Fabrications.
- .3 Section 09 21 16 - Gypsum Board Assemblies.
- .4 Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- .1 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- .2 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes (Metric).
- .3 ASTM E119-22: Standard Test Methods for Fire Tests of Building Construction and Materials.
- .4 NFPA 80-2007: Fire Doors and Other Opening Protectives.
- .5 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .6 ULC List of Equipment and Materials.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating materials, profiles, accessories, locations, and dimensions.

1.4 CERTIFICATIONS

- .1 Submit certification reports as specified in Section 01 33 00.
- .2 Fire Test Certification Report: Certifying performance within specified fire rating.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Store Products in a dry, protected, well-vented area.
- .3 Remove protective wrapping immediately after installation.

1.6 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: For a period of 5 years, covering parts against defects.

2 Products

2.1 MANUFACTURERS

.1 Manufacturers having Product considered acceptable for use:

- .1 Acudor Access Doors.
- .2 Bilco Canada.
- .3 Cendrex.
- .4 The Williams Brothers Corporation.

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

2.2 REGULATORY REQUIREMENTS

.1 Fire Rated Assemblies: To NFPA requirements for fire rated class indicated in schedule.

2.3 MATERIALS

.1 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel; thicknesses as specified below.

.2 Extruded Aluminum: To ASTM B221M, 6061-T5 alloy, mill finish; thicknesses as specified below.

.3 Insulation: To CAN/ULC-S702.1, Type 1; non-rigid mineral fibre insulation, made from rock or slag fibers.

.4 Gypsum Board: As specified in Section 09 21 16.

2.4 MANUFACTURED UNITS

.1 Gypsum Board Wall Access Panel - Fire-Rated: 1-1/2 hour B-label with maximum temperature rise of 110 degrees C; suitable for both horizontal or vertical installation; sizes as indicated on Drawings; and meeting the following characteristics:

- .1 Door: 48 mm deep, 1.2 mm thick sheet steel, insulated with non-rigid mineral fibre insulation, completely filling door cavity.
- .2 Box Frame: 1.5 mm thick sheet steel, complete with 25 mm wide, 0.61 mm thick galvanized steel perforated flange.
- .3 Closer: Automatic, spring-type.
- .4 Hinge: Fully concealed, 170 degree opening pivot-type.
- .5 Latch: Self-latching direct action lock opposite hinge; lock designed to accept both key and knurled knob included with each door.
- .6 Manufacturer and Product Name: eg. Model WB-FR Standard Fire Rated Access Door With Drywall Bead by The Williams Brothers Corporation.

.2 Gypsum Board Ceiling Access Panel - Fire-Resistive: Suitable for horizontal installation in fire rated gypsum ceilings; sizes as indicated on Drawings; and meeting the following characteristics:

- .1 Door: 1.6 mm thick sheet steel, recessed 38 mm to receive double layer of gypsum board infill.
- .2 Frame: 1.6 mm thick sheet steel, hat-channel shape.
- .3 Hinge: Full length piano hinge, 180 degree opening.
- .4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
- .5 Manufacturer and Product Name: eg. Model WB-ATR Fire-Resistive Ceiling Access Door by The Williams Brothers Corporation.

.3 Gypsum Board Wall Access Panel - Non-Rated: Suitable for vertical installation in gypsum board partitions; sizes as indicated on Drawings; and meeting the following characteristics:

- .1 Door: 1.9 mm thick sheet steel, recessed design to receive gypsum board infill.
- .2 Box Return Frame: 1.6 mm thick sheet steel, complete with 25 mm wide, 0.61 mm thick galvanized steel perforated flange.

- .3 Hinge: Full length piano hinge, 110 degree opening.
- .4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
- .5 Manufacturer and Product Name: eg. Model WB-RDW Access Door for Drywall Surfaces by The Williams Brothers Corporation.
- .4 Gypsum Board Ceiling Access Panel - Non-Rated: Suitable for horizontal installation in gypsum board ceilings; sizes as indicated on Drawings; and meeting the following characteristics:
  - .1 Door: 2.0 mm thick extruded aluminum, complete with 16 mm thick moisture resistant gypsum board infill, brush gasket, and safety chain.
  - .2 Box Return Frame: 2.0 mm thick extruded aluminum, concealed flange of depth to match adjacent ceiling board thickness.
  - .3 Hinge: Concealed pivot hinge, allowing for door removal.
  - .4 Latch: Push to open latch.
  - .5 Manufacturer and Product Name: eg. Model WB-NTG Recessed Drywall Access Door by The Williams Brothers Corporation.
- .5 Masonry Wall Access Panel - Fire-Rated: 1-1/2 hour B-label with maximum temperature rise of 110 degrees C; suitable for both horizontal or vertical installation; and meeting the following characteristics:
  - .1 Door and Trim: 48 mm deep, 1.9 mm thick sheet steel, with rolled safety edge on inside of door; insulated with non-rigid mineral fibre insulation, completely filling door cavity.
  - .2 Return Frame: 1.5 mm thick sheet steel, complete with 4 masonry strap anchors.
  - .3 Closer: Automatic, spring-type.
  - .4 Hinge: Continuous piano hinge, 180 degree opening.
  - .5 Latch: Self-latching keyed cylinder paddle latch, opposite hinge.
  - .6 Manufacturer and Product Name: eg. Model WB-FR Premium Ultra Fire-Rated Access Door by The Williams Brothers Corporation.
- .6 Masonry Wall Access Panel - Non-Rated: Suitable for both horizontal or vertical installation in masonry or concrete partitions or bulkheads; and meeting the following characteristics:
  - .1 Door: 1.9 mm thick sheet steel.
  - .2 Return Frame: 1.2 mm thick sheet steel, complete with 4 masonry strap anchors.
  - .3 Hinge: Fully concealed, piano type.
  - .4 Latch: Flush, stainless steel cam designed to be operated with a screwdriver.
  - .5 Manufacturer and Product Name: eg. Model WB-GP Premium General Purpose Access Door by The Williams Brothers Corporation.

## 2.5 FINISHES

- .1 Aluminum: Standard factory mill finish.
- .2 Baked Enamel Primer on Steel: Electrostatically-applied baked enamel grey primer applied over rust-inhibiting phosphate treatment; paintable.

## 3 Execution

### 3.1 PREPARATION

- .1 Coordinate installation of access panels in masonry walls with Section 04 22 00.
- .2 Coordinate installation of access panels in gypsum board partitions and ceilings with Section 09 21 16.
- .3 Coordinate locations of access panels with facility services Subcontractors.

### 3.2 INSTALLATION

- .1 Install Products straight, plumb and level.



- .2 Install Products flush with adjacent surfaces.
- .3 Install Products for long life under hard use.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 04 22 00 - Concrete Unit Masonry.
  - .2 Section 05 10 00 - Structural Metal Framing.
  - .3 Section 05 50 00 - Metal Fabrications.
  - .4 Section 09 90 00 - Painting and Coating.
- 1.2 REFERENCES
  - .1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
  - .2 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .4 ASTM A229/A229M-18: Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs.
  - .5 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .6 ASTM A780/A780M-09(2015): Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - .7 CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel.
  - .8 CSA G40.21-13 (R2018): Structural Quality Steel.
  - .9 CSA W47.1:19: Certification of Companies for Fusion Welding of Steel.
  - .10 CSA W55.3-08 (R2018): Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .11 CSA W59-18: Welded Steel Construction (Metal Arc Welding).
  - .12 DASMA 204-2018: Standard for Fire Rated Rolling Door Assemblies.
  - .13 NFPA 80-2007: Fire Doors and Other Opening Protectives.
- 1.3 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating sizes, closure type, arrangement of hardware, required clearances, fabrication methods, and anchorage details.
- 1.4 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

## 1.5 QUALIFICATIONS

- .1 Fabricator: A firm specializing in fabricating coiling counter shutters, having minimum 3 years documented experience and a member of DASMA.
- .2 Welders: Workers certified by CWB to CSA W47.1 and CSA W55.3.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Amstel Manufacturing.
  - .2 Atlas Door.
  - .3 Cookson Company, Inc.
  - .4 McKeon Door Company.
  - .5 Overhead Door Corporation.
  - .6 Security Rollo Ltd.
  - .7 Wayne-Dalton Corporation.

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

### 2.2 DESCRIPTION

- .1 Counter Shutter - Fire Rated: Galvanized steel construction; 3 hour fire rating with ULC label and automatic closing operation activated by fusible link mechanism; complete with a governor regulating shutter's rate of descent during automatic door closure to a safe closing speed; manual push-up operation; powder coated finish; eg. Firestar 540 Series by Wayne-Dalton Corporation.

### 2.3 REGULATORY REQUIREMENTS

- .1 Fire Rated Closure: To NFPA 80.

### 2.4 MATERIALS

- .1 Sheet Steel: To ASTM A653/A653M, Structural Steel (SS) Grade 230, Types 1 and 2; cold-rolled sheet steel, galvanized.
- .2 Steel Sections and Plates: To CSA G40.20 and CSA G40.21, Grade 300W.
- .3 Fasteners: Series 300 stainless steel.
- .4 Welding Materials: To CSA W59.
- .5 Touch-up Primer: Zinc-rich paint type.

### 2.5 COMPONENTS

- .1 Curtain Slat: 0.76 mm thick galvanized sheet steel; 13 mm deep, 48 mm wide flat profile; eg. No. 17 Slat by Wayne-Dalton Corporation.
- .2 Bottom Slat: Galvanized steel, tubular shape, complete with slide bolt locks.
- .3 Counterbalance Assembly: Oil tempered torsion type helical springs to ASTM A229/A229M, complete with spring barrel.
- .4 Curtain Hood: 174 x 174 mm size hood enclosure; fabricated from 0.46 mm thick galvanized steel sheet.
- .5 Brackets: 4.76 mm thick galvanized steel plates, with permanently sealed bearings.

- .6 Guides: Galvanized steel, sealed box-type guides, upward expandable.
- .7 Automatic Release Mechanism: Thermally-actuated fusible link, rated at 74 degrees C.
- .8 Manual Release Mechanism: Manufacturer's standard release handle.
- .9 Governor: Engagement only after cable release, restricting automatic door closing speed to between 0.15 m/s and 0.61 m/s.
- .10 Seals: Flexible vinyl type.

## 2.6 FABRICATION

- .1 Prior to fabrication, verify existing conditions and take field measurements necessary to ensure a perfect fit.
- .2 Fabricate fire-rated coiling shutters to DASMA 204; complete with fire rating label clearly visible.
- .3 Provide endlocks fitted to ends of alternate slats.
- .4 Provide counter balance assembly with torsion spring for easy manual operation.
- .5 Store curtain in metal hood.
- .6 Provide automatic closure operation activated by fusible link mechanism.
- .7 Provide slide bolt lock mechanisms to secure coiling counter shutter in closed position.

## 2.7 FINISHES

- .1 Shop Priming:
  - .1 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
  - .2 Do not prime surfaces designated to come into direct contact with concrete, or where field welding is required.
  - .3 Prime paint components using minimum two coats primer.
- .2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .5 Powder Coated Finish on Sheet Steel: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colour as selected by Consultant.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify site measurements of existing openings to ensure suitability.

### 3.2 INSTALLATION

- .1 Securely install Products to DASHMA 204; complete with necessary fitments and trim.
- .2 Install Products straight, plumb and square, in accordance with accepted Shop Drawings.
- .3 Connect fire-rated coiling shutters to fusible link mechanism.

### 3.3 FIELD QUALITY CONTROL

- .1 Drop test fire-rated coiling shutters to NFPA 80.
- .2 Submit written statement attesting to successful operation at time of installation.

### 3.4 ADJUSTING

- .1 Adjust Products to operate smoothly and correctly.
- .2 Make Good damaged or defective galvanized coatings to ASTM A780/A780M.

### 3.5 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Instruct Owner's personnel in proper operating and maintenance procedures.
- .3 Demonstrate fire-rated coiling shutter drop test device operation and coiling shutter re-setting procedure.

### 3.6 MAINTENANCE

- .1 Adjust and maintain completed installation during warranty period.
- .2 Upon completion of warranty period, test fire-rated coiling shutters for proper operation and full closure. Re-set release mechanism.
- .3 Submit a written record to Owner and authority having jurisdiction, verifying fire-rated coiling shutters operate properly at completion of warranty period.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 07 26 00 - Vapour Retarders.
- .4 Section 07 27 00 - Air Barriers.
- .5 Section 07 27 36 - Sprayed Foam Air Barrier.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .8 Section 08 51 13 - Aluminum Windows.
- .9 Section 08 71 00 - Door Hardware.
- .10 Section 08 80 00 - Glazing.
- .11 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 AAMA CW-10-15: Care and Handling of Architectural Aluminum from Shop to Site.
- .2 AAMA 501.1-17: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- .3 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .4 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .5 AAMA SFM-1-14: Aluminum Storefront and Entrance Manual.
- .6 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .7 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .8 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .9 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .10 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .11 ASTM D3363-2020: Standard Test Method for Film Hardness by Pencil Test.
- .12 ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .13 ASTM E330/E330M-14(2021): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

- .14 ASTM E331-00(2023): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  - .15 CSA A440.2:22: Fenestration Energy Performance.
  - .16 CSA A440.4:19: Window, Door, and Skylight Installation.
  - .17 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
  - .18 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- 1.3 PRODUCT DATA
- .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, component sizes, anchorage and fasteners, glass and infill, specified door hardware, internal drainage details and thermal break details.
- 1.4 SHOP DRAWINGS
- .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating:
    - .1 Large scale details of members and materials, of brackets and anchorage devices and of connection and jointing details;
    - .2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
    - .3 Dimensions and thicknesses;
    - .4 Glazing details, description of materials including catalogue numbers, products and manufacturer's names;
    - .5 Aluminum alloy and temper designations;
    - .6 Finish specifications; and
    - .7 Other pertinent data.
  - .3 Submit documentation of:
    - .1 Thicknesses, profiles and descriptions of components used in assembly.
    - .2 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project and meet specified performance criteria.
    - .3 Ensure calculations are stamped, signed and dated by fabricator's design engineer.
- 1.5 CERTIFICATES
- .1 Submit certifications as specified in Section 01 40 00.
  - .2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.
- 1.6 TEST AND EVALUATION REPORTS
- .1 Submit test reports as specified in Section 01 33 00.
  - .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past 5 years.
- 1.7 CLOSEOUT SUBMITTALS
- .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.8 QUALIFICATIONS

- .1 Fabricator's Design Engineer: A professional structural engineer experienced in designing aluminum-framed entrances and storefronts, licensed to practice at Place of the Work.
- .2 Fabricator and Installer: A firm specializing in fabricating and installing aluminum-framed entrances and storefronts, having minimum 5 years documented experience.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Conform to AAMA CW-10.
- .3 Take precautionary measures and adequately protect aluminum and aluminum finishes to prevent damage during fabrication, storage, shipping, handling and installation.
- .4 Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.

1.10 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: For a period of 10 years, covering the following:
  - .1 Finish: Replace any unit whose finish shows defects such as but not limited to delamination, blistering or excessive fading.
  - .2 Performance: Replace or repair any unit with air leakage, water leakage, defects or malfunctions under normal usage.
- .3 Installer's Extended Warranty: For a period of two years, protecting against leakage, operational defects and malfunction under normal usage.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Aerloc Industries Ltd.
  - .2 Alumicor.
  - .3 Alwind Industries, Ltd.
  - .4 Commdoor Aluminum.
  - .5 CRL US Aluminum.
  - .6 Kawneer.
  - .7 Oldcastle BuildingEnvelope.
  - .8 Windspec Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Exterior Entrance Doors and Frames: Thermally-broken tubular aluminum extrusions, factory anodized finish, site glazed with sealed insulating glass units, complete with sills, thresholds, flashings, specified door hardware, anchorages and attachment devices.
- .2 Interior Vestibule Doors and Frames: Tubular aluminum extrusions, factory anodized finish, site glazed with single pane tempered safety glass, complete with specified door hardware, anchorages and attachment devices.



## 2.3 PERFORMANCE CRITERIA

- .1 Exterior Entrance Doors and Frames: Meeting the following performance criteria:
  - .1 Air Leakage (ASTM E283):
    - .1 Frames:  $\leq 0.2 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
    - .2 Doors:  $\leq 1.5 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
  - .2 Water Penetration:
    - .1 Static Pressure (ASTM E331): No penetration @ 103 kPa.
    - .2 Dynamic Pressure (AAMA 501.1): No penetration @ 103 kPa.
  - .3 Wind Load Resistance (ASTM E330/E330M): Limit mullion deflection to L/175 when measured at a cross pressure of 275 kPa.
  - .4 Temperature Index (CSA A440.2):  $I \geq 53$ .
  - .5 Assembly Thermal Transmittance (ANSI/NFRC 100):
    - .1 Frames:  $U \leq 2.15 \text{ W/m}^2 \text{ degrees C}$ .
    - .2 Doors:  $U \leq 3.94 \text{ W/m}^2 \text{ degrees C}$ .
  - .6 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} \leq 0.40$ .

## 2.4 DESIGN CRITERIA

- .1 Design assemblies to AAMA SFM-1.
- .2 Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall in accordance with applicable regulatory requirements.
- .3 Design assemblies to drain water entering joints, condensation occurring in glazing channels and migrating moisture occurring within system to exterior.

## 2.5 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063-T54 alloy.
- .2 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.
- .3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.
- .4 Steel Sections: Shaped to suit mullion sections.
- .5 Fasteners: Stainless steel, 300 Series.
- .6 Thermal Break: Rigid polyamide.
- .7 Vapour Retarder: As specified in Section 07 26 00.
- .8 Air Barriers: As specified in Section 07 27 00.
- .9 Air Sealant Foam: As specified in Section 07 27 36.
- .10 Glazing Materials: As specified in Section 08 80 00.
- .11 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.
- .12 Joint Sealants: As specified in Section 07 92 00, Types as follows:
  - .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
  - .2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
  - .3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.
- .13 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

## 2.6 COMPONENTS

- .1 Exterior Entrance Frames: 2.5 mm thick extruded aluminum sections, 50 x 115 mm size profiles; thermally broken with interior tubular section insulated from exterior; applied glazing stops; drainage holes; internal weep drainage system; eg. Trifab VG 451T by Kawneer.
- .2 Interior Vestibule Frames: 2.5 mm thick extruded aluminum sections, 45 x 115 mm size profiles; flush glazing stops; drainage holes; internal weep drainage system; eg. Trifab VG 450 by Kawneer.
- .3 Exterior Entrance Doors: 2.5 mm thick extruded aluminum sections, 57.2 mm deep profile; 127 mm wide top rail and vertical stiles, 165 mm wide bottom rail; thermally broken with interior tubular section insulated from exterior; rectangular glazing stops; eg. 560 Insulclad by Kawneer.
- .4 Interior Vestibule Doors: 2.5 mm thick extruded aluminum sections, 44.5 mm deep profile; 127 mm wide top rail and vertical stiles, 165 mm wide bottom rail; beveled glazing stops; eg. 500 Wide Stile by Kawneer.
- .5 Compensating Receptors: 51 x 140 mm size, extruded aluminum sections, head and jamb types.
- .6 Metal Flashing: 2.5 mm thick extruded aluminum, finish to match mullion sections where exposed.
- .7 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams.
- .8 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.
- .9 Glass: As specified in Section 08 80 00, Types as indicated on Drawings.

## 2.7 HARDWARE

- .1 Door Handles: 25 mm OD aluminum tubing, ladder style, with anodized finish to match door stiles.
- .2 Hinges: 114.3 x 101.6 mm size, commercial quality steel, radius corner standard template butt style, 5 knuckle construction with two stainless steel ball bearings and non-rising removable pin; powder coated finish on exterior applications; 1-1/2 pairs per door leaf.
- .3 Push Bars: 25 mm OD aluminum tubing with anodized finish to match door stiles, double bend, 57 mm from face of door.
- .4 Drop Arm Holder: Cast aluminum, surface-mounted, pivoting rubber-tipped holder-arm; anodized finish to match door stile.
- .5 Weatherstripping and Sill Sweep Strips: Manufacturers standard type to suit application, finish to match door and frame.
- .6 Thresholds: Extruded aluminum, low profile design, width to suit application, mill finish.
- .7 All other finish hardware is specified in Section 08 71 00. This may include panic hardware, closers, powered door operators, locks and cylinders.

## 2.8 FABRICATION

- .1 Fabricate entrance and storefront assemblies to AAMA SFM-1.
- .2 Fabricate Products with minimum clearances and shim spacing around assembly perimeter.
- .3 Make joints flush, hairline, and weatherproof.

- .4 Arrange fasteners and attachments to conceal from view.
- .5 Prepare components with internal reinforcement for door hardware and door operator hinge hardware.
- .6 Provide connection flange to full perimeter of frame, attached from interior side of frame with concealed fasteners cut flush with face of flange. Pre-drill fastener holes into flange to accommodate immediate on-site installation.
- .7 Prepare doors and frames for required door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components as required.

## 2.9 FINISHES

- .1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.
- .2 Steel Door Hardware: To ANSI/BHMA 652 - Satin Chromium Plated.
- .3 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .4 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .5 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to CSA A440.4.
- .2 Permanently fasten frames to building structure.
- .3 Align assembly plumb and level, free of warp or twist.
- .4 Maintain assembly dimensional tolerances, aligning with adjacent work.
- .5 Fasten connection flange to wall assembly and connect transition sheet membrane to flange.
- .6 Seal connection flange to transition sheet membranes with continuous bead of joint sealant prior to application of air sealant foam.
- .7 Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.
- .8 Install hardware using templates provided.
- .9 Install glass as specified in Section 08 80 00.
- .10 Provide perimeter joint sealant as specified in Section 07 92 00.

### 3.2 TOLERANCES

- .1 Deviation From Plumb and Level:  $\leq 3$  mm in 3 000 mm.

### 3.3 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean glass and aluminum surfaces.

- .3 Do not scratch or damage surfaces.
- .4 Do not remove protective cover from door units until after final cleaning operations have been completed.

3.4 PROTECTION

- .1 Protect installed Products as specified in Section 01 76 00.
- .2 Provide protective coatings on surfaces subject to damage.
- .3 Prevent scratches and overspray of concrete and grout.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 06 10 00 - Rough Carpentry.
- .4 Section 07 26 00 - Vapour Retarders.
- .5 Section 07 27 00 - Air Barriers.
- .6 Section 07 27 36 - Sprayed Foam Air Barrier.
- .7 Section 07 84 00 - Firestopping.
- .8 Section 07 92 00 - Joint Sealants.
- .9 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .10 Section 08 51 13 - Aluminum Windows.
- .11 Section 08 80 00 - Glazing.
- .12 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 AAMA CWM-19: The Curtain Wall Manual.
- .2 AAMA CW-10-15: Care and Handling of Architectural Aluminum from Shop to Site.
- .3 AAMA 501.1-17: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- .4 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .5 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .6 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .7 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .8 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .9 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .10 ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .11 ASTM E330/E330M-14(2021): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .12 ASTM E331-00(2023): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

- .13 CAN/CGSB-79.1-M91: Insect Screens.
- .14 CAN/CSA-S157-05 (R2010): Strength Design in Aluminum.
- .15 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
- .16 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

### 1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating:
  - .1 Large scale details of members and materials, of brackets and anchorage devices and of connection and jointing details;
  - .2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
  - .3 Dimensions and thicknesses;
  - .4 Glazing details, description of materials including catalogue numbers, products and manufacturer's names;
  - .5 Aluminum alloy and temper designations;
  - .6 Finish specifications; and
  - .7 Other pertinent data.
- .3 Submit documentation of:
  - .1 Compliance with AAMA CWM.
  - .2 Thicknesses, profiles and descriptions of components used in assembly.
  - .3 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project and meet specified performance criteria.
  - .4 Ensure calculations are stamped, signed and dated by fabricator's design engineer.

### 1.4 CERTIFICATES

- .1 Submit certifications as specified in Section 01 40 00.
- .2 Frame Certification: A certificate issued by aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

### 1.5 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past 5 years.

### 1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions, sufficient quantity for inclusion in operation and maintenance manual.

### 1.7 QUALIFICATIONS

- .1 Fabricator's Design Engineer: A professional structural engineer experienced in designing glazed aluminum curtain wall, licensed to practice at Place of the Work.
- .2 Fabricator and Erector: A firm specializing in fabricating and erecting glazed aluminum curtain wall, having minimum 5 years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Conform to AAMA CW-10.
- .3 Take precautionary measures and adequately protect aluminum and aluminum finishes to prevent damage thereto during fabrication, storage, shipping, handling and installation.
- .4 Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.

1.9 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: For a period of 10 years, covering the following:
  - .1 Finish: Replace any unit whose finish shows defects such as but not limited to delamination, blistering or excessive fading.
  - .2 Performance: Replace or repair any unit with air leakage, water leakage, defects or malfunctions under normal usage.
- .3 Installer's Extended Warranty: For a period of two years, protecting against leakage, operational defects and malfunction under normal usage.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Aerloc Industries Ltd.
  - .2 Alumicor.
  - .3 Alwind Industries, Ltd.
  - .4 Commdoor Aluminum.
  - .5 CRL US Aluminum.
  - .6 Kawneer.
  - .7 Oldcastle BuildingEnvelope.
  - .8 Windspec Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Glazed Aluminum Curtain Wall: Extruded aluminum frame and operable vent sash sections, shop fabricated, factory anodized finish; site glazed with sealed insulating glass units and insulated spandrel glass panels; complete with insect screens, metal flashings, metal sills, metal closure panels, anchorages and attachment devices.
- .2 Configuration: As indicated on Window Schedule.

2.3 PERFORMANCE CRITERIA

- .1 Glazed Aluminum Curtain Wall: To AAMA CWM; meeting the following performance criteria:
  - .1 Performance Class: AW-PG40-FW.
  - .2 Air Infiltration (ASTM E283):
    - .1 Fixed:  $\leq 0.01 \text{ L/s}\cdot\text{m}^2 @ 300 \text{ Pa}$ .
    - .2 Operable Vent (Class AW-PG40-AP):  $\leq 0.5 \text{ L/s}\cdot\text{m}^2 @ 300 \text{ Pa}$ .
  - .3 Water Penetration:
    - .1 Static Pressure (ASTM E331): No penetration @ 103 kPa.
    - .2 Dynamic Pressure (AAMA 501.1): No penetration @ 103 kPa.

- .4 Design Wind Load (ASTM E330/E330M): Limit mullion deflection to  $L/175$  for spans up to 4 115 mm and  $L/240+6\text{mm}$  for spans above 4 115 mm, when measured at a cross pressure of 275 kPa.
- .5 Assembly Thermal Transmittance (ANSI/NFRC 100):
  - .1 Fixed Units:  $U \leq 2.15 \text{ W/m}^2 \text{ degrees C.}$
  - .2 Operable Vents:  $U \leq 2.56 \text{ W/m}^2 \text{ degrees C.}$
- .6 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} \leq 0.40.$

## 2.4 DESIGN CRITERIA

- .1 Design curtain wall assemblies to AAMA CWM.
- .2 Design curtain wall assemblies to drain water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system to exterior.
- .3 Design curtain wall assemblies with glazing cavities compartmentalized horizontally to prevent air movement.
- .4 Design intermediate members within units to be either solid or tubular design to suit wind loading, weight carrying requirements and wind deflection limitations.
- .5 Design coupling mullions to permit unit module construction and provide for thermal expansion. When required reinforce wind load carrying members with steel reinforcement suitably treated to prevent electrolytic action.
- .6 Design light gauge aluminum products to CAN/CSA-S157.
- .7 Mullion Deflection Limits: Maintain integrity of glass and seals at design loading. Prevent permanent deformation of members caused by applied loads. Prevent deflection that could result in noise, breaking of adhesives or sealants, to cause them to touch other building components, or to break the integrity of the insulation thermal blanket or air/vapour barrier seal.
- .8 Design anchors, fasteners and braces so as to limit their structural stress to not more than 50 percent of the allowable stress when maximum load conditions are applied.
- .9 Design glass not to exceed a statistical probability of failure of 8 units per thousand, representing a safety factor of 2.5.
- .10 Design frames so that edges of inner pane of insulating glass units do not fall more than 8 degrees C below the temperature of the centre of the inner pane.
- .11 Design and supply floor edge angles for support of curtain wall mullions and provide the necessary anchorage to support eccentric loads on the angle. Arrange for angles to be cast in to the floor slabs. Submit a fully dimensioned plan drawing to locate angles.
- .12 Design operable vents to have a restricted opening not exceeding 100 mm.

## 2.5 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy.
- .2 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.
- .3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.
- .4 Steel Sections: Shaped to suit mullion sections.
- .5 Fastener: 300 Series stainless steel.
- .6 Screen Mesh: 18/16 aluminum mesh, Black colour.



- .7 Bituminous Coating: Fibre asphalt emulsion.
- .8 Thermal Break: Rigid polyamide.
- .9 Vapour Retarder: As specified in Section 07 26 00.
- .10 Air Barriers: As specified in Section 07 27 00.
- .11 Air Sealant Foam: As specified in Section 07 27 36.
- .12 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.
- .13 Joint Sealants: As specified in Section 07 92 00, Types as follows:
  - .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
  - .2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
  - .3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.
- .14 Glazing Materials: As specified in Section 08 80 00.
- .15 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

## 2.6 COMPONENTS

- .1 Frames and Mullions: 2.5 mm thick extruded aluminum sections, 64 mm wide, adequate depth to accommodate design loads but not less than that indicated on Drawings; thermally broken with interior tubular section insulated from exterior; applied fiberglass pressure plates; complete with drainage holes, internal weep drainage system, continuous aluminum mounting flange, and special corner adapters as necessary; eg. 1600UT System 1 by Kawneer.
- .2 Caps: 2.5 mm thick extruded aluminum; 64 mm wide, 19.1 mm deep; snap-on type.
- .3 Operable Vent Sash: 2.5 mm thick extruded aluminum sections; 81 x 57 mm size profile, top-hinged projecting out (TPO) design; thermally broken with interior tubular section insulated from exterior; applied glazing stops; eg. 526 TPO Isoport Window by Kawneer.
- .4 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams.
- .5 Metal Flashings: 2.0 mm thick extruded aluminum, finish to match mullion sections where exposed.
- .6 Metal Closure Panels: 1.2 mm thick aluminum sheet, sizes to suit spandrel panel openings; bent returns on 4 sides to accommodate attachment to curtain wall framing; complete with anodized finish.
- .7 Operable Vent Hardware:
  - .1 Hinges: Stainless steel 4 bar hinges, complete with limit stop device.
  - .2 Operator: Pivot shoe roto operator complete with collapsable crank handle.
  - .3 Lockable Handles: Hook bolt lock handle, complete with sash mounted strike plate.
  - .4 Weatherstripping: Manufacturers standard type to suit application, finish to match frame.
- .8 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.
- .9 Glass: As specified in Section 08 80 00, Types as indicated on Drawings.

## 2.7 FABRICATION

- .1 Fabricate Products to AAMA CWM.
- .2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.
- .3 Make joints flush, hairline and weatherproof.

- .4 Arrange fasteners and attachments to conceal from view.
- .5 Prepare components with internal reinforcement for operating hardware.
- .6 Provide minimum two lockable handles per operable vent sash.
- .7 Overlap and seal glazing flanges of abutting members for the entire depth and width of the flanges to provide a solid unbroken water barrier. Glass stops shall be screwless, lock-in type.
- .8 Provide fully resilient settings for glass and panels by use of EPDM elastomeric glazing gaskets on both sides of glass installed in curtain wall frames.
- .9 Provide connection flange to full perimeter of frame assembly, attached from interior side of frame with concealed fasteners cut flush with the face of the flange. Pre-drill fastener holes into flange to accommodate immediate on-site installation.
- .10 Insect Screens
  - .1 Fabricate screen frames from tubular extruded aluminum, to CAN/CGSB-79.1-M; prefinished to match curtain wall framing.
  - .2 Secure screen mesh to screen frame with a removable polyethylene spline.
  - .3 Secure screen assembly to curtain wall frames using mechanical fasteners as required by authorities having jurisdiction.

## 2.8 FINISHES

- .1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.
- .2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify adjoining air and vapour seal materials are ready to receive work of this Section.

### 3.2 PREPARATION

- .1 Apply heavy coat of bituminous paint on surfaces of aluminum placed in contact with concrete, mortar, plaster or dissimilar metals.
- .2 Supply fastenings and anchors required to be built-in to adjacent work to other Sections.

### 3.3 INSTALLATION

- .1 Install curtain wall assemblies to AAMA CWM.
- .2 Install Products in correct locations, level, square, plumb, free from distortion, properly aligned and at proper elevations.
- .3 Make joints neat, fine and weather tight. Provide additional mouldings and closures necessary.

- .4 Use appropriate fastening components compatible with supporting structure.
- .5 Install materials with clean cut edges, leaving spaces for expansion and contraction between edge of material and inside of frame as recommended by manufacturer.
- .6 Fasten connection flange to wall assembly and connect building envelope air barrier membrane to flange.
- .7 Seal connection flange to transition sheet membranes with continuous bead of joint sealant prior to application of air sealant foam.
- .8 Install metal closure panels securely fastened to curtain wall frames for concealment of spandrel panel back pans, in locations indicated on Drawings.
- .9 Install glazing as specified in Section 08 80 00.
- .10 Fill gaps between curtain wall frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.
- .11 Grind smooth exposed edges of aluminum sills, ensuring no sharp edges.
- .12 Provide perimeter joint sealant as specified in Section 07 92 00.

### 3.4 TOLERANCES

- .1 Deviation From Plumb and Level:  $\leq 3$  mm in 3 000 mm.

### 3.5 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Field Inspection and Testing: Arrange for independent testing agency to test a random selection of installed Product, verifying installed Products meet specified performance criteria.
- .3 Commissioning: Conduct thermographic survey of curtain wall to determine any areas where thermal barrier is not continuous.
- .4 Make Good installed Products not meeting specified performance criteria, and where thermographic survey indicates inadequate thermal resistance.
- .5 Re-test replacement Products at no additional cost to Owner.

### 3.6 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean glass and aluminum surfaces.
- .3 Do not scratch or damage surfaces.
- .4 Do not remove protective cover from framing until final cleaning operations.

### 3.7 PROTECTION

- .1 Protect installed Products as specified in Section 01 76 00.
- .2 Provide protective coatings on surfaces subject to damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 05 40 00 - Cold-Formed Metal Framing.
- .3 Section 07 26 00 - Vapour Retarders.
- .4 Section 07 27 00 - Air Barriers.
- .5 Section 07 27 36 - Sprayed Foam Air Barrier.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .8 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .9 Section 08 80 00 - Glazing.
- .10 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 AAMA CW-10-15: Care and Handling of Architectural Aluminum from Shop to Site.
- .2 AAMA/WDMA/CSA 101/I.S. 2/A440-22: North American Fenestration Standard / Specification for Windows, Doors and Skylights.
- .3 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .4 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .6 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .7 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .8 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .9 CAN/CGSB-79.1-M91: Insect Screens.
- .10 CSA A440S1:19: Canadian Supplement to AAMA/WDMA/CSA 101/I.S. 2/A440-17, North American Fenestration Standard / Specification for Windows, Doors and Skylights.
- .11 CSA A440.2:22: Fenestration Energy Performance.
- .12 CSA A440.4:19: Window, Door, and Skylight Installation.
- .13 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
- .14 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.

- .2 Shop Drawings: Project-specific drawings, illustrating:
  - .1 Large scale details of members and materials, of brackets and anchorage devices and of connection and jointing details;
  - .2 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
  - .3 Dimensions and thicknesses;
  - .4 Glazing details, description of materials including catalogue numbers, products and manufacturer's names;
  - .5 Aluminum alloy and temper designations;
  - .6 Finish specifications; and
  - .7 Other pertinent data.
- .3 Submit documentation of:
  - .1 Compliance with AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1.
  - .2 Thicknesses, profiles and descriptions of components used in assembly.
  - .3 Engineering calculations verifying assembly has been designed, constructed and attached to withstand forces anticipated for Project and meet specified performance criteria.
  - .4 Ensure calculations are stamped, signed and dated by fabricator's design engineer.

#### 1.4 CERTIFICATES

- .1 Submit certifications as specified in Section 01 40 00.
- .2 Frame Certification: A certificate from aluminum extruder certifying aluminum alloys and tempers meet or exceed specified types.

#### 1.5 TEST AND EVALUATION REPORTS

- .1 Submit test reports as specified in Section 01 33 00.
- .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past 5 years.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard maintenance and cleaning instructions; sufficient quantity for inclusion in operation and maintenance manual.

#### 1.7 QUALIFICATIONS

- .1 Fabricator's Design Engineer: A professional structural engineer experienced in designing aluminum windows, licensed to practice at Place of the Work.
- .2 Fabricator and Installer: A firm specializing in fabricating and installing aluminum windows, having minimum 5 years documented experience.

#### 1.8 MOCK-UPS

- .1 Construct mock-ups as specified in Section 01 40 00.
- .2 Mock-Up: One 1 220 x 1 220 mm size mock-up panel, including one corner cross section for each type of window assembly, demonstrating sill and jamb sections, and complete with thermal break, hardware, weatherstripping, glazing, screen, and shop-applied finishes.
- .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
- .4 Remove and replace installed Product that does not conform to accepted mock-up.
- .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Conform to AAMA CW-10.
- .3 Take precautionary measures and adequately protect frames and frame finishes to prevent damage during fabrication, storage, shipping, handling and installation.
- .4 Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.
- .5 Deliver and store units carefully to avoid damage to window frame.

1.10 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: For a period of 10 years, covering the following:
  - .1 Finish: Replace any window unit whose finish shows defects, such as but not limited to delamination, blistering or excessive fading.
  - .2 Performance: Replace or repair any window unit with air leakage, water leakage, defects or malfunctions under normal usage.
- .3 Installer's Extended Warranty: For a period of two years, protecting against leakage, operational defects and malfunction under normal usage.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Aerloc Industries Ltd.
  - .2 Alumicor.
  - .3 Alwind Industries, Ltd.
  - .4 Commdoor Aluminum.
  - .5 CRL US Aluminum.
  - .6 Kawneer.
  - .7 Oldcastle BuildingEnvelope.
  - .8 Windspec Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Aluminum Windows: Extruded aluminum frame and operable vent sash sections, shop fabricated, black anodized finish; site-glazed with sealed insulating glass units; complete with insect screens, metal sills, metal flashings, anchorages and attachment devices.
- .2 Configuration: As indicated on Window Schedule.

2.3 PERFORMANCE CRITERIA

- .1 Aluminum Windows: To AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1, and meeting the following performance criteria:
  - .1 Air Tightness:
    - .1 Fixed Units: Class Fixed.
    - .2 Operable Vents: Class A3.
  - .2 Water Tightness: Class B3.
  - .3 Wind Load Resistance: Class C5.
  - .4 Screen Strength: Class S1.
  - .5 Forced Entry: Class F2.

- .6 Temperature Index (CSA A440.2):  $I \geq 58$ .
- .7 Assembly Thermal Transmittance (ANSI/NFRC 100):
  - .1 Fixed Units:  $U \leq 2.15 \text{ W/m}^2 \text{ degrees C}$ .
  - .2 Operable Vents:  $U \leq 2.56 \text{ W/m}^2 \text{ degrees C}$ .
- .8 Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} \leq 0.40$ .

## 2.4 DESIGN CRITERIA

- .1 Design assembly to drain water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system to the exterior.
- .2 Design intermediate members within units to be either solid or tubular design to suit wind loading, weight carrying requirements and wind deflection limitations.
- .3 Design coupling mullions to permit unit module construction and provide for thermal expansion. When required, reinforce wind load carrying members with steel reinforcement suitably treated to prevent electrolytic action.
- .4 Design operable vents to have a restricted opening not exceeding 100 mm.

## 2.5 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy.
- .2 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.
- .3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel, galvanized.
- .4 Steel Sections: Shaped to suit mullion sections.
- .5 Fastener: Stainless steel.
- .6 Screen Mesh: 18/16 aluminum mesh, Black colour.
- .7 Bituminous Coating: Fibred asphalt emulsion.
- .8 Thermal Break: Rigid polyamide.
- .9 Vapour Retarder: As specified in Section 07 26 00.
- .10 Air Barriers: As specified in Section 07 27 00.
- .11 Air Sealant Foam: As specified in Section 07 27 36.
- .12 Glazing Sealant: Type SEAL-GLZ as specified in Section 07 92 00.
- .13 Glazing Materials: As specified in Section 08 80 00.
- .14 Joint Sealants: As specified in Section 07 92 00, Types as follows:
  - .1 Exterior Applications: Exterior weatherseal sealant, Type SEAL-EXT.
  - .2 Transition Sheet Connections: Exterior flashing sealant, Type SEAL-EXT-FL.
  - .3 Interior Applications: Interior general purpose sealant, Type SEAL-INT-GP.
- .15 Touch-Up Primer for Galvanized Metal Surfaces: Zinc-rich paint type.

## 2.6 COMPONENTS

- .1 Frames and Mullions: 2.5 mm thick extruded aluminum; 127 mm deep profile; thermally broken with interior tubular section insulated from exterior; applied glazing stops; drainage holes; internal weep drainage system; eg. 518 Isoport by Kawneer.

- .2 Operable Vent Sash: 2.5 mm thick extruded aluminum sections; 81 x 57 mm size profile, top-hinged projecting out (TPO) design; thermally broken with interior tubular section insulated from exterior; applied glazing stops; eg. 526 TPO Isoport Window by Kawneer.
- .3 Metal Sills: 2.5 mm thick extruded aluminum sections, complete with pre-formed clip anchor; sufficient depth to extend beyond wall face, full length pieces to minimize joints; and with integral drip edge profile and end dams.
- .4 Metal Flashing: 2.0 mm thick extruded aluminum, finish to match mullion sections where exposed.
- .5 Operable Vent Hardware:
  - .1 Hinges: Stainless steel 4 bar hinges, complete with limit stop device.
  - .2 Operator: Pivot shoe roto operator complete with collapsable crank handle.
  - .3 Lockable Handles: Hook bolt lock handle, complete with sash mounted strike plate.
  - .4 Weatherstripping: Manufacturers standard type to suit application, finish to match frame.
- .6 Connection Flange: 3.0 mm thick extruded aluminum angle, size as indicated on Drawings.
- .7 Glass: As specified in Section 08 80 00, Types as indicated on Drawings.

## 2.7 FABRICATION

- .1 Fabricate Products to AAMA/WDMA/CSA 101/I.S. 2/A440 and CSA A440S1.
- .2 Fabricate Products with minimum clearances and shim spacing around perimeter of assembly.
- .3 Make joints flush, hairline, and weatherproof.
- .4 Arrange fasteners and attachments to conceal from view.
- .5 Prepare components with internal reinforcement for operating hardware.
- .6 Provide minimum two lockable handles per operable vent sash.
- .7 Overlap and seal glazing flanges of abutting members for entire depth and width of flanges to ensure a solid, unbroken air and water barrier. Glass stops shall be screwless, lock-in type.
- .8 Provide fully resilient settings for glass and panels by use of EPDM elastomeric glazing gaskets on both sides of glass installed in window frames.
- .9 Provide connection flange to full perimeter of frame, attached from interior side of frame with concealed fasteners cut flush with face of flange. Pre-drill fastener holes into flange to accommodate immediate on-site installation.
- .10 Insect Screens
  - .1 Fabricate screen frames of tubular extruded aluminum, to CAN/CGSB-79.1-M; prefinished to match window frames.
  - .2 Secure screen mesh to screen frame with removable polyethylene spline.
  - .3 Secure screen assemblies to window frames using mechanical fasteners as required by authorities having jurisdiction.

## 2.8 FINISHES

- .1 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.
- .2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.



- .4 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.

## 2.9 SOURCE QUALITY CONTROL

- .1 Perform shop inspection and testing as specified in Section 01 40 00.
- .2 Shop Inspection and Testing: Random tests conducted by independent testing agency on fabricated window framing at point of manufacture, verifying compliance with specified performance criteria.

## 3 Execution

### 3.1 PREPARATION

- .1 Apply heavy coat of bituminous paint on surfaces of aluminum placed in contact with concrete, mortar, plaster, or dissimilar metals.
- .2 Provide fastenings and anchors required to be built in to adjacent work to other Sections.

### 3.2 INSTALLATION

- .1 Install Products to CSA A440.4.
- .2 Install Products in correct locations, level, square, plumb, free from distortion, properly aligned, and at proper elevations.
- .3 Make joints neat, fine, and weathertight.
- .4 Allow for expansion and contraction of components.
- .5 Provide additional mouldings and closures necessary.
- .6 Use appropriate fasteners compatible with materials being fastened. Conceal fasteners.
- .7 Fasten connection flange to wall assembly and connect building envelope air barrier membrane to flange.
- .8 Seal connection flange to transition sheet membranes with continuous bead of joint sealant prior to application of air sealant foam.
- .9 Provide trim panning and flashings of sufficient size to neatly finish the window frame to the interior and exterior window opening.
- .10 Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.
- .11 Install glass as specified in Section 08 80 00.
- .12 Provide sills in place with anchoring devices located at ends and evenly spaced at 600 mm OC. Fasten expansion joint cover plates and drip deflectors with self-tapping stainless steel screws.
- .13 Maintain 6 mm to 9 mm space between butted ends of continuous sills. For sills over 1 220 mm in length, maintain 3 mm to 6 mm space at each end.
- .14 Install end dams at each sill.
- .15 Grind smooth exposed edges of aluminum sills, ensuring no sharp edges.
- .16 Provide joint sealants as specified in Section 07 92 00.

3.3 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Field Inspection and Testing: Random tests conducted by independent testing agency on installed windows, verifying compliance with specified performance criteria.
- .3 Make Good Products not meeting specified performance criteria.
- .4 Re-test replacement Products at no additional cost to Owner.

3.4 TOLERANCES

- .1 Deviation From Plumb and Level:  $\leq 3$  mm in 3 000 mm.

3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean glass and aluminum surfaces.
- .3 Do not scratch or damage surfaces.
- .4 Do not remove protective cover from framing until final cleaning operations.

3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Provide protective coatings on surfaces subject to damage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 08 12 13 - Hollow Metal Frames.
- .2 Section 08 13 13 - Hollow Metal Doors.
- .3 Section 08 14 00 - Wood Doors.
- .4 Section 26 01 16 - Electrical General Requirements.

1.2 REFERENCES

- .1 ANSI/BHMA A156.1-2016: Butts and Hinges.
- .2 ANSI/BHMA A156.2-2017: Bored & Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.3-2014: Exit Devices.
- .4 ANSI/BHMA A156.4-2019: Door Controls - Closers.
- .5 ANSI/BHMA A156.5-2014: Cylinders and Input Devices for Locks.
- .6 ANSI/BHMA A156.6-2010: Architectural Door Trim.
- .7 ANSI/BHMA A156.8-2010: Door Controls - Overhead Stops & Holders.
- .8 ANSI/BHMA A156.12-2018: Interconnected Locks & Latches.
- .9 ANSI/BHMA A156.13-2017: Mortise Locks.
- .10 ANSI/BHMA A156.14-2013: Sliding and Folding Hardware.
- .11 ANSI/BHMA A156.15-2015: Release Devices - Closer Holder, Electromagnetic and Electromechanical.
- .12 ANSI/BHMA A156.16-2018: Auxiliary Hardware.
- .13 ANSI/BHMA A156.17-2014: Self Closing Hinges & Pivots.
- .14 ANSI/BHMA A156.18-2016: Materials and Finishes.
- .15 ANSI/BHMA A156.19-2013: Power Assist & Low Energy Power Operated Doors.
- .16 ANSI/BHMA A156.21-2014: Thresholds.
- .17 ANSI/BHMA A156.22-2017: Door Gasketing and Edge Seal Systems.
- .18 ANSI/BHMA A156.23-2017: Electromagnetic Locks.
- .19 ANSI/BHMA A156.24-2012: Delayed Egress Locks.
- .20 ANSI/BHMA A156.25-2018: Electrified Locking Devices.
- .21 ANSI/BHMA A156.26-2017: Continuous Hinges.
- .22 ANSI/BHMA A156.28-2018: Recommended Practices for Mechanical Keying Systems.
- .23 ANSI/BHMA A156.29-2017: Exit Locks, Exit Alarms, Alarms for Exit Devices.
- .24 ANSI/BHMA A156.31-2019: Electric Strikes and Frame Mounted Actuators.
- .25 ANSI/BHMA A156.36-2016: Auxiliary Locks.
- .26 ANSI/BHMA A156.37-2014: Multipoint Locks.

- .27 CSDMA Recommended Dimensional Standard for Steel Doors and Frames.
  - .28 CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
  - .29 CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).
  - .30 ANSI/DHI A115.IG-1994: Installation Guide for Doors and Hardware.
  - .31 DHI Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
  - .32 DHI Recommended Locations for Architectural Hardware for Flush Wood Doors.
  - .33 DHI Sequence and Format for the Hardware Schedule.
  - .34 DHI Keying Systems and Nomenclature.
  - .35 DHI Abbreviations and Symbols.
  - .36 NFPA 80-2007: Fire Doors and Other Opening Protectives.
- 1.3 PREINSTALLATION MEETINGS
- .1 Refer to Section 01 31 00.
  - .2 Prior to installation of hardware, arrange a meeting between Owner, Contractor, Consultant, manufacturer, hardware Supplier, architectural hardware consultant, and installation Subcontractor to review materials, procedures and coordinate related work.
- 1.4 PRODUCT DATA
- .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, illustrating materials, sizes, and operating features for each specified piece of door hardware.
  - .3 Submit templates to installer prior to installation.
- 1.5 SHOP DRAWINGS
- .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific documents, including door hardware schedule, keying schedule, and wiring diagrams, as follows:
    - .1 Door Hardware Schedule, prepared by architectural hardware consultant (AHC), in vertical format, to DHI Sequence and Format for the Hardware Schedule.
    - .2 Keying Schedule: Prepared by architectural hardware consultant (AHC), to DHI Keying Systems and Nomenclature, including special keying notes and stamping instructions. Do not order locks and cylinders until key schedule has been accepted by Consultant.
    - .3 Wiring Diagrams: A written description of the functional use of power-operated door hardware. Include door and frame elevations showing location of each scheduled power-operated hardware item, including a wiring diagram showing number and size of conductors.
- 1.6 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Samples: One sample of each hardware item complete with fasteners, clearly labeled with hardware schedule designation and manufacturer's name and model number.

1.7 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Operating and Maintenance Data: Including maintenance instructions for each hardware item, catalogue cut sheets and Product data sheets for each Product, parts list for each Product, an updated copy of door hardware schedule illustrating actual Products installed, and a copy of final keying schedule.

1.8 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.
- .2 Extra Stock Materials: Clearly labeled to identify type of hardware, manufacturer name, model number, and finish; for each of the following:
  - .1 Ten key lock cylinders for each master keyed group.
  - .2 Three installation tools for passage sets, locksets and privacy sets.

1.9 QUALIFICATIONS

- .1 Hardware Supplier: A firm specializing in supplying institutional door hardware, having minimum 10 years documented experience.
- .2 Hardware Supplier Personnel: Employ a qualified architectural hardware consultant (AHC) to supervise scheduling and supplying door hardware.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Package hardware separately for each opening in a package which contains all hardware for that opening and is designated with applicable heading number, door number and key-set symbol.
- .3 Store Products in a clean, dry and secure area, on adequate shelving to permit organization so item numbers are readily visible.
- .4 Supply Products complete with keys, templates and installation instructions, together with all required screws, expansion shields, anchors, jigs and other related accessories for satisfactory attachment and installation of hardware.

1.11 WARRANTY

- .1 Submit manufacturers' standard extended warranties for each item of hardware.

2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Fire Rated Assemblies: To NFPA requirements for fire rated doors, frames and hardware.
- .2 Ensure fire exit requirements are met with regard to automatic closers, fusible links, positive latching, and direction of travel.

2.2 KEYING

- .1 Conform to ANSI/BHMA A156.28.
- .2 Key doors to Owner's existing GMK or MK system.
- .3 Provide visual key control (VKC) on face of each cylinder and on change keys.

## 2.3 DOOR HARDWARE

- .1 Butt Hinges: To ANSI/BHMA A156.1, Grade 1.
- .2 Continuous Hinges: To ANSI/BHMA A156.26.
- .3 Self-Closing Hinges and Pivots: To ANSI/BHMA A156.17.
- .4 Locksets and Latchsets: To ANSI/BHMA A156.2, Grade 1.
- .5 Exit Devices: To ANSI/BHMA A156.3.
- .6 Closers: To ANSI/BHMA A156.4; surface-mounted type.
- .7 Cylinders and Input Devices: To ANSI/BHMA A156.5, Operational Class, Grade 1.
- .8 Overhead Door Stops: To ANSI/BHMA A156.8.
- .9 Interconnected Locks and Latches: To ANSI/BHMA A156.12, Grade 1.
- .10 Mortise Locks: To ANSI/BHMA A156.13, Operational Class, Grade 1.
- .11 Auxiliary Locks: To ANSI/BHMA A156.36, Grade 1.
- .12 Multipoint Locks: To ANSI/BHMA A156.13, Operational Class, Grade 1.
- .13 Sliding and Folding Door Hardware: To ANSI/BHMA A156.14.
- .14 Powered Release Devices: To ANSI/BHMA A156.15.
- .15 Powered Door Operators: To ANSI/BHMA A156.19.
- .16 Powered Door Locks: To ANSI/BHMA A156.23; electromagnetic type.
- .17 Powered Locking Devices: To ANSI/BHMA A156.25.
- .18 Powered Strikes and Actuators: To ANSI/BHMA A156.31.
- .19 Delayed Egress Locks: To ANSI/BHMA A156.24.
- .20 Alarms for Exit Devices: To ANSI/BHMA A156.29.
- .21 Door Trim: Protection plates, push plates, door pulls, push bars, and pull bars; to ANSI/BHMA A156.6.
- .22 Thresholds: To ANSI/BHMA A156.21.
- .23 Auxiliary Hardware: To ANSI/BHMA A156.16.
- .24 Door Gaskets and Weatherstripping: To ANSI/BHMA A156.21.

## 2.4 FINISHES

- .1 Conform to ANSI/BHMA A156.18.
- .2 Provide hardware with finishes to match door hardware in existing facility.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.

- .2 Verify doors and frames are ready to receive hardware, and that dimensions are as indicated on accepted Shop Drawings and door hardware schedule.
- .3 Verify power supply of 120V AC, 20 amps, 3 phase, 60 Hz is available to power-operated devices.

### 3.2 INSTALLATION

- .1 Install hardware to ANSI/DHI A115.IG.
- .2 Use templates provided by hardware manufacturer.
- .3 Provide routing or mortising for hinges and other items required to be mortised or rebated or otherwise housed within material.
- .4 Install hardware at mounting heights specified in manufacturers' templates or as indicated in hardware schedule.
- .5 Install hardware using only manufacturer-supplied and -approved fasteners, in strict accordance with manufacturers' published installation instructions. Provide suitable security-type fasteners as specified in hardware sets.
- .6 Ensure locksets, latchsets and deadbolts are of correct hand before installation to ensure cylinder is in correct position. Handing is part of installation procedure.
- .7 Ensure exit devices are of correct hand and adjust device cam for proper outside trim function prior to installation. Handing is part of installation procedure.
- .8 Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops and holders.
- .9 Counter sink through-bolt of door pull under push plate during installation.
- .10 Mount closers, automatic operators and hold-open devices as noted in hardware schedule.
- .11 Secure thresholds with machine screws and anchors.

### 3.3 FIELD QUALITY CONTROL

- .1 Examine installed hardware and notify Consultant of improper installations, defective Products or where installation does not conform to Contract Documents.

### 3.4 ADJUSTING

- .1 Replace Products exhibiting scratched or damaged surfaces.
- .2 Properly tighten fasteners and ensure that fasteners are installed to the full required complement.
- .3 Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.
- .4 Adjust delayed-action door operators and closers to forty-second delay to accommodate barrier-free access. Time period to be approved by Owner.

### 3.5 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Demonstrate operation and maintenance of hardware items, including proper use, servicing, adjusting and lubrication procedures.

3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Cover surfaces with temporary, removable protective film.

END OF SECTION



Glenview Public School Gym Addition

Legend:

-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

133

Provide each RU door(s) with the following:







QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	ALL HARDWARE BY ROLL-UP DOOR SUPPLIER		UNK

Hardware Group No. 02

For use on Door #(s):

134 135

Provide each SGL door(s) with the following:








QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 127X114MM 	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC 	626	SCH
1	EA	SURFACE CLOSER	1461 EDA STD 	689	LCN
1	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT 	630	CBH
1	EA	WALL STOP	WS401/402CVX 	626	IVE
1	SET	SMOKE SEAL	W-22 	BLK	KNC

Hardware Group No. 03

For use on Door #(s):

136

Provide each PR door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 127X114MM 	652	IVE
1	EA	FIXED MULLION	FIXED MULLION BY FRAME SUPPLIER		
2	EA	CLASSROOM DEADBOLT	B663P6 	626	SCH
2	EA	PUSH PLATE	CBH 923 127 X 508 C.F.DB. 	630	CBH
2	EA	DOOR PULL	CBH 9523B #1 MTG. 	630	CBH
2	EA	SURFACE CLOSER	4040XP DEL EDA ST-3068 	689	LCN
2	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT 	630	CBH
2	EA	WALL STOP	WS401/402CVX 	626	IVE








Glenview Public School Gym Addition

Hardware Group No. 04

For use on Door #(s):

137 138

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 127X114MM		652	IVE
1	EA	CLASSROOM DEADBOLT	B663P6		626	SCH
1	EA	PUSH PLATE	CBH 923 127 X 508 C.F.DB.		630	CBH
1	EA	DOOR PULL	CBH 9523B #1 MTG.		630	CBH
1	EA	SURFACE CLOSER	4040XP EDA ST-3068		689	LCN
1	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT		630	CBH
1	EA	WALL STOP	WS401/402CVX		626	IVE








NOTE: CUT PUSH PLATE FOR DEADBOLT

Hardware Group No. 05

For use on Door #(s):

139A

Provide each SGL door(s) with the following:








QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	CLASSROOM DEADBOLT	B663P6		626	SCH
1	EA	PUSH PLATE	CBH 923 127 X 508 C.F.DB.		630	CBH
1	EA	DOOR PULL	CBH 9523B #1 MTG.		630	CBH
1	EA	SURFACE CLOSER	4040XP DEL EDA ST-3068		689	LCN
1	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT		630	CBH
1	EA	WALL STOP	WS401/402CVX		626	IVE

Hardware Group No. 06

For use on Door #(s):

139B

Provide each SGL door(s) with the following:












QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	CLASSROOM DEADBOLT	B663P6		626	SCH
1	EA	PUSH PLATE	CBH 923 127 X 508 C.F.DB.		630	CBH
1	EA	DOOR PULL	CBH 9523B #1 MTG.		630	CBH
1	EA	SURFACE CLOSER	4040XP DEL EDA ST-3068		689	LCN
1	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT		630	CBH
1	EA	WALL STOP	WS401/402CVX		626	IVE

Glenview Public School Gym Addition

Hardware Group No. 07

For use on Door #(s):  
139C












Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY X DR HT		628	IVE
1	EA	FIXED MULLION	FIXED MULLION BY FRAME SUPPLIER			
1	EA	PANIC HARDWARE	CD-98-EO-4'		626	VON
1	EA	PANIC HARDWARE	CD-98-NL-OP-4'-110MD		626	VON
2	EA	MORTISE CYLINDER	20-001 114 XQ11-949 cylinder dogging		626	SCH
1	EA	RIM CYLINDER	20-021		626	SCH
2	EA	DOOR PULL	CBH 7008-1 #6 MTG.		630	CBH
2	EA	OH STOP & HOLDER	100H		630	GLY
2	EA	SURFACE CLOSER	TJ4040XP LONG		689	LCN
2	EA	FLUSH CEILING MTG PLATE	4040XP-18G SRT		689	LCN
2	EA	DOOR SWEEP	W-24S X DR. WIDTH		628	KNC
1	EA	THRESHOLD	CT-46 X FRAME WIDTH		627	KNC
1	EA	FRAME WEATHER SEAL	BY FRAME SUPPLIER			
2	EA	DOOR CONTACT	679-05HM		BLK	SCE

Hardware Group No. 08

For use on Door #(s):  
139D

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY X DR HT		628	IVE
1	EA	REMOVABLE MULLION	5754		628	VON
1	EA	PANIC HARDWARE	CD-98-EO-4'		626	VON
1	EA	PANIC HARDWARE	CD-98-NL-OP-4'-110MD		626	VON
2	EA	MORTISE CYLINDER	20-001 114 XQ11-949 cylinder dogging		626	SCH
1	EA	RIM CYLINDER	20-021		626	SCH
2	EA	OH STOP & HOLDER	100H		630	GLY
2	EA	SURFACE CLOSER	TJ4040XP LONG		689	LCN
2	EA	FLUSH CEILING MTG PLATE	4040XP-18G SRT		689	LCN
2	EA	DOOR SWEEP	W-24S X DR. WIDTH		628	KNC
1	EA	THRESHOLD	CT-46 X FRAME WIDTH		627	KNC
1	EA	FRAME WEATHER SEAL	BY FRAME SUPPLIER			
2	EA	DOOR CONTACT	679-05HM		BLK	SCE

Glenview Public School Gym Addition

Hardware Group No. 09

For use on Door #(s):

140

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		630	IVE
1	EA	SGL CYL DEADBOLT	B660P6		626	SCH
1	EA	CYLINDER PULL	CBH 351		630	CBH
1	EA	PUSH/PULL	CBH 380 125 X 500 (CUT FOR D.BOLT)		630	CBH
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	SET	WEATHERSTRIP	W-17S		628	KNC
1	EA	DOOR BOTTOM	CT-730 X DR. WIDTH		628	KNC
1	EA	THRESHOLD	CT-10 X FRAME WIDTH		627	KNC

Hardware Group No. 10

For use on Door #(s):

V4A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY X DR HT		628	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP-4'-110MD		626	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-949 cylinder dogging		626	SCH
1	EA	RIM CYLINDER	20-021		626	SCH
1	EA	DOOR PULL	CBH 7008-1 #6 MTG.		630	CBH
1	EA	OH STOP	100S		630	GLY
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)		↗ ANCL R	LCN
2	EA	SWITCH	8310-806R			LCN
2	EA	ACTUATOR, TOUCH	8310-852		630	LCN
2	EA	ESCUTCHEON	8310-876		630	LCN
1	EA	DOOR SWEEP	W-24S X DR. WIDTH		628	KNC
1	EA	THRESHOLD	CT-46 X FRAME WIDTH		627	KNC
1	EA	FRAME WEATHER SEAL	BY FRAME SUPPLIER			
1	EA	DOOR CONTACT	679-05HM		↗ BLK	SCE








Glenview Public School Gym Addition

Hardware Group No. 11

For use on Door #(s):

V4B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 127X114MM		652	IVE
1	EA	PUSH PLATE	CBH 923 125 X 500		630	CBH
1	EA	DOOR PULL	CBH 9523B #1 MTG.		630	CBH
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)		✎ ANCL R	LCN
2	EA	ACTUATOR, TOUCH	8310-852		630	LCN
2	EA	ESCUTCHEON	8310-876		630	LCN
1	EA	KICK PLATE	CBH 903 200MM X SIZE TO SUIT		630	CBH
1	EA	WALL STOP	WS401/402CVX		626	IVE

Hardware Group No. 12 - Not Used

1 General

1.1 RELATED SECTIONS

- .1 Section 07 21 00 - Thermal Insulation.
- .2 Section 07 92 00 - Joint Sealants.
- .3 Section 08 12 13 - Hollow Metal Frames.
- .4 Section 08 13 13 - Hollow Metal Doors.
- .5 Section 08 14 00 - Wood Doors.
- .6 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- .7 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .8 Section 08 51 13 - Aluminum Windows.
- .9 Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

- .1 AAMA 800-16: Voluntary Specifications and Test Methods for Sealants.
- .2 ANSI Z97.1-2009: Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .3 ASTM C509-06(2021): Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- .4 ASTM C864-05(2019): Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- .5 ASTM C1115-17: Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
- .6 ASTM C1281-16(2023): Standard Specification for Preformed Tape Sealants for Glazing Applications.
- .7 ASTM C1376-21a: Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- .8 ASTM C1503-24: Standard Specification for Silvered Flat Glass Mirror.
- .9 ASTM E1300-16: Standard Practice for Determining Load Resistance of Glass in Buildings.
- .10 CAN/CGSB-12.1-2017: Safety Glazing.
- .11 CAN/CGSB-12.2-M91 (R2017): Flat, Clear Sheet Glass.
- .12 CAN/CGSB-12.3-M91 (R2017): Flat, Clear Float Glass.
- .13 CAN/CGSB-12.8-2017: Insulating Glass Units.
- .14 CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
- .15 GANA Glazing Manual.
- .16 GANA Laminated Glazing Reference Manual.
- .17 GANA GIB 01-0300: Proper Procedures for Cleaning Architectural Glass.

- .18 GANA 89-1-6: Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifier.
  - .19 IGMA TM-3000-90(16): North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
  - .20 IGMA TM-4510-18(19): IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.
  - .21 IWFA-LT-105: The Use of Window Films on Insulating Glass Windows.
  - .22 ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
  - .23 ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
  - .24 CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
  - .25 CAN/ULC-S106-15 (R2020): Standard Method for Fire Tests of Window and Glass Block Assemblies.
- 1.3 PRODUCT DATA
- .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating structural, physical and environmental characteristics, thickness and size limitations, special handling and installation requirements.
- 1.4 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: Duplicate 300 x 300 mm size samples of each specified sealed insulating glass unit, insulated spandrel glass panel and window film; illustrating colouration and design.
- 1.5 CERTIFICATES
- .1 Submit certificates as specified in Section 01 33 00.
  - .2 Certificate of Compliance: Manufacturer's standard certificate of compliance, attesting fire-rated glazing materials comply with CPSC requirements.
- 1.6 TEST AND EVALUATION REPORTS
- .1 Submit test reports as specified in Section 01 33 00.
  - .2 Test Reports: Manufacturer's standard test results indicating Products meet specified performance criteria, prepared by independent testing agency and current within past two years.
- 1.7 QUALITY ASSURANCE
- .1 Conform to glazing installation methods and quality standards specified in:
    - .1 GANA Glazing Manual,
    - .2 GANA Laminated Glazing Reference Manual,
    - .3 IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use, and
    - .4 IGMA TM-4510, IGMA Quality Procedures for the Fabrication of Insulating Glass Units to the ISO 9001:2008 Standard.
  - .2 Select glazing compounds and sealants in accordance with glass manufacturers' instructions.

## 1.8 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranties: For a period of 5 years, covering complete replacement of units experiencing:
  - .1 Sealed Insulating Glass Units: Seal failure or interpane dusting and misting.
  - .2 Mirrored Glass Units: Deterioration or delamination of reflective coating that affects reflectivity of mirrored unit.
  - .3 Laminated Glass Units: Edge separation or delamination within the field area of glass that obstructs or affects visibility through laminated unit.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of single pane glass and sealed insulating glass units having Product considered acceptable for use:
  - .1 AFG Glass Inc.
  - .2 AGC Glass Company North America.
  - .3 Cardinal Glass Industries.
  - .4 Guardian Glass.
  - .5 Libbey-Owens Ford.
  - .6 Pilkington Glass North America, Inc.
  - .7 Prelco.
  - .8 Vitro Architectural Glass.
- .2 Manufacturers of fire-rated ceramic glass having Product considered acceptable for use:
  - .1 Nippon Glass.
  - .2 Schott North America, Inc.
- .3 Manufacturers of window film having Product considered acceptable for use:
  - .1 3M Company Canada.
  - .2 Avery Dennison.
  - .3 Madico, Inc.
- .4 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 REGULATORY REQUIREMENTS

- .1 Fire-rated Glass: Each lite to bear a permanent, non-removable label designating type of glass, fire rating and UL mark.

### 2.3 DESIGN CRITERIA

- .1 Design glass Products to ASTM E1300.
  - .1 Determine necessary glass thickness to withstand dead loads and positive and negative live loads acting normal to plane of glass.
  - .2 Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
- .2 Design Products installed as exterior glazing to contribute to continuity of building enclosure air and vapour seals.



## 2.4 PERFORMANCE CRITERIA

- .1 Sealed Insulating Glass Units (SIG-CLR): Having the following tested physical properties:
  - .1 Visible Light Transmittance (VLT): 64 percent.
  - .2 Visible Light Reflectance:
    - .1 Exterior: 12 percent.
    - .2 Interior: 13 percent.
  - .3 Coefficient of Heat Transmission, Winter, Argon-Filled (ANSI/NFRC 100):  $U = 1.36 \text{ W/m}^2 \text{ degrees C}$ .
  - .4 Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} = 0.27$ .
  - .5 Light to Solar Gain Ratio:  $\text{LSG} = 2.37$ .

## 2.5 SINGLE PANE GLASS

- .1 Float Glass (GL-1): To CAN/CGSB-12.3-M; glazing quality, 6 mm thick unless noted otherwise.
- .2 Mirrored Glass (GL-2): To ASTM C1503; clear float glass, with silvered coating evenly applied over rear face; complete with polished edges; sizes as scheduled or noted on Drawings; 4 mm thick unless noted otherwise.
- .3 Tempered Safety Glass (GL-3): To CAN/CGSB-12.1; clear float glass fully tempered horizontally to achieve a net strength of not less than 4 to 5 times greater than regular annealed glass; impact safety rating meeting ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II; 6 mm thick unless noted otherwise.
- .4 Laminated Safety Glass (GL-4): To CAN/CGSB-12.1; two layers of 3 mm thick tempered safety glass laminated to a 0.76 mm thick vinyl interlayer to form a single, unified construction; impact safety-rated to ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II.
- .5 Sheet Glass (GL-5): To CAN/CGSB-12.2-M; glazing quality, 3 mm thick unless noted otherwise.
- .6 Fire-Rated Ceramic Glass (GL-6): 5 mm thick fire-rated and impact safety-rated glass ceramic with surface-applied safety film; impact safety rating meeting ANSI Z97.1, Class A and CPSC 16 CFR 1201, Categories I and II; Clear style; Standard Grade; 88 percent visible light transmittance, 9 percent visible light reflectance; 90-minute fire rating when tested to CAN/ULC S104 and CAN/ULC-S106; eg. FireLite NT by Nippon Glass.

## 2.6 SEALED INSULATING GLASS UNITS

- .1 Sealed Insulating Glass Units (SIG-CLR-1): To CAN/CGSB-12.8; double pane with warm edge seal; comprised as follows:
  - .1 Outer Pane: 6 mm thick, Clear tempered safety glass (GL-3), sputtered Low-E coating on #2 surface.
  - .2 Interpane Space: Filled with minimum 90 percent Argon gas.
  - .3 Inner Pane: 6 mm thick Clear tempered safety glass (GL-3).
  - .4 Overall Thickness: 25 mm.
  - .5 Manufacturer's Name and Product: eg. Solarban 70 (2) + Clear by Vitro Architectural Glass.
- .2 Sealed Insulating Glass Units (SIG-CLR-2): To CAN/CGSB-12.8; double pane with warm edge seal; comprised as follows:
  - .1 Outer Pane: 6 mm thick Clear tempered safety glass (GL-3), sputtered Low-E coating on #2 surface.
  - .2 Interpane Space: Filled with minimum 90 percent Argon gas.
  - .3 Inner Pane: 6.8 mm thick Clear laminated safety glass (GL-4).
  - .4 Overall Thickness: 25 mm.
  - .5 Manufacturer's Name and Product: eg. Solarban 70 (2) + Clear by Vitro Architectural Glass.

## 2.7 INSULATED SPANDREL GLASS PANELS

- .1 Insulated Spandrel Glass Panels (SGP-CLR-1): Single pane insulated infill panel; comprised as follows:
  - .1 Outer Pane: 6 mm thick Clear tempered safety glass (GL-3), with opaque coating on #2 surface;
  - .2 Insulation: Mineral fibre semi-rigid board insulation, Type INS-SR-1 as specified in Section 07 21 00, sufficient thickness to achieve  $RSI \geq 0.74$ , and secured to inner liner;
  - .3 Inner Liner: 1.5 mm thick galvanized steel panel, sealed at edges, corners and fasteners.

## 2.8 COATINGS AND FILMS

- .1 Low-E Coating: To ASTM C1376, Kind CV; magnetron sputtered vacuum deposition (MSVD) coating; eg. Solarban 70 Solar Control Low-E by Vitro Architectural Glass.
- .2 Opaque Coating: To GANA 89-1-6; 0.2 mm thick water-based silicone elastomeric coating; eg. Opaci-Coat-300 by ICD High Performance Coatings, colour as selected by Consultant.
- .3 Window Film - Decorative (FILM-DEC): Polyester film with acrylic pressure-sensitive adhesive backing accommodating subsequent removal without the use of heat; as follows:
  - .1 Overall Thickness: 0.089 mm.
  - .2 Colour: White.
  - .3 Opacity: Translucent.
  - .4 Finish: Matte.
  - .5 Pattern Design: Fabric / Washi.
  - .6 Shading Coefficient: 0.89.
  - .7 Solar Heat Absorbance: 14 percent.
  - .8 Visible Light Reflectance: 15 percent.
  - .9 Visible Light Transmittance: 79 percent.
  - .10 UV Transmittance: 0 percent.
  - .11 Manufacturer and Product Name: eg. Fasara Series, SH2PTYA - Yamato by 3M Company Canada.
- .4 Window Film - Bird-Control (FILM-BIRD): 0.08 mm thick flexible calendered vinyl film with opacity barrier and removable acrylic adhesive; eg. HP700 High Performance Calendered Series Opaque Permanent Long Term Removable by Avery Dennison, Semi-Gloss White colour.

## 2.9 ACCESSORIES

- .1 Warm Edge Seal: Polyisobutylene primary seal with a secondary seal comprised of either silicone, butyl, polysulphide or urethane, as recommended by sealed insulating glass unit manufacturer for each particular glazing application; and with port at top of unit.
- .2 Dense Compression Gasket: Moulded or extruded gaskets, made from neoprene or EPDM to ASTM C864, or thermoplastic polyolefin rubber to ASTM C1115; of profile and hardness required to maintain watertight seal.
- .3 Soft Compression Gasket: To ASTM C509, Type II; moulded or extruded, closed-cell, integral-skinned gaskets made from neoprene, EPDM or thermoplastic polyolefin rubber; Black colour; profile and hardness required to maintain watertight seal.
- .4 Back-Bedding Mastic Glazing Tapes: To ASTM C1281 and AAMA 800, preformed, butyl-based elastomeric tape with 100 percent solids content; non-staining and non-migrating in contact with non-porous surfaces; with or without spacer rod; packaged on rolls with release paper backing.

- .5 Expanded Cellular Glazing Tapes: Closed cell, PVC foam tape, factory-coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; to AAMA 800 for the following types:
    - .1 Tape Acts as Primary Seal: Type 1.
    - .2 Tape Used in Combination with Full-Bead of Sealant: Type 2.
  - .6 Glazing Tape for Fire-rated Glass Applications: Fiberfrax Alumino-Silicate Fiber glazing tape by Unifrax Corporation.
  - .7 Setting Blocks: Elastomeric material, having a Shore A durometer hardness of 85, plus or minus 5.
  - .8 Setting Blocks for Fire-rated Glass Applications: Calcium silicate.
  - .9 Spacers: Elastomeric blocks or continuous extrusions, having a Shore A durometer hardness sufficient to maintain glass lites in place both during and after installation.
  - .10 Edge Blocks: Elastomeric material of sufficient hardness to limit glass lateral movement.
  - .11 Glazing Sealant: SEAL-GLZ as specified in Section 07 92 00.
  - .12 Metal Channel Trim: 0.41 mm thick Series 430 stainless steel J-trim; 7.6 mm deep, 22 mm high back leg, 7.9 mm high front leg, and 6.3 mm deep channel to accommodate 6 mm thick glass; eg. SS960 by C. R. Laurence Co. Inc.
  - .13 Wall Adhesive: Chemically compatible with glass coating and wall substrate.
  - .14 Cleaners, Primers and Sealers: Types recommended by sealant and gasket manufacturers.
- 2.10 FABRICATION
- .1 Fabricate sealed insulating glass units to IGMA TM-4510.
- 3 Execution
- 3.1 EXAMINATION
- .1 Refer to Section 01 71 00.
  - .2 Verify openings for glazing are correctly sized, within tolerance and clean.
- 3.2 PREPARATION
- .1 Clean contact surfaces with solvent and wipe dry.
  - .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
  - .3 Prime surfaces scheduled to receive sealant.
- 3.3 INSTALLATION
- .1 Conform to GANA Glazing Manual.
  - .2 Install exterior glazing forming part of building envelope to IGMA TM-3000 to achieve airtight and watertight seal.
  - .3 Protect glass edges from damage during handling and installation. Remove damaged glass Products from Place of the Work and dispose of in accordance with authorities having jurisdiction. Damaged glass is defined as glass with edge damage or other imperfections that, when installed, could weaken the glass and impair performance and appearance.
  - .4 Install setting blocks in sill rabbets, sized and located in accordance with GANA Glazing Manual. Set blocks in heel bead of glazing sealant.

- .5 Do not exceed edge pressures stipulated by glass manufacturer for installing glass lites.
- .6 Provide spacers for glass lites where length plus width is larger than 1 270 mm.
- .7 Provide edge blocking necessary to prevent glass lites from moving sideways in glazing channel, in accordance with GANA Glazing Manual.
- .8 Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sight line of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
  - .1 Cover vertical framing joints by applying tapes first to heads and sills, and then to jambs.
  - .2 Cover horizontal framing joints by applying tapes first to jambs, and then to heads and sills.
  - .3 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant.
  - .4 Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.
- .9 Gasket Glazing: Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
  - .1 Insert soft compression gasket between glass and frame or fixed stop such that it is securely in place, with joints miter cut and bonded together at corners.
  - .2 Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets, formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work towards center of openings.
  - .3 Install gaskets so they protrude evenly past face of glazing stops.
  - .4 Compress gaskets to produce weather tight seal without developing bending stress in glass.
  - .5 Seal gasket joints with compatible sealant.
- .10 Wall-Mounted Glass Mirrors
  - .1 Ensure wall surface is flat.
  - .2 Install top and bottom metal channel trim, secured rigidly to wall construction.
  - .3 Provide setting blocks and shims as required to level and adjust mirrored glass faces continuously flush with adjacent mirrored glass panels.
  - .4 Set mirrored glass panels plumb and level on wall surface, using beads of adhesive.
  - .5 Adjust top metal channel trim to glass edge for snug fit.

### 3.4 WINDOW FILM APPLICATION

- .1 Clean glass surfaces using recommended cleaners and methods prior to film application.
- .2 Securely adhere decorative window films in locations and patterns indicated on Drawings.
- .3 Securely adhere bird-control window film to #1 surface of designated sealed insulating glass units, in patterns indicated on Drawings.
- .4 Ensure no air pockets, creases, folds, marks, delaminations or other visual disfigurements appear in completed window film application.
- .5 Conform to IWFA-LT-105, visual acceptance standard.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Remove glazing materials from finish surfaces.

.3 Remove non-permanent labels upon Ready-for-Takeover.

.4 Clean glass surfaces to GANA GIB 01-0300.

### 3.6 PROTECTION

.1 Refer to Section 01 76 00.

.2 Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.

.3 Protect glass from contact with contaminating substances resulting from subsequent construction operations.

.4 Protect window film from damage by installing tape warning strips or barricades to prevent contact. Maintain protection until Ready-for-Takeover.

.5 Remove and replace Products that have been damaged, including but not limited to having been broken, chipped, cracked or abraded; regardless of cause, before Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 40 00 - Cold-Formed Metal Framing.
- .4 Section 06 16 43 - Gypsum Sheathing.
- .5 Section 06 20 00 - Finish Carpentry.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 08 12 13 - Hollow Metal Frames.
- .8 Section 08 31 00 - Access Door and Panels.
- .9 Section 09 51 23 - Acoustical Tile Ceilings.
- .10 Section 09 81 00 - Acoustic Insulation.
- .11 Section 09 90 00 - Painting and Coating.
- .12 Section 21 13 13 - Wet Pipe Fire Suppression.
- .13 Section 23 37 13 - Diffusers, Registers, and Grilles.
- .14 Section 26 51 13 - Lighting Equipment.

1.2 REFERENCES

- .1 ASTM A641/A641M-19: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .2 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM A792/A792M-23: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .4 ASTM C475/C475M-17: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .5 ASTM C514-04(2020): Standard Specification for Nails for the Application of Gypsum Board.
- .6 ASTM C645-18: Standard Specification for Nonstructural Steel Framing Members.
- .7 ASTM C754-20: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .8 ASTM C840-23: Standard Specification for Application and Finishing of Gypsum Board.
- .9 ASTM C954-18: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .10 ASTM C1002-20: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .11 ASTM C1047-19: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

- .12 ASTM C1264-19: Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products.
- .13 ASTM C1396/C1396M-17: Standard Specification for Gypsum Board.
- .14 ASTM C1629/C1629M-23: Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- .15 ASTM C1658/C1658M-19e1: Standard Specification for Glass Mat Gypsum Panels.
- .16 ASTM E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .17 CGC Gypsum Construction Handbook.
- .18 CAN/CGSB-71.25-M88: Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .19 CISCA Ceiling Systems Handbook, 2012 Edition.
- .20 GA-214-2021: Levels of Finish for Gypsum Panel Products.
- .21 GA-226-2019: Application of Gypsum Board to Form Curved Surfaces.
- .22 CAN/ULC-S101-14 (REV1): Standard Method of Fire Endurance Tests of Building Construction and Materials.
- .23 ULC List of Equipment and Materials.

### 1.3 QUALIFICATIONS

- .1 Installers: A firm specializing in erecting metal support framing and installing gypsum board, and having minimum 5 years documented experience.

### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Conform to ASTM C1264.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of metal framing having Product considered acceptable for use:
  - .1 Bailey Metal Products Limited.
  - .2 CGC Inc.
  - .3 Dietrich Metal Framing.
- .2 Manufacturers of gypsum board and coated tile backer board having Product considered acceptable for use:
  - .1 CertainTeed Canada, Inc.
  - .2 CGC Inc.
  - .3 G-P Gypsum Corporation.
- .3 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 DESCRIPTION

- .1 Interior Partitions: Vertical non-load bearing metal stud framing clad with wall boards mechanically-fastened or adhered on one or both sides, and including acoustical insulation and accessories where indicated.

- .2 Suspended Ceilings: Horizontal non-load bearing channels and framing carrying mechanically-fastened ceiling boards, and including acoustical insulation and accessories where indicated.
- .3 A non-load bearing (non-structural) member is defined as a member in a steel-framed system which is limited to transverse (out-of-plane) load of not more than 480 Pa, a superimposed axial load, exclusive of sheathing materials, of not more than 1 460 N/m, or a superimposed axial load of not more than 890 N.
- .4 A load bearing (structural) stud may be used in a non-load bearing application; however, non-load bearing members (studs or track) may never be used in a load bearing (axial or lateral loading) application.

## 2.3 PERFORMANCE CRITERIA

- .1 Provide metal wall framing systems with maximum design limit of 240 Pa and maximum allowable deflection of L/360.
- .2 Provide metal ceiling framing systems with maximum allowable deflection of L/240.
- .3 Fire-Resistance Rated Assemblies: Provide Products and construction identical to those tested in listed assemblies; to CAN/ULC-S101.
- .4 Sound Rated Assemblies: Provide Products and construction identical to those tested in listed assemblies; to ASTM E90.

## 2.4 METAL FRAMING

- .1 Metal Standard Duty Studs: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; C-Shape with 32 mm wide flange, complete with serrated faces and knock-outs for electrical fitments; depths as indicated on Drawings.
- .2 Metal Heavy Duty Studs: To ASTM C645; 0.836 mm thick sheet steel; galvanized or galvalumed finish; C-Shape with 32 mm wide flange, complete with serrated faces and knock-outs for electrical fitments; depths as indicated on Drawings.
- .3 Metal Shaft Wall Studs: To ASTM C645; 0.836 mm thick sheet steel; galvanized or galvalumed finish; CH- and E-Shapes, complete with serrated faces and knock-outs for electrical fitments; depths as indicated on Drawings.
- .4 Metal Standard Duty Floor and Ceiling Tracks: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with 32 mm wide flanges; depths as indicated on Drawings.
- .5 Metal Heavy Duty and Shaft Wall Floor and Ceiling Tracks: To ASTM C645; 0.836 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with 32 mm wide flanges; depths as indicated on Drawings.
- .6 Metal Ceiling Deflection Track: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; U-Shape with long legs, designed to accommodate structural deflections; depths as indicated on Drawings.
- .7 Carrying Channels: To ASTM C754; 1.37 mm thick cold-formed steel with galvanized or galvalumed finish; having minimum yield strength of 228 MPa; C-Shape with 13 mm flange width, 38 mm deep unless noted otherwise on Drawings.
- .8 Furring Members: To ASTM C645; 0.455 mm thick sheet steel; galvanized or galvalumed finish; and as described below:
  - .1 C-Shaped Furring Channels: 13 mm wide flange, 19 mm deep unless noted otherwise on Drawings.
  - .2 Hat-Shaped Furring Channels: 13 mm wide flange, 22 mm deep unless noted otherwise on Drawings.



- .3 Z-Shaped Furring: With slotted or non-slotted web, 32 mm face flange, 22 mm wall attachment flange; depth as indicated on Drawings.
- .4 Resilient Furring Channels: Designed to reduce sound transmission; 13 mm deep unless noted otherwise on Drawings.
- .9 Furring Brackets: 0.79 mm thick sheet steel; galvanized or galvalumed finish; adjustable, with corrugated-edge.
- .10 Flat Strap and Backing Plates: 0.455 mm thick sheet steel; galvanized or galvalumed finish; lengths and widths as indicated on Drawings.
- .11 Channel Bridging: 0.455 mm thick sheet steel; galvanized or galvalumed finish; 13 mm wide flange, 19 mm deep unless noted otherwise on Drawings.
- .12 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.
- .13 Tie Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 1.21 mm OD steel wire.

## 2.5 BOARDS

- .1 Moisture/Mould Resistant Gypsum Board (GB-MR-1): To ASTM C1396/C1396M; 12.7 mm thick gypsum panel with water- and mould-resistant gypsum core and paper facers, tapered edges; eg. Sheetrock Brand Ultralight Panels Mold Tough by CGC Inc.
- .2 Moisture/Mould Resistant Gypsum Board (GB-MR-2): To ASTM C1396/C1396M, Type X; 15.9 mm thick gypsum panel with water- and mould-resistant gypsum core and paper facers, tapered edges; eg. Sheetrock Brand Mold Tough Panels FireCode X by CGC Inc.
- .3 Fire-Rated Gypsum Board (GB-FR): To ASTM C1396/C1396M, Type C; fire-rated gypsum panel with water- and mould-resistant gypsum core and paper facers, tapered edges, ULC labelled; thicknesses as indicated on Drawings; eg. Sheetrock Brand Mold Tough Panels FireCode C by CGC Inc.
- .4 Abuse-Resistant Gypsum Board (GB-AR): To ASTM C1629/C1629M, Type X; Level II - Mild to Moderate Duty; 15.9 mm thick gypsum abuse-resistant panel with water- and mould-resistant gypsum core and paper facers, tapered long edges and square ends; eg. Sheetrock Brand Panels Mold Tough AR FireCode X by CGC Inc.
- .5 Shaft Liner Gypsum Board (GB-SL): To ASTM C1658/C1658M, Type X; 25 mm thick; double bevelled edges; silicone treated gypsum core, with coated glass mat facers both sides; eg. Sheetrock Brand Glass-Mat Liner Panels by CGC Inc.
- .6 Gypsum Ceiling Board (GB-CLG): To ASTM C1396/C1396M; 12.7 mm thick; paper-facers, eased edges; maximum 6.5 kg/m<sup>2</sup> weight; eg. Sheetrock Brand Ultralight Interior Ceiling Board Sag-Resistant by CGC Inc.

## 2.6 ACCESSORIES

- .1 Foam Gasket: 3.2 mm thick adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement; width to suit track depth.
- .2 Corner Beads, Casing Beads, Control Joints and Edge Trim: To ASTM C1047; metal type.
- .3 Reveals and Trim Reglets: To ASTM C1047; extruded aluminum profiles; as indicated on Drawings.
- .4 Nail Fasteners: To ASTM C514; galvanized steel.
- .5 Steel Drill Screws: To ASTM C954; galvanized steel.
- .6 Self-Tapping Screws: To ASTM C1002, Type S, Fine Thread; galvanized steel.
- .7 Adhesive: To CAN/CGSB-71.25-M.

- .8 Joint Tape: Fiberglass joint tape, 50 mm wide, self-adhering type; eg. Mould Resistant Fiberglass Drywall Tape by CGC Inc.
  - .9 Joint Compound: Ready-mixed drying type drywall compound, to ASTM C475/C475M; eg. Synko Brand Classic All Purpose Drywall Compound by CGC Inc.
  - .10 Acoustic Insulation: Mineral fibre acoustical batt insulation, as specified in Section 09 81 00.
  - .11 Joint Sealant: Interior general purpose sealant, Type SEAL-INT-GP as specified in Section 07 92 00.
  - .12 Water: Potable.
- 2.7 MIXING
- .1 Thoroughly mix joint and skim coat materials to homogeneous mixture with trowelling consistency.
- 2.8 FINISHES
- .1 Galvanized Coating on Metal Framing Components: To ASTM A653/A653M, Coating Designation Z120; hot dipped zinc alloy coating.
  - .2 Galvalumed Coating on Metal Framing Components: To ASTM A792/A792M, Coating Designation AZM150; hot dipped aluminum-zinc alloy coating.
- 3 Execution
- 3.1 PREPARATION
- .1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure.
    - .1 Ensure inserts and other provisions for anchorages to building structure have been installed to receive hangers at required spacings.
    - .2 Supply concrete inserts and other devices to other related Sections for installation in advance.
  - .2 Before sprayed fireproofing is applied, attach offset anchor plates or ceiling track to surfaces designated to receive sprayed fireproofing. Where offset anchor plates are required, Provide continuous plates fastened to structure at maximum 600 mm OC.
  - .3 Once sprayed fireproofing has been applied, remove them only to the extent necessary for installation of non-load bearing steel framing. Do not reduce thickness for sprayed fireproofing below that required for fire-resistance ratings indicated. Protect adjacent sprayed fireproofing from damage.
- 3.2 METAL WALL FRAMING
- .1 Install metal wall framing to ASTM C754 and CGC Gypsum Construction Handbook.
  - .2 Where metal framing is installed directly against exterior masonry walls or dissimilar metals at exterior walls, Provide foam gasket between metal framing and exterior wall.

- .3 Install studs such that flanges within framing system point in same direction.
- .4 Space metal studs along straight runs at maximum 400 mm OC.
- .5 Install track floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions of structure.
- .6 Where framing extends to overhead structural supports, Provide deflection track to create a slip-type head joints to produce joints at tops of framing system that prevent axial loading of finished assemblies due to deflection of structure.
- .7 Screw vertical studs at door opening jambs to jamb anchor clips at door frames. Install track section for cripple studs at head and secure to jamb studs.
  - .1 Provide two studs at each jamb.
  - .2 Provide cripple studs at head adjacent to each jamb stud, with minimum 13 mm clearance from jamb stud to allow for installation of control joint in finished assembly.
- .8 Provide framing below sills of openings to match framing required above opening heads.
- .9 Fire-Resistance-Rated Partitions:
  - .1 Install framing to comply with fire-resistance-rated assembly indicated.
  - .2 Support closures and make partitions continuous from floor to underside of solid structure.
- .10 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- .11 Curved Partitions: Conform to GA-226, as follows:
  - .1 Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  - .2 Begin and end each arc with a stud, and space intermediate studs equally along arcs.
  - .3 Provide studs spaced at 150 mm OC.
  - .4 On straight lengths of not less than two studs at ends of arcs, place studs at 150 mm OC.
- .12 Direct Furring: Attach furring to concrete or masonry with stub nails, screws designed for masonry attachment, or power-driven fasteners spaced at 610 mm OC.
- .13 Z-Furring Members:
  - .1 Erect insulation vertically and hold in place with Z-furring members spaced at 610 mm OC.
  - .2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners spaced at 610 mm OC.
  - .3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel.
  - .4 At interior corners, space second member no more than 305 mm from corner and butt insulation to fit.
- .14 Unless indicated otherwise, Provide supplementary framing and furring to conceal pipes, conduit and ducts.
- .15 Provide supplementary framing and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings and similar construction.
- .16 Install bracing at terminations in assemblies.
- .17 Do not bridge building control joints and expansion joints with non-load bearing steel framing members. Frame both sides of joints independently.
- .18 Installation Tolerances: Install framing members so fastening surfaces vary not more than 3 mm from plane formed by faces of adjacent framing members.

### 3.3 SUSPENDED CEILING FRAMING

- .1 Install ceiling framing to ASTM C754 and CISCA installation standards.
- .2 Isolate suspension system from building structure. Prevent transfer of loading imposed by structural movement.
- .3 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum.
- .4 Size supplemental suspension members and hangers to support ceiling loads within established performance limits.
- .5 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or similar devices.
- .6 Secure wire hangers by looping and wire tying, either directly to structure or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate; and in a manner that will not cause hangers to fail or deteriorate.
- .7 Do not attach hangers to steel roof decking, or to rolled-in hanger tabs of composite steel floor decking.
- .8 Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- .9 Do not connect or suspend steel framing from ducts, pipes or conduit.
- .10 For fire-resistance-rated assemblies, wire tie furring channels to supports.
- .11 Installation Tolerances: Level to within 3 mm in 3 600 mm, measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

### 3.4 ACOUSTICAL ACCESSORIES

- .1 Install resilient channels at maximum 600 mm OC.
- .2 Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- .3 Provide acoustic seals in designated sound-rated partitions with beads of joint sealant where indicated on Drawings.

### 3.5 BOARD INSTALLATION

- .1 Install board Products to ASTM C840 and the CGC Gypsum Construction Handbook.
- .2 Install gypsum ceiling board perpendicular to supports.
- .3 Screw fasten boards to furring or framing.
- .4 Install abuse-resistant gypsum board on metal heavy duty stud and track framing.
- .5 Install shaft liner gypsum board on metal shaft wall stud and track framing.
- .6 Double Layer Applications: Place first layer perpendicular to framing or furring members. Place second layer perpendicular to first layer.

- .7 Place corner beads at external corners. Place edge trim where gypsum board abuts dissimilar materials. Fasten with nail attachment, unless specified otherwise.
- .8 Provide bulkheads where changes of ceiling or height occur.
- .9 Install access panels when and where directed by affected Subcontractors. Refer to Section 08 31 00.

### 3.6 BOARD FINISHING

- .1 Tape, fill, and sand exposed joints, edges, and corners to a smooth surface.
- .2 Leave surfaces smooth, even, plumb and true, ready to receive final finishes specified in other Sections.
- .3 Except as specified below, finish gypsum board to GA-214, Level 4.
  - .1 Provide Level 1 finish on concealed surfaces, such as in plenum spaces above ceilings, and behind casework.
  - .2 Provide Level 5 finish on glass mat-faced gypsum surfaces designated to receive painted finish.

### 3.7 CONTROL JOINTS

- .1 Provide control joints where indicated on Drawings, and where:
  - .1 Ceiling, partition or furring abuts a structural element,
  - .2 Ceiling, partition or furring abuts dissimilar construction,
  - .3 Construction changes within plane of the partition or ceiling,
  - .4 Partition or furring run exceeds 9 000 mm,
  - .5 Ceiling dimensions exceed 15 000 mm in either direction,
  - .6 Wings of "L-", "U-" and "T"-shaped ceiling areas are joined, and
  - .7 Expansion or control joints occur in the structural elements of the building.
- .2 Break continuity of gypsum board and framing system at control joints.
- .3 Provide continuous control joint profile.

### 3.8 RELIEF JOINTS

- .1 Provide relief joints where indicated on Drawings, and where gypsum board assemblies abut dissimilar construction.
- .2 Stop gypsum board 6 mm from abutting construction at dissimilar building elements, unless indicated otherwise.
- .3 Provide a thermal break where gypsum board comes into contact with frames. Adhere self-adhering tape to casing bead and compress during installation of gypsum board.
- .4 Provide reveal mouldings where gypsum board ceilings meet curved wall surfaces, and where indicated on Drawings.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 06 10 00 - Rough Carpentry.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 09 65 19 - Resilient Tile Flooring.
- .6 Section 09 65 66 - Resilient Athletic Flooring.

1.2 REFERENCES

- .1 ANSI A108.01-2016: General Requirements: Subsurfaces and Preparations by Other Trades.
- .2 ANSI A108.4-2009: Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
- .3 ANSI A108.5-1999: Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar (Reaffirmed 2010).
- .4 ANSI A108.10-1999: Installation of Grout in Tilework (Reaffirmed 2010).
- .5 ANSI A108.13-2005: Installation of Load Bearing, Bonded, Waterproof Membrane for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).
- .6 ANSI A108.17-2005: Installation of Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone (Reaffirmed 2016).
- .7 ANSI A118.1-2012: Specifications for Dry-Set Portland Cement Mortar.
- .8 ANSI A118.4-2012: Specifications for Modified Dry-Set Cement Mortar.
- .9 ANSI A118.7-2010: Specifications for Polymer Modified Cement Grouts for Tile Installation (Reaffirmed 2016).
- .10 ANSI A118.10-2014: Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- .11 ANSI A118.12-2014: Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- .12 ANSI A136.1-2008: Specifications for Organic Adhesives for Installation of Ceramic Tile (Reaffirmed 2013).
- .13 ANSI A137.1-2012: Specifications for Ceramic Tile.
- .14 ASTM C144-18: Standard Specification for Aggregate for Masonry Mortar.
- .15 ASTM C207-18: Standard Specification for Hydrated Lime for Masonry Purposes.
- .16 ASTM C627-18: Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.
- .17 ASTM C847-18: Standard Specification for Metal Lath.
- .18 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

- .19 ASTM F3191-23: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.
  - .20 CAN/CGSB-25.20-95: Surface Sealer for Floors.
  - .21 CSA A3001-18: Cementitious Materials for Use in Concrete.
  - .22 TTMAC Specification Guide 09 30 00 - Tile Installation Manual 2019-2021.
- 1.3 SHOP DRAWINGS
- .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating swim lines, terminal, targets, pool markings, and special patterns. Include locations and details for proposed control joints.
- 1.4 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: One 300 x 300 mm size panel for each specified tile, complete with selected grout colour; mounted to 19 mm thick plywood backer.
- 1.5 CLOSEOUT SUBMITTALS
- .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Latest edition of TTMAC Hard Surface Maintenance Guide; sufficient quantities for inclusion in operation and maintenance manual.
- 1.6 EXTRA STOCK MATERIALS
- .1 Supply extra stock materials as specified in Section 01 78 00.
  - .2 Extra Stock Materials: Two percent or 4.0 m<sup>2</sup>, whichever is the greater, of each type and colour of installed tile; clearly marked to identify:
    - .1 Manufacturer's name,
    - .2 Product's name,
    - .3 Product colour and pattern.
  - .3 Package tiles neatly in original containers, to prevent damage.
- 1.7 QUALIFICATIONS
- .1 Installers: Skilled mechanics trained and experienced in tiling, and members of TTMAC.
- 1.8 DELIVERY STORAGE AND HANDLING
- .1 Refer to Section 01 60 00.
  - .2 Store Products in a dry area, protected from freezing, staining and damage.
  - .3 Store cementitious materials on a dry surface.
- 1.9 AMBIENT CONDITIONS
- .1 Do not install tiles at temperatures less than 12 degrees C.
  - .2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers of mortars, grouts and adhesives having Product considered acceptable for use:
  - .1 Custom Building Products.
  - .2 Flextile.
  - .3 Laticrete.
  - .4 Mapei.
  - .5 Proma Adhesives, Inc.
  - .6 TEC.
- .2 Manufacturers of tile-setting accessories having Product considered acceptable for use:
  - .1 Bengard.
  - .2 Profilitec.
  - .3 Schlüter Systems (Canada) Inc.
- .3 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 PERFORMANCE CRITERIA

- .1 Traffic Level Performance (ASTM C627): Moderate Class.

### 2.3 TILE MATERIALS

- .1 Porcelain Floor Tile (PFT): To ANSI A137.1; 305 x 610 mm size, matte porcelain tile; Glocal as distributed by Centura Floor & Wall Fashions; colours as selected by Consultant.
- .2 Ceramic Wall Tile (CWT): To ANSI A137.1; 100 x 400 mm size, matte glazed ceramic tile; Rainbow as distributed by Centura Floor & Wall Fashions; colours as selected by Consultant.
- .3 Cut Base Tile: 100 mm high, full-length, site-cut from floor tile, and having at least one factory-formed edge along each tile's length; type, size, colour and texture to match adjacent flooring material.

### 2.4 MORTAR AND GROUT MATERIALS

- .1 Portland Cement: To CSA A3001, Type GU.
- .2 Hydrated Lime: To ASTM C207, Type N-Normal.
- .3 Sand: To ASTM C144, passing 16 mesh.
- .4 Dry-Set Portland Cement Mortar: To ANSI A118.1.
- .5 Latex-Portland Cement Mortar: To ANSI A118.4.
- .6 Cementitious Grout: To ANSI A118.7; rapid setting type, polymer-modified sanded grout; eg. Ultracolor Plus FA by Mapei, colours as selected by Consultant.

### 2.5 ACCESSORIES

- .1 Crack Isolation Membrane: To ANSI A118.12, High Performance Rating; loadbearing membrane.
- .2 Reinforcing Mesh: 50 x 50 mm size; 1.6 mm thick steel wire mesh; welded fabric, galvanized.
- .3 Metal Lath: To ASTM C847; 1.4 kg/m<sup>2</sup> galvanized steel lath.
- .4 Tape: 50 mm fibre mesh tape, as recommended by backer board manufacturer.
- .5 Organic Adhesive: To ANSI A136.1; Type 1 for wet areas and Type 2 for dry areas.



- .6 Latex Additive: Formulated for use in portland cement mortars and grout.
- .7 Water: Clean, cold and potable.
- .8 Joint Sealant: As specified in Section 07 92 00, Types as follows:
  - .1 Floor Tiling: Type SEAL-INT-FT.
  - .2 Wall Tiling: Type SEAL-INT-WT.
- .9 Tile Sealer: To CAN/CGSB-25.20, Type 1 - Penetrating.

## 2.6 MANUFACTURED COMPONENTS AND ACCESSORIES

- .1 Edge and Transition Strips: Roll-formed stainless steel edge strips, 3 mm wide at top edge; with integral perforated anchoring leg for setting the strip into the setting material; height as required; Brushed finish; eg. SCHIENE-EB by Schlüter Systems (Canada) Inc.
- .2 Tapered Transition Strips - To Other Floor Finishes: Roll-formed stainless steel transition strips; profile and height as indicated; with integral perforated anchoring leg for setting the strip into the setting material; sloped transition and decorative edge strip for transition from tile to lower finish; Brushed finish; eg. RENO-EBU by Schlüter Systems (Canada) Inc.
- .3 Edge Strips at Recessed Tile Floors: Roll-formed stainless steel transition strips; with integral perforated anchoring leg for setting the strip into the setting material; height as required; eg. DECO-E by Schlüter Systems (Canada) Inc.
- .4 Decorative Edge Trim: Extruded aluminum decorative edge trim with integral perforated anchoring leg for setting the strip into the setting material; complete with pre-formed corners; Satin Anodized finish; eg. RONDEC-DB 14 AE by Schlüter Systems (Canada) Inc.
- .5 Expansion and Control Joints for Thin-Set Applications: Roll formed stainless steel profiles joined by a soft CPE movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed; height as required to suit application; insert colour as selected by Consultant; eg. DILEX-EKSN by Schlüter Systems (Canada) Inc.
- .6 Uncoupling Membrane: To ANSI A118.10; 3 mm thick high density polyethylene membrane with grid structure of 12 x 12 mm square cavities, each cut back in dovetail configuration, and polypropylene anchoring fleece laminated to underside; eg. DITRA by Schlüter Systems (Canada) Inc.

## 2.7 MIXES

- .1 Scratch Coat (by volume): One part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.
- .2 Slurry Bond Coat: Mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC Detail.
- .3 Levelling Coat (by volume): One part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used per manufacturer's instructions.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Ensure substrates have been prepared to ANSI A108.01.

- .3 Ensure substrate surfaces are clean, dimensionally stable, cured and free of contaminants such as oil, sealers and curing compounds.
- .4 Ensure concrete has cured for minimum 28 days.
- .5 Ensure concrete slabs have not been treated with proprietary curing compounds.
- .6 Ensure concrete slabs have been steel trowelled to a fine broom finish.
- .7 Ensure concrete slabs have been finished with a maximum permissible variation of 3 mm in 3 000 mm from required plane, and not more than 1.5 mm in 305 mm when measured from high points in the surface.
- .8 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate  $MVER \leq 1.45$  kg per 100 m<sup>2</sup> for 24 hours.
- .9 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

### 3.2 PREPARATION

- .1 Protect surrounding work from damage or disfiguration.
- .2 Thoroughly clean existing surfaces which are to receive tile finish to ensure removal of grease, oil and dust film.
- .3 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test.
- .4 Apply latex modified cementitious levelling coat wherever concrete slab does not meet specified tolerance for flatness and levelness, and where slight irregularities exist. Limit levelling coat thickness to less than 8 mm.
- .5 Install crack isolation membrane over suspended concrete slabs to ANSI A108.17. If crack isolation membrane is applied over rough surface, apply 6 mm thick sand-bed under crack isolation membrane.
- .6 Install uncoupling membrane as required by TTMAC Details, to ANSI A108.13.

### 3.3 INSTALLATION

- .1 Install Products to TTMAC Specification Guide 09 30 00, as scheduled below.
- .2 Apply tile using water-resistant organic adhesives to ANSI A108.4.
- .3 Apply tile using dry-set Portland cement mortar or latex-Portland cement mortar beds to ANSI A108.5.
- .4 Install tiles with straight, uniform joints, to tile manufacturers' recommended joint widths.
- .5 Fit tile units around corners, fittings, fixtures, drains and other built-in objects to maintain uniform joint appearance.
- .6 Make cut edges smooth, even and free from chipping. Do not split tile.
- .7 Lay out tiles according to patterns indicated on Drawings. Ensure perimeter and cut tiles are minimum half size.
- .8 Set tiles in place while bond coat is wet and tacky, prior to skinning over. Slide tile back and forth to ensure a proper bond and level surface. Avoid lippage.
- .9 Clean backs of tiles and back butter tiles to ensure a 95 percent bond coverage.
- .10 Clean excess mortar from surface prior to final set.

- .11 Sound tiles after setting materials have cured and replace hollow sounding tile before grouting.
- .12 Exterior Surfaces and Wet Areas (Thin Set Method): Notch adhesive in straight lines, backbutter tile and set on freshly trowelled thin-set mortar. Move tile back and forth perpendicular to notches.
- .13 Ungauged Slate, Marble, Stone and Large Ceramics: Immediately prior to setting, backbutter tile through a push box or box screed to achieve a uniform thickness of tile and mortar.
- .14 Install site-cut tiles with site-cut edges concealed within either grouted joint or metal trim. Visually expose only factory-made edges.
- .15 Keep two-thirds the depth of grout joints free of setting material.

### 3.4 MOVEMENT JOINTS

- .1 Install control and expansion joints to TTMAC Detail 301MJ.
- .2 Keep control joints and expansion joints free of setting materials.
- .3 In addition to guidelines outlined in TTMAC Specification Guide 09 30 00, Provide movement joints over cold joints, saw cuts, at columns and at wall plane changes.

### 3.5 TILE-SETTING ACCESSORIES INSTALLATION

- .1 Install tile-setting accessories in continuous lengths, to level straight lines by pressing the perforated anchoring leg of the accessory solidly into the tile setting adhesive.
- .2 Butt ends of units tightly together with hairline joint. Trowel an additional layer of tile setting material over the anchored leg of the accessory prior to placement of tiles.
- .3 Unless specified otherwise, solidly embed tiles over anchoring leg of installed trim with surface of tile flush with top of tile-setting accessories.
- .4 Leave 3 mm joint between tile and tile-setting accessories for filling with grout.
- .5 Install pre-formed corners, end-caps and trim at changes in direction and at terminations. Mitered joints will be rejected.
- .6 Expansion and Control Joints: Solidly embed tiles over installed edge strips with joint surface either flush with top of joint or 1 mm below top of tile.

### 3.6 GROUTING

- .1 Allow proper setting time prior to grouting.
- .2 Preseal tiles requiring protection from grout staining.
- .3 Apply cementitious grout to ANSI A108.10.
- .4 Force grout into joints to ensure dense finish.
- .5 Remove excess and polish with clean cloths.

### 3.7 FIELD QUALITY CONTROL

- .1 Inspect completed work and replace broken, cracked, or damaged tile.

### 3.8 TOLERANCES

- .1 Level tiles to conform to a 1 mm tolerance over a 3 mm joint.

3.9 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Apply tile sealer to floor tiles.

3.10 PROTECTION

- .1 Protect finished areas from traffic until setting materials have sufficiently cured.
- .2 Protect grouted areas from traffic for 24 hours after grouting.
- .3 Protect tiled surfaces with temporary protective coverings.
- .4 Protect wall tiles and bases from impact, vibration, heavy hammering on adjacent and opposite walls for at least 14 days after installation.

3.11 SCHEDULE

- .1 Tile Installed Over Masonry or Concrete Walls - Thin-Set Method: TTMAC Detail 303W.
- .2 Tile Bonded to Concrete Slab - Thin-Set Method: TTMAC Detail 311F (A - Interior/Exterior), (C - Crack Concrete Interior/Exterior - Full Coverage) or (D - Uncoupling Over Green/Young Concrete).
- .3 Large Format Tile on Interior Floors: TTMAC Detail 329 LFT.
- .4 Large Format Tile on Interior Walls: TTMAC Detail 330 LFTW.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 07 42 93.23 - Linear Metal Soffits.
- .2 Section 09 21 16 - Gypsum Board Assemblies.
- .3 Section 09 81 00 - Acoustic Insulation.
- .4 Section 21 13 13 - Wet Pipe Fire Suppression.
- .5 Section 23 37 13 - Diffusers, Registers, and Grilles.
- .6 Section 26 51 13 - Lighting Equipment.

1.2 REFERENCES

- .1 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A641/A641M-19: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .4 ASTM C635/C635M-17: Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- .5 ASTM C636/C636M-19: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- .6 ASTM E1264-23: Standard Classification for Acoustical Ceiling Products.
- .7 CISCA Ceiling Systems Handbook, 2012 Edition.
- .8 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .9 ULC List of Equipment and Materials.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: Duplicate 140 x 290 mm size sample of each specified acoustic lay-in tile, indicating texture, pattern, colour and edge profile.

1.4 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.
- .2 Extra Stock Materials: Minimum two full bundles for each lay-in tile ceiling Product, colour and pattern; clearly marked to identify:
  - .1 Manufacturer's name,
  - .2 Product's name,
  - .3 Product colour and pattern.
- .3 Store bundles in original undamaged packages, in a warm, dry area.

## 1.5 QUALIFICATIONS

- .1 Installers: A firm specializing in erecting suspended ceiling grid and installing lay-in tile ceiling systems, having minimum 3 years documented experience.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products undamaged original containers.
- .3 Store Products in warm, dry area.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Armstrong World Industries.
  - .2 CertainTeed Canada, Inc.
  - .3 CGC Inc.
  - .4 Rockfon.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 MATERIALS

- .1 Acoustic Ceiling Tile (ACT-1): To ASTM E1264, Type III, Form 2, Pattern C E; wet-formed mineral fiber non-sagging lay-in tile, complete with anti-mould and mildew treatment, and sag resisting treatment; as follows:
  - .1 Size: 610 x 1 220 mm.
  - .2 Thickness: 15 mm.
  - .3 Pattern: Medium texture, non-directional fissured.
  - .4 Edge: Square.
  - .5 Finish: Factory-applied latex paint, White colour.
  - .6 Fire Resistance (CAN/ULC-S102): Class A.
  - .7 Weight: 3.42 kg/m<sup>2</sup>;
  - .8 Noise Reduction Coefficient: NRC = 0.55.
  - .9 Light Reflectance: LR = 0.84.
  - .10 Manufacturer and Product Name: eg. Fine Fissured, Item No. 1729 by Armstrong World Industries.
- .2 Suspended Ceiling Grid: To ASTM C635/C635M, Class HD; commercial quality, cold rolled steel, non-fire rated; main tees, cross tees and grid adapters with exposed 24 mm T-shape, 43 mm high; die cut and interlocking components; baked enamel finish; eg. Prelude XL by Armstrong World Industries.
- .3 Accessories: Stabilizer bars, clips, splices, edge mouldings, and hold down clips required for suspended grid system; same material and finish as suspended grid.
- .4 Support Channels and Hangers: Galvanized steel, to rigidly secure ceiling system with maximum deflection of L/360.
- .5 Hanger Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 3.77 mm OD steel wire.
- .6 Tie Wire: To ASTM A641/A641M; zinc-coated, soft-annealed, 1.21 mm OD steel wire.

## 2.3 FINISHES

- .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 35; hot dipped zinc alloy coating.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Baked Enamel Coating on Ceiling Grid and Trim: One coat of zinc oxide primer sprayed and baked followed by two coats of semi-gloss enamel sprayed and baked; White colour.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify layout of hangers will not interfere with other work.
- .3 Verify ducts, pipes, fittings and other penetrations have been properly installed.

### 3.2 SUSPENDED CEILING GRID SYSTEM

- .1 Install suspended ceiling grid system to ASTM C636/C636M and CISCA installation standards.
- .2 Hang ceiling grid directly from structural elements, independent of walls, columns, metal deck, ducts, pipe fittings and conduit. Provide additional support channels and hangers as required.
- .3 Space hangers at maximum 1 220 mm OC along supporting grillage, and not more than 150 mm OC from ends. Do not place hangers in front of access panels.
- .4 Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers to span the extra distance.
- .5 Install additional hangers and reinforcing to accommodate loads being carried.
- .6 Provide suspension hanger at each corner of suspended fixtures, and at maximum 610 mm OC around perimeter of fixture.
- .7 Locate ceiling grid system on room axis leaving equal border units according to reflected ceiling plan.
- .8 Install main tees suspended at maximum 1 220 mm OC and maximum 600 mm from wall.
- .9 Install cross tees and grid adapters perpendicular to main tees, and interlock with main tees.
- .10 Frame around fixtures and openings.
- .11 Install edge moulding at intersection of ceiling and vertical surfaces.
- .12 Form expansion joints as detailed. Form to accommodate plus or minus 25 mm movement. Maintain visual closure.

### 3.3 LAY-IN TILE

- .1 Fit lay-in tiles in place, free from damaged edges.
- .2 Neatly cut lay-in tiles to accommodate necessary penetrations.
- .3 Cut and rabbet lay-in tiles at border areas and vertical surfaces.
- .4 Lay directional patterned units one way with pattern parallel to longest room axis. Fit border neatly against abutting surfaces.

- .5 Install hold-down clips to retain lay-in tiles tight to grid system within 6 000 mm of exterior doors.

3.4 TOLERANCES

- .1 Variation from Flat and Level Surface:  $\leq 3$  mm in 3 000 mm.

END OF SECTION



1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 09 21 16 - Gypsum Board Assemblies.
- .3 Section 09 30 00 - Tiling.
- .4 Section 09 65 19 - Resilient Tile Flooring.
- .5 Section 09 65 66 - Resilient Athletic Flooring.

1.2 REFERENCES

- .1 ASTM F1861-21: Standard Specification for Resilient Wall Base.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate 100 mm long sample sets, illustrating manufacturer's complete line of available colour selections.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.
- .2 Extra Stock Materials: Three percent or 6 m<sup>2</sup>, whichever is greater, of each Product, colour and pattern; clearly marked to identify:
  - .1 Manufacturer's name,
  - .2 Product's name,
  - .3 Product colour and pattern.
- .3 Package Products neatly in original containers, to prevent damage.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Products undamaged in original wrapping or cartons.
- .3 Store Products for minimum 3 days prior to installation in a warm, dry room; stacked not more than four boxes high.

1.7 AMBIENT CONDITIONS

- .1 Maintain ambient air temperature of 20 degrees C three days prior to, during, and 48 hours after installation of flooring materials.
- .2 Maintain ambient air relative humidity between 35 percent and 55 percent RH.
- .3 Do not install Products in conditions of high humidity or where exposed to cold drafts.
- .4 In hot weather, protect Products from direct sunlight.
- .5 Provide adequate ventilation.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Armstrong World Industries.
  - .2 Roppe Corporation.
  - .3 Tarkett Johnsonite.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 MATERIALS

- .1 Resilient Straight Base (RB-STR): To ASTM F1861, Type TP, Group 1, Style A - Straight; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; colours as selected by Consultant.
- .2 Resilient Coved Base (RB-COVE): To ASTM F1861, Type TP, Group 1, Style B - Cove; 3.2 mm thick thermoplastic rubber, 102 mm high; top set; complete with pre-moulded end stops and external corners; colours as selected by Consultant.
- .3 Resilient Transition Strips (RTS): Thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; colours as selected by Consultant.
- .4 Adhesive: Non-flammable, solvent free contact adhesive, neoprene water-based formulation, Off-white colour; eg. Johnsonite #946 Premium Contact Adhesive by Tarkett Johnsonite.
- .5 Filler: Premixed latex filler, White colour.
- .6 Primers: Acrylic, waterproof type; as recommended by manufacturer.
- .7 Sealers and Wax: As recommended by manufacturer.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify surfaces are dry, true, even and smooth, and free of gaps, holes and depressions.
- .3 Verify surfaces are free of paint, grease and oil.

### 3.2 PREPARATION

- .1 Clean substrate to remove deleterious matter which would impair adhesion of Products.
- .2 Prepare substrate to a smooth and flat surface, as follows:
  - .1 Remove ridges and bumps by grinding or other means.
  - .2 Fill low spots, cracks, joints, holes, and other defects with filler.
  - .3 Apply, trowel and float filler to leave smooth, flat, hard surface.
  - .4 Prohibit traffic until filler is cured.
  - .5 Vacuum clean substrate.
- .3 Prime substrates to ensure proper adhesion of Products.

### 3.3 INSTALLATION

- .1 Install Products on solid backing.
- .2 Bond Products tight to surfaces.

- .3 Mitre internal corners.
  - .4 At exposed ends and external corners, conform to the following:
    - .1 Coved Base: Use pre-moulded units.
    - .2 Straight Base: V-cut back of base strip to two-thirds of its thickness, and fold to desired shape.
  - .5 Scribe and fit base to door frames and other interruptions.
- 3.4 CLEANING
- .1 Refer to Section 01 74 00.
  - .2 Clean, seal and wax installed Products.
- 3.5 PROTECTION
- .1 Refer to Section 01 76 00.
  - .2 Protect completed installation with suitable and durable materials.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 09 30 00 - Tiling.
- .2 Section 09 65 13 - Resilient Base and Accessories.
- .3 Section 09 65 66 - Resilient Athletic Flooring.

1.2 REFERENCES

- .1 ASTM F710-22: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .2 ASTM F1700-20: Standard Specification for Solid Vinyl Floor Tile.
- .3 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .4 ASTM F2170-19a: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .5 ASTM F2678-16(2021): Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring.
- .6 ASTM F3191-23: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.
- .7 ASTM F3441-24a: Standard Guide for Measurement of pH Involving Resilient Flooring Installations.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate 300 x 300 mm size samples of each specified Product, illustrating manufacturer's complete line of available colours and patterns.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.
- .2 Extra Stock Materials: Three percent or 6 m<sup>2</sup>, whichever is greater, of each resilient flooring Product, colour and pattern; clearly marked to identify:
  - .1 Manufacturer's name,
  - .2 Product's name,
  - .3 Product colour and pattern.
- .3 Package tile products neatly in original containers, to prevent damage.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Products undamaged in original wrapping or cartons.
- .3 Store Products for minimum 3 days prior to installation in a warm, dry room.
- .4 Store Products stacked not more than four boxes high.

## 1.7 AMBIENT CONDITIONS

- .1 Maintain ambient air temperature of 20 degrees C three days prior to, during and 48 hours after installation.
- .2 Maintain ambient air relative humidity between 35 percent and 55 percent RH.
- .3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts.
- .4 In hot weather, protect flooring from direct sunlight.
- .5 Provide adequate ventilation.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 American Biltrite Flooring.
  - .2 Gerflor.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 MATERIALS

- .1 Luxury Vinyl Tile (LVT): To ASTM F1700, Class III, Type B, Embossed Surface; as follows:
  - .1 Plank Size: As selected by Consultant.
  - .2 Total Thickness: 2.5 mm.
  - .3 Wear Layer Thickness: 0.7 mm
  - .4 Colours: As selected by Consultant.
  - .5 Product and Manufacturer Names: Mirra Wood by American Biltrite Flooring or Creation 70 by Gerflor.
- .2 Adhesive: Epoxy adhesive, solvent free; eg. AD-535 by American Biltrite Flooring.
- .3 Underlayment Patching Compound: Self-drying, hydraulic cement-based underlayment, having a trowel-applied consistency; mould- and mildew-resistant; capable of achieving a true feather edge; zero VOC content; eg. Feather Finish by Ardex Americas.
- .4 Primers: Acrylic, waterproof type; as recommended by flooring manufacturer.
- .5 Sealers and Wax: As recommended by flooring manufacturer.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify substrates are dry, true, even and smooth.
- .3 Verify substrates are free of gaps, holes and depressions.

- .4 Verify substrates are free of paint, grease and oil.
- .5 Verify concrete slabs have cured for minimum 28 days.
- .6 Verify concrete slabs have pH level between 7 and 9, to ASTM F3441.
- .7 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER  $\leq$  2.26 kg per 100 m<sup>2</sup> for 24 hours.
- .8 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with installation until tests indicate RH  $\leq$  75 percent.
- .9 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

### 3.2 PREPARATION

- .1 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test. Conform to ASTM F710.
- .2 Prepare underlayment patching compounds and surrounding slab surface to ASTM F2678.
- .3 Clean substrate to remove deleterious matter that would impair subsequent installation.
- .4 Prime substrates to ensure proper adhesion of Products.

### 3.3 INSTALLATION

- .1 Install Products with joints and seams parallel to building lines, laid in a brick ashlar pattern.
- .2 Spread only enough adhesive to permit installation of Products before initial set.
- .3 Set Products in place, press with heavy roller to attain full adhesion.
- .4 Provide perimeter tile of similar size within any given area.
- .5 Lay flooring continuously from wall to wall in each area, including beneath casework.
- .6 Terminate flooring at centre line of door openings where adjacent floor finish is dissimilar.
- .7 Scribe flooring to walls, columns, floor outlets and other appurtenances to produce tight joints.

### 3.4 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean, seal and wax installed Products.

### 3.5 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect completed installation with suitable and durable protective coverings, or by keeping traffic off floor.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 09 30 00 - Tiling.
- .3 Section 09 65 13 - Resilient Base and Accessories.
- .4 Section 09 65 19 - Resilient Tile Flooring.
- .5 Section 11 66 23 - Gymnasium Equipment.

1.2 REFERENCES

- .1 ASTM F710-22: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .2 ASTM F1303-04(2021): Standard Specification for Sheet Vinyl Floor Covering with Backing.
- .3 ASTM F1516-13(2018): Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).
- .4 ASTM F1869-23: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .5 ASTM F2170-19a: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .6 ASTM F2772-11(2019): Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems.
- .7 ASTM F2678-16(2021): Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring.
- .8 ASTM F3191-16: Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating game line layout, locations and sizes of special graphics, floor inserts, and equipment anchors. Note colours and thicknesses of games lines and graphic inserts.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.5 EXTRA STOCK MATERIALS

- .1 Supply extra stock materials as specified in Section 01 78 00.

- .2 Extra Stock Materials: One percent of each resilient athletic flooring Product, colour and pattern; clearly marked to identify:
  - .1 Manufacturer's name,
  - .2 Product's name,
  - .3 Product colour and pattern.
- .3 Supply roll goods in full width rolls.
- .4 Store roll goods in upright position, with roll wrapped in a protective cover to prevent damage.

## 1.6 QUALIFICATIONS

- .1 Installer: A firm specializing in installing resilient athletic flooring, approved by flooring manufacturer and having minimum two years documented experience indicating successful completion of not less than 5 similar installations.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver and store Products undamaged in original wrapping or cartons, with manufacturer's labels and seals intact.
- .3 Store Products in up-right position in a warm dry room for minimum 3 days prior to installation.

## 1.8 AMBIENT CONDITIONS

- .1 Maintain ambient air temperature between 18 degrees C and 30 degrees C.
- .2 Do not lay Products in conditions of high humidity or where exposed to cold drafts.
- .3 In hot weather, protect flooring from direct sunlight.
- .4 Provide adequate ventilation.

## 1.9 WARRANTY

- .1 Submit extended warranties in accordance with General Conditions of the Contract.
- .2 Installer's Extended Warranty: For a period of two years, covering against punctures, tears, delamination, and excessive wear.
- .3 Manufacturer's Extended Warranty: A non-prorated manufacturer's extended warranty, covering against the following:
  - .1 Product defects for 10 years.
  - .2 Wear through wear layer (with surface as defined in ASTM F1303) for 15 years.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Gerflor Sports Flooring.
  - .2 Tarkett Sports.
- .2 Substitution Procedures: Refer to Section 01 25 00.



## 2.2 DESCRIPTION

- .1 Resilient Athletic Flooring: Multi-purpose sport vinyl surface, comprised of a vinyl foam backing, reinforced fiberglass mesh and a smooth faced PVC wear layer; complete with game lines and graphics.

## 2.3 PERFORMANCE CRITERIA

- .1 Resilient Athletic Flooring: To ASTM F2772, as follows:
  - .1 Shock Absorption: 22-33 percent.
  - .2 Vertical Deformation: Maximum 3.5 mm.
  - .3 Ball Bounce: Minimum 90 percent.
  - .4 Sliding Coefficient: 80 -110.

## 2.4 MATERIALS

- .1 Resilient Athletic Flooring (RAF): To ASTM F2772, Class 2; 6.5 mm overall thickness, comprised of 2.0 mm thick homogenous wear-layer and closed-cell foam cushioned backing, reinforced with fiber glass mesh interlayer; integral fungistatic and bacteriostatic treatment; treated with factory-applied photoreticulated, UV cured polyurethane, anti-dirt treatment; eg. Omnisports Multiflex by Tarkett Sports, Pure Maple pattern and colour, complete with line work and graphic inserts as indicated on Drawings.
- .2 Welding Rods: 4 mm OD vinyl, solid colour; colour matched to flooring.
- .3 Levelling Compound: Approved by manufacturer to correct minor subfloor deviations.
- .4 Adhesive: Two-part, solvent free adhesive; Multi-Poxy by Tarkett Sports.
- .5 Seaming Tape: eg. Tarkotape by Tarkett Sports.
- .6 Game Line Primer and Paint: As recommended by flooring manufacturer.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify concrete slab is adequately vapour sealed.
- .3 Verify adequate perimeter drainage has been installed.
- .4 Verify concrete slab is clean and dry.
- .5 Verify no curing compounds or sealers have been applied to concrete slab.
- .6 Verify variations in concrete slab do not exceed plus or minus 3 mm in 3 000 mm radius.
- .7 Verify concrete slabs have cured for minimum 28 days.
- .8 Verify concrete slabs have neutral alkalinity and have carbonized.
- .9 Conduct moisture vapour emission rate tests on concrete slabs-on-fill to ASTM F1869. Do not proceed with installation until tests indicate MVER  $\leq$  6.8 kg per 100 sm for 24 hours.
- .10 Conduct relative humidity tests on concrete slabs to ASTM F2170. Do not proceed with flooring installation until tests indicate RH  $\leq$  90 percent.
- .11 Determine absorptive nature of substrates by conducting porosity tests to ASTM F3191.

### 3.2 PREPARATION

- .1 Prepare substrate as recommended by manufacturer for absorptive conditions determined by porosity test. Conform to ASTM F710.
- .2 Prepare levelling compounds and surrounding concrete slab to ASTM F2678.
- .3 Fill cracks, grooves, voids and construction joints with approved levelling compound.
- .4 Remove high spots on floor slab by grinding method.
- .5 Remove deleterious matter which would impair adhesion of flooring.
- .6 Broom clean substrate.

### 3.3 INSTALLATION

- .1 Install Product using loose laid, non-adhered method, similar to Tarkett GreenLay. Minimize cross seams.
- .2 Terminate flooring at centerline of openings where adjacent floor finish or colour is dissimilar.
- .3 Cut neatly around penetrations.
- .4 Heat weld seams to ASTM F1516 using matching welding rods.
- .5 Lay out game lines and special graphics in accordance with accepted Shop Drawings.

### 3.4 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Restrict access to completed installation for 72 hours after completion of flooring.
- .3 Protect completed installation with suitable and durable protective coverings, or by keeping traffic off floor.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 07 21 00 - Thermal Insulation.
- .2 Section 09 21 16 - Gypsum Board Assemblies.
- .3 Section 09 51 23 - Acoustical Tile Ceilings.

1.2 REFERENCES

- .1 ASTM C423-17: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .2 ASTM E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 CAN/ULC-S114-2018: Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .5 CAN/ULC-S129-15 (REV1): Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).
- .6 CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .7 ULC-S702.2-15: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Store Products away from construction activity and sources of ignition.
- .3 Protect Products from damage during handling, installation and at point of installation.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of acoustical insulation having Product considered acceptable for use:
  - .1 CertainTeed Canada, Inc.
  - .2 Knauf Insulation.
  - .3 Owens-Corning Canada Inc.
  - .4 Rockwool.
- .2 Manufacturers of flame-resistant acoustical insulation having Product considered acceptable for use:
  - .1 Johns Manville.
  - .2 Owens-Corning Canada Inc.
  - .3 Rockwool.
- .3 Substitution Procedures: Refer to Section 01 25 00.

## 2.2 MATERIALS

- .1 Acoustical Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre acoustical batts, non-rigid, friction fit type, manufactured from glass, rock, or slag fibers; and as follows:
  - .1 Noise Reduction Coefficient (ASTM C423):  $NRC \geq 1.10$  @ 100 mm thick.
  - .2 Facing: Unfaced.
  - .3 Density:  $\geq 40$  kg/m<sup>3</sup>.
  - .4 Combustibility (CAN/ULC-S114): Noncombustible.
  - .5 Thickness: As indicated on Drawings.
  - .6 Manufacturer and Product Name: eg. QuietZone by Owens-Corning Canada Inc.
- .2 Flame-Resistant Acoustical Insulation: To CAN/ULC-S702.1, Type 1; mineral fibre acoustical batts, non-rigid, friction fit type, manufactured from only rock or slag fibers; acceptable for use in fire-rated partitions; and as follows:
  - .1 Noise Reduction Coefficient (ASTM C423):  $NRC \geq 1.10$  @ 100 mm thick.
  - .2 Facing: Unfaced.
  - .3 Density:  $\geq 40$  kg/m<sup>3</sup>.
  - .4 Combustibility (CAN/ULC-S114): Noncombustible.
  - .5 Surface Burning Characteristics (CAN/ULC-S102)
    - .1 Flame Spread Index = 0.
    - .2 Smoke Developed Index = 0.
  - .6 Smoulder Resistance (CAN/ULC-S129): 0.09 percent.
  - .7 Thickness: As indicated on Drawings.
  - .8 Manufacturer and Product Name: eg. Rockwool AFB by Rockwool.
- .3 Mechanical Fasteners: Stainless steel screw type fastener, complete with 75 mm OD moulded plastic disc washer.
- .4 Adhesive: Mastic type, synthetic rubber base, fungi resistant, gun or trowel application.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to ULC-S702.2 and ASTM E90, without gaps and voids.
- .2 Fit acoustic insulation tight within spaces, around cut openings, behind and around facility service components within or behind partitions, and tight to items passing through partitions.

### 3.2 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect acoustic insulation at end of each Working Day.
- .3 Protect acoustic insulation in areas where welding will be carried out.
- .4 Replace acoustic insulation damaged by others.
- .5 Protect acoustic insulation requiring a thermal barrier in accordance with authorities having jurisdiction.

END OF SECTION

1 General

1.1 PRODUCTS FURNISHED OR INSTALLED UNDER OTHER SECTIONS

.1 Carefully examine the scope of the Work as indicated on Drawings, and include all finishing, whether specifically mentioned or not, except as specifically excluded below:

- .1 Section 04 21 00 - Clay Unit Masonry: Integral colour.
- .2 Section 04 22 00 - Concrete Unit Masonry: Integral colour of decorative concrete masonry units.
- .3 Section 05 10 00 - Structural Metal Framing: Shop priming.
- .4 Section 05 30 00 - Metal Decking: Galvanized coating.
- .5 Section 05 50 00 - Metal Fabrications: Shop priming.
- .6 Section 06 24 00 - High Pressure Decorative Laminate: Integral colour.
- .7 Section 06 41 00 - Architectural Wood Casework: Shop finishing.
- .8 Section 07 42 13 - Metal Wall Panels: Shop finishing.
- .9 Section 07 42 93.23 - Linear Metal Soffits: Shop finishing.
- .10 Section 07 62 00 - Sheet Metal Flashing and Trim: Shop finishing.
- .11 Section 07 81 00 - Applied Fireproofing: Integral colour.
- .12 Section 07 84 00 - Firestopping: Integral colour.
- .13 Section 07 91 00 - Preformed Joint Seals: Integral colour.
- .14 Section 07 92 00 - Joint Sealants: Integral colour.
- .15 Section 07 95 13 - Expansion Joint Cover Assemblies: Shop finishing.
- .16 Section 08 12 13 - Hollow Metal Frames: Galvannealed coating.
- .17 Section 08 13 13 - Hollow Metal Doors: Galvannealed coating.
- .18 Section 08 14 00 - Wood Doors: Laminate-clad door faces.
- .19 Section 08 31 00 - Access Doors and Panels: Shop priming.
- .20 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Anodized coating.
- .21 Section 08 44 13 - Glazed Aluminum Curtain Wall: Anodized coating.
- .22 Section 08 51 13 - Aluminum Windows: Anodized coating.
- .23 Section 08 71 00 - Door Hardware: Shop finishing.
- .24 Section 09 51 23 - Acoustical Tile Ceilings: Shop finishing.
- .25 Section 09 65 66 - Resilient Athletic Flooring: Game line markings.
- .26 Section 09 96 46 - Intumescent Painting.
- .27 Section 10 11 00 - Visual Display Surfaces: Shop finishing.
- .28 Section 10 14 00 - Signage: Shop finishing.
- .29 Section 10 14 53 - Traffic Signage: Shop finishing.
- .30 Section 10 28 13 - Toilet Accessories: Shop finishing.
- .31 Section 10 56 13 - Metal Storage Shelving: Shop finishing.
- .32 Section 11 66 23 - Gymnasium Equipment: Shop finishing.
- .33 Section 12 24 13.13 - Motorized Roller Window Shades: Anodized coating.
- .34 Section 12 24 13.16 - Manual Roller Window Shades: Anodized coating.
- .35 Section 32 17 23 - Pavement Markings.
- .36 Do not paint glass surfaces.
- .37 Do not paint plastic components.
- .38 Do not paint plated, polished or anodized metal components.
- .39 Do not paint stainless steel components.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 04 22 00 - Concrete Unit Masonry.
- .3 Section 05 10 00 - Structural Metal Framing.
- .4 Section 05 30 00 - Metal Decking.
- .5 Section 05 50 00 - Metal Fabrications.
- .6 Section 06 10 00 - Rough Carpentry.

- .7 Section 06 20 00 - Finish Carpentry.
  - .8 Section 08 12 13 - Hollow Metal Frames.
  - .9 Section 08 13 13 - Hollow Metal Doors.
  - .10 Section 08 14 00 - Wood Doors.
  - .11 Section 08 31 00 - Access Doors and Panels.
  - .12 Section 09 21 16 - Gypsum Board Assemblies.
  - .13 Section 20 05 53 - Identification of Mechanical Services.
- 1.3 REFERENCES
- .1 MPI Architectural Painting Specification Manual.
  - .2 MPI Maintenance Repainting Manual.
  - .3 SSPC Painting Manual, Volume 2 - Systems and Specifications.
- 1.4 SCHEDULING
- .1 Schedule painting operations to prevent disruption to the Work.
  - .2 Schedule painting and coating operations in occupied facilities to prevent disruption of occupants at existing facility. Conduct painting and coating after facility's normal hours of operation and on weekends, in accordance with Owner's operating requirements.
  - .3 Schedule work such that finished surfaces have dried before occupants are affected.
  - .4 Schedule site finishing of doors and frames prior to door, glass and hardware installation.
  - .5 Obtain written authorization from Consultant for changes in finishing schedule.
- 1.5 PRODUCT DATA
- .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturers' standard data sheets for each finishing Product being used, indicating relevant MPI finish system, volatile organic compound (VOC) content, and volume solids (VOL SOL) content.
- 1.6 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Selection Samples: A full range of colour selector samples for each type of coating required.
  - .3 Verification Samples: If requested by Consultant, prepare 1 000 x 1 000 mm size sample panels. Apply finish to actual substrate material, or an acceptable alternate if required to be portable.
- 1.7 EXTRA STOCK MATERIALS
- .1 Supply extra stock materials as specified in Section 01 78 00.
  - .2 Extra Stock Materials: Minimum 4 L of each Product, colour and sheen used.
  - .3 Supply extra stock materials in unopened, new containers, clearly labelled as to manufacturer, Product, colour and sheen.

1.8 QUALIFICATIONS

- .1 Applicators: A firm specializing in commercial painting and finishing of buildings in accordance with MPI Architectural Painting Specification Manual and MPI Maintenance Repainting Manual, and having minimum 10 years documented experience.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Deliver Products in original containers with unbroken seals and labelled to indicate name of manufacturer, brand, colour and quality of contents.
- .3 Store thinners, loose soaked rags and similar combustible materials in closed containers. Remove from Place of the Work or store in an assigned area.
- .4 Provide adequate safe-guards against spontaneous combustion of finishing materials.
- .5 Arrange for a properly enclosed and heated space, satisfactory to Consultant, to be used as a paint shop. Store Products at minimum 10 degrees C.

1.10 AMBIENT CONDITIONS

- .1 Conform to MPI Architectural Painting Specification Manual.
- .2 Apply water-based paints only when temperature of surfaces to be finished and surrounding air temperatures are between 10 degrees C and 30 degrees C.
- .3 Apply solvent-thinned paints only when temperature of surfaces to be finished and surrounding air temperatures are between 6 degrees C and 32 degrees C.
- .4 Do not apply finishes in snow, rain, fog or mist.
- .5 Do not apply finishes when relative humidity exceeds 85 percent RH; or at temperatures less than 2 degrees C above dew point; or to damp or wet surfaces.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturer: Use only Products from manufacturers listed in MPI Architectural Painting Specification Manual for specified paint and finish system.
- .2 Single-Source Responsibility: Provide primers and undercoats from same manufacturer as finish coats.

2.2 DESCRIPTION

- .1 Gloss Ratings: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following gloss level categories, as defined in MPI Architectural Painting Specification Manual:
  - .1 Gloss Level G1: Matte or Flat finish.
  - .2 Gloss Level G2: Velvet finish.
  - .3 Gloss Level G3: Eggshell finish.
  - .4 Gloss Level G4: Satin finish.
  - .5 Gloss Level G5: Semi-Gloss finish.
  - .6 Gloss Level G6: Gloss finish.
  - .7 Gloss Level G7: High-Gloss finish.
- .2 Colours: A maximum of 5 exterior colours and 20 interior colours may be required. There may be more than two colours used in each room or space.

## 2.3 PERFORMANCE CRITERIA

- .1 Volatile Organic Compound Content (VOC): Use only paints and coatings having a volatile organic compound (VOC) content as follows:
  - .1 Gloss Level G1: < 50 g/L.
  - .2 Gloss Levels G2-G7: < 150 g/L.
- .2 Volume Solids Content (VOL SOL): Use only paints and coatings having a volume solids (VOL SOL) content as follows:
  - .1 Alkyd Paints and Coatings:  $\geq$  45 percent.
  - .2 Latex Paints and Coatings:  $\geq$  40 percent.

## 2.4 MATERIALS

- .1 Paints and Coatings: Use only Products meeting specified performance criteria and listed in most current Approved Products List included in MPI Architectural Painting Specification Manual, for each specified paint and finish system.
- .2 Paint Accessory Materials: Linseed oil, shellac, turpentine, and other materials of commercial quality.

## 2.5 MIXING

- .1 Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage, that can and will be dispersed readily and uniformly by paddle to a complete, homogeneous mixture.
- .2 Carefully mix and prepare paint materials according to manufacturer's directions.
- .3 Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
- .4 Stir material before application to produce a mixture of uniform density. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
- .5 Use only thinners approved by paint manufacturer, and only within recommended limits.
- .6 Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of same material are applied. Tint undercoats to match colour of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Measure moisture content of surfaces using an electronic moisture metre. Do not apply finishes unless moisture content of surfaces are below recommended maximum values.

### 3.2 PREPARATION

- .1 Prepare surfaces to MPI Architectural Painting Specification Manual.
- .2 Prepare existing surfaces designated to be re-finished to MPI Maintenance Repainting Manual.
- .3 Mask out surrounding surfaces not to receive paint, to protect from overspray or overbrushing.
- .4 Remove hardware and accessories, plates, machined surfaces, lighting fixtures and similar items already installed but not intended to be painted.



- .5 Remove mildew, efflorescence and foreign materials from surfaces using appropriate methods.
- .6 Correct minor defects and deficiencies in surfaces which affect application of paints and coatings.
- .7 Clean and prepare surfaces to be painted according to manufacturers' instructions for each particular substrate condition and finish system.
- .8 Provide barrier coats over incompatible primers.
- .9 Clean ungalvanized ferrous metal surfaces designated to receive site finish. Use solvent or mechanical cleaning methods to SSPC Painting Manual, Volume 2 - Systems and Specifications.
- .10 Clean galvanized surfaces with non-petroleum-based solvents. Surface to be free of oil and surface contaminants. Remove pretreatment from galvanized steel metal fabricated from coil stock by mechanical methods.

### 3.3 APPLICATION

- .1 Apply Products to MPI Architectural Painting Specification Manual.
- .2 Protect adjacent surfaces and areas, including equipment, labels and signage from damage during painting operations. Use drop cloths, shields, masking, templates or other suitable protective means.
- .3 Make Good damage caused by failure to protect surfaces.
- .4 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work areas as required.
- .5 Use methods best suited for substrate and type of material being applied.
- .6 Do not use compressed air or aerosol methods of application without prior written approval of Consultant.
- .7 Spread finishes evenly and flow on smoothly without runs or sags.
- .8 Apply Products no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.
- .9 Apply Products under adequate illumination.
- .10 Sand lightly between coats to achieve required finish.
- .11 Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- .12 Back prime interior wood work with enamel primer sealer paint.
- .13 Back prime exterior wood work with exterior primer paint.
- .14 Pigmented (Opaque) Finishes: Completely cover substrate to a smooth, opaque surface of uniform finish, colour, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be accepted.
- .15 Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, colour irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.
- .16 Match approved samples for colour, texture, and coverage. Remove, refinish or repaint work not complying with specified requirements.

- .17 Finish wood door stiles, top rails, bottom rails and glass stops to match laminate-clad door faces.

### 3.4 FACILITY SERVICES

- .1 Unless otherwise specified or noted, paint "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
  - .1 Where exposed-to-view in exterior and interior areas.
  - .2 In high humidity interior areas.
  - .3 In mechanical and electrical rooms.
- .2 Remove finished louvres, grilles, covers, and access panels on facility service components from location and paint separately. Finish paint primed equipment to colour selected by Consultant.
- .3 Paint inside of air ducts, convection and baseboard heating cabinets where visible behind louvers, grilles and diffusers for minimum 460 mm or beyond sight line, whichever is greater with primer and one coat of matt black (non-reflecting) paint.
- .4 Paint inside of light valances gloss white.
- .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .6 Paint red or band fire protection piping and sprinkler lines as specified in Section 20 05 53. Keep sprinkler heads free of paint.
- .7 Paint yellow or band natural gas piping as specified in Section 20 05 53.
- .8 Backprime and paint face and edges of plywood service panels a semi-gloss, gray colour before installation of telephone and electrical equipment. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .9 Paint exterior steel electrical light standards. Do not paint outdoor transformers and substation equipment.
- .10 Colour code equipment, piping, conduit, and exposed ductwork in accordance with colour schedule. Colour band and identify with flow arrows, names, and numbering.
- .11 In unfinished areas, leave exposed conduits, piping, hangers, ductwork and other facility service components in original finish. Touch-up scratches and marks.
- .12 Touch-up scratches and marks on factory painted finishes and equipment with paint as supplied by equipment manufacturer.
- .13 Do not paint over nameplates.

### 3.5 FIELD QUALITY CONTROL

- .1 Inspect surfaces, preparation and paint applications.
- .2 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent:
  - .1 Brush or roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in painted coatings.
  - .2 Evidence of poor coverage at fastener heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - .3 Damage due to touching before paint is sufficiently dry or other contributory cause.

- .4 Damage due to application on moist surfaces or caused by inadequate protection from weather.
- .5 Damage or contamination of paint due to blown contaminants (dust, spray paint, etc).
- .3 Painted surfaces will be rejected if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
  - .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1 000 mm.
  - .2 Visible defects are evident on horizontal surfaces when viewed at normal veiwing angles from distance of not less than 1 000 mm.
  - .3 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
  - .4 When final coat on any surface exhibits a lack of uniformity of colour, sheen, texture and hiding across full surface area.
- .4 Make Good rejected surfaces. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags or damaged paint shall be removed by scraper or by sanding prior to application of paint.

### 3.6 ADJUSTING

- .1 Following completion of painting and finishing operations, reinstall removed items.
- .2 Remove protective covers and masking from protected surfaces.
- .3 Repaint damaged surfaces to satisfaction of Consultant.

### 3.7 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Remove paint where spilled, splashed, splattered or sprayed using means and materials that are not detrimental to affected surfaces.
- .3 Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.
- .4 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with authorities having jurisdiction.
- .5 Clean equipment and dispose of wash water / solvents as well as other cleaning and protective materials, paints, thinners, paint removers and strippers in accordance with authorities having jurisdiction.
- .6 Leave the Work clean and free from dirt and debris.

### 3.8 WASTE MANAGEMENT

- .1 Paint, stain and wood preservative finishes and related materials (thinner, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from authorities having jurisdiction.
- .2 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and deliver to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

- .4 To reduce the amount of contaminants entering waterways, sanitary sewers, storm sewers, or into the ground strictly adhere to the following procedures:
  - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. Do not clean equipment using free draining water.
  - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - .4 Dispose of contaminants in an approved legal manner in accordance with applicable regulatory requirements dealing with hazardous waste.
  - .5 Empty paint cans are to be dry prior to disposal or recycling.
  - .6 Close and tightly seal partly used cans of materials, including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .5 Set aside and protect surplus and uncontaminated finish materials not required by Owner and deliver or arrange collection of verifiable re-use or re-manufacturing.

### 3.9 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect other surfaces from paint or damage.
- .3 Repair damage.

### 3.10 FINISH SCHEDULE

- .1 Provide the following paint or finish systems for the various substrates indicated, in accordance with MPI Architectural Painting Specification Manual.
- .2 Refinishing Existing, Previously Finished Surfaces:
  - .1 Refer to MPI Maintenance Repainting Manual Section for refinishing existing finishes.
  - .2 Use finish coat of respective new surface finish system for minor repair of existing finishes.
  - .3 Use system primer where existing finishes are damaged down to bare surface.
- .3 Exterior Painting and Finishing Schedule
  - .1 Structural Steel
    - .1 Corrosion-Resistant Opaque Painted Finish: EXT. 5.1B - W.B. LIGHT INDUSTRIAL COATING (over inorganic zinc), Premium Grade; Gloss Level G5.
  - .2 Metal Fabrications
    - .1 Opaque Painted Finish: EXT. 5.1D - ALKYD (over alkyd metal primer), Premium Grade; Gloss Level G5.
  - .3 Galvanized and Galvannealed Metal
    - .1 Opaque Painted Finish: EXT. 5.3B - ALKYD (over cementitious primer), Premium Grade; Gloss Level G6.
  - .4 Aluminum (Not Anodized)
    - .1 Opaque Painted Finish: EXT. 5.4H - LATEX (over q.d. metal primer), Premium Grade, Gloss Level G6.
  - .5 Dimension Lumber and Panels
    - .1 Opaque Painted Finish: EXT 6.2A - LATEX (over alkyd/oil primer), Premium Grade; Gloss Level G5.
    - .2 Opaque Stained Finish: EXT. 6.2B - SOLID COLOR STAIN, W.B. (over alkyd/oil primer), Premium Grade; Gloss Level G1.
    - .3 Semi-Transparent Stained Finish: EXT. 6.2E - VARNISH, S.B. (over s.b. stain), Premium Grade; Gloss Level G5.
  - .6 Dressed Lumber and Panels
    - .1 Opaque Painted Finish: EXT. 6.3A - LATEX (over alkyd/oil primer), Premium Grade; Gloss Level G5.

- .2 Semi-Transparent Stained Finish: EXT. 6.3E - VARNISH, S.B. (over s.b. stain), Premium Grade; Gloss Level G5.
- .3 Opaque Stained Finish: EXT. 6.3K - SOLID COLOR STAIN, W.B. (over alkyd/oil primer), Premium Grade; Gloss Level G1.
- .4 Interior Painting and Finishing Schedule
  - .1 Concrete Surfaces (except floors)
    - .1 Epoxy Finish: INT. 3.1G - EPOXY-MODIFIED LATEX (for smooth concrete), Premium Grade; Gloss Level G6.
    - .2 Opaque Painted Finish: INT. 3.1M - INSTITUTIONAL LOW ODOR / VOC, Premium Grade; Gloss Level G4.
  - .2 Concrete Floors
    - .1 Epoxy Finish: INT. 3.2C - EPOXY, Premium Grade; Gloss Level G5.
  - .3 Concrete Masonry Units
    - .1 Opaque Painted Finish: INT. 4.2E - INSTITUTIONAL LOW ODOR / VOC (over latex block filler), Premium Grade; Gloss Level G4.
    - .2 Epoxy Finish: INT. 4.2J - EPOXY-MODIFIED LATEX (over latex block filler) FOR DRY ENVIRONMENTS, Premium Grade; Gloss Level G6.
  - .4 Structural Steel, Steel Joists, Steel Deck and Metal Fabrications
    - .1 Opaque Painted Finish - Overhead Applications: INT. 5.1C - W.B. DRY FALL (over q. d. alkyd primer), Budget Grade; Gloss Level G5.
    - .2 Opaque Painted Finish: INT. 5.1E - ALKYD (over q.d. alkyd primer), Premium Grade; Gloss Level G5.
    - .3 Epoxy Finish: INT. 5.1K - EPOXY-MODIFIED LATEX (over w.b. rust-inhibitive primer), Premium Grade; Gloss Level G6.
  - .5 Galvanized and Galvannealed Metal
    - .1 Opaque Painted Finish: INT. 5.3N - INSTITUTIONAL LOW ODOR / VOC (over w. b. galvanized primer), Premium Grade; Gloss Level G5.
  - .6 Dimension Lumber and Panels
    - .1 Opaque Painted Finish: INT. 6.2L - INSTITUTIONAL LOW ODOR / VOC (over latex primer), Premium Grade; Gloss Level G5.
  - .7 Dressed Lumber, Panels and Veneers
    - .1 Semi-Transparent Stained Finish: INT. 6.3EE - POLYURETHANE VARNISH (over w.b. stain), Premium Grade; Gloss Level G4.
    - .2 Semi-Transparent Stained Fire Retardant Finish: INT. 6.3RR - FIRE RETARDANT, PIGMENTED, W.B., Gloss Level G4.
    - .3 Opaque Painted Finish: INT. 6.3V - INSTITUTIONAL LOW ODOR / VOC (over latex primer), Premium Grade; Gloss Level G5.
  - .8 Gypsum Board
    - .1 Epoxy Finish: INT. 9.2F - EPOXY-MODIFIED LATEX (over latex primer/sealer), Premium Grade; Gloss Level G6.
    - .2 Opaque Painted Finish: INT. 9.2M - INSTITUTIONAL LOW ODOR / VOC (over latex primer/sealer), Premium Grade; Gloss Levels as follows:
      - .1 Ceiling Applications: G1.
      - .2 All Other Applications: G3.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 05 10 00 - Structural Metal Framing.
  - .2 Section 05 30 00 - Metal Decking.
  - .3 Section 09 90 00 - Painting and Coating.
- 1.2 REFERENCES
  - .1 ASTM E2924-14(2020): Standard Practice for Intumescent Coatings.
  - .2 SSPC-PA 2-2015: Procedure for Determining Conformance to Dry Coating Thickness Requirements.
  - .3 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- 1.3 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, including information on physical properties, installation instructions, and general requirements for each specified intumescent material.
- 1.4 SAMPLES
  - .1 Submit samples as specified in Section 01 33 00.
  - .2 Verification Samples: 300 x 300 mm size sample of each type of intumescent coating, applied to a rigid backing, in colour and finish indicated.
- 1.5 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines, including procedures for stain removal, repairing surface, and general cleaning; sufficient quantity for inclusion in operation and maintenance manual.
- 1.6 QUALIFICATIONS
  - .1 Applicator: A firm experienced in applying intumescent coatings, having minimum 10 years documented experience.
- 1.7 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Store Products in a dry, enclosed area protected from exposure to moisture.
  - .3 Maintain temperatures between 16 degrees C and 32 degrees C.
- 1.8 AMBIENT CONDITIONS
  - .1 Refer to Section 01 60 00.
  - .2 Do not install coating when ambient temperature is below 4 degrees C or above 43 degrees C.
  - .3 Maintain this temperature range 7 days before, during and 48 hours after coating application.

- .4 Ensure adequate ventilation is maintained during and after coating application. Comply with WHMIS requirements and manufacturer's instructions.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Products considered acceptable for use:

- .1 3M Company Canada.
- .2 AD Fire Protection Systems Inc.
- .3 Carboline Company.
- .4 Isolatek International.

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

### 2.2 DESCRIPTION

- .1 Intumescent Coating: Multi-component seamless intumescent coating system, consisting of a primer, intermediate, finish and tinted top coats, applied to sufficient thicknesses to achieve required fire resistance ratings and W/D factors.

### 2.3 REGULATORY REQUIREMENTS

- .1 Conform to applicable regulatory requirements for surface burning characteristics when tested to CAN/ULC-S102.

### 2.4 MATERIALS

- .1 Ferrous Metal Primer: Two-component, high solids, low-VOC, corrosion-resistant epoxy; eg. Carboguard 880 by Carboline; Gray colour.
- .2 Galvanized Metal Primer: Two-component polymeric epoxy amine, 99 percent solids by volume; eg. Rustbond by Carboline; Translucent Green colour.
- .3 Intermediate Coat - Exterior Applications: Single-component intumescent, 67 percent solids by volume; eg. Nullifire S605 by Carboline, Pale Green colour.
- .4 Intermediate Coat - Interior Applications: Single-component intumescent, 67 percent solids by volume; eg. Nullifire S606 by Carboline, Pale Pink colour.
- .5 Finish Coat: Two-component polyamido-amine epoxy, 98 percent solids by volume; eg. Carboguard 1340 by Carboline; Clear Amber colour, Gloss finish.
- .6 Tinted Top Coat: Two-component urethane, Semi-Gloss finish, colours as selected by Consultant; eg. Carbothane 133 VOC by Carboline.

### 2.5 MIXING

- .1 Thoroughly mix ingredients in proper quantities needed for immediate use.
- .2 Provide uniformity of mix and colouration.
- .3 Discard mixed material 45 minutes after initial mixing at an air temperature of 25 degrees C.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.

- .2 Verify ferrous metal surfaces have been prepared using SSPC SP-6, Commercial Blast Cleaning method.

### 3.2 PREPARATION

- .1 Clean substrate surface free of foreign matter.
- .2 Spray apply ferrous metal primer to 0.02 mm dry film thickness.
- .3 Spray apply galvanized metal primer to 0.05 mm dry film thickness.
- .4 Allow primer to cure.

### 3.3 APPLICATION

- .1 Apply intumescent coatings to ASTM E2924 and SSPC Steel Structures Painting Manual, Volume 2.
- .2 Spray apply intermediate coating to primed substrate in multiple coats, to a dry film thickness sufficient to achieve required fire resistance rating and W/D factor of steel member being protected. Refer to UL Directory under relevant UL design. Allow each coat to cure prior to applying subsequent coats.
- .3 Spray apply finish coating over cured intermediate coating to 0.05 mm dry film thickness.
- .4 Apply tinted top coating over cured finish coating, applied to 0.125 mm dry film thickness.
- .5 Terminate in straight lines, at masking tape line.
- .6 Thoroughly air cure applied Products.
- .7 Prevent contamination during application and prior to completion of curing process. Close area of application for minimum 24 hours after application.
- .8 Ensure cured intumescent coatings have a smooth, flat and even surface, without visually noticeable runs, sags, waves and other imperfections.

### 3.4 FIELD QUALITY CONTROL

- .1 Arrange for manufacturer's representative to be present at start of installation.
- .2 Field inspection will be performed by independent inspector, as specified in Section 01 40 00.
- .3 Verify dry film thicknesses to SSPC-PA 2, using positector or similar dry film thickness testing device.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Remove temporary protective coverings and clean intumescent coatings prior to final inspection.

### 3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect intumescent coatings from damage and wear during construction with temporary protective coverings.

END OF SECTION



- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 04 22 00 - Concrete Unit Masonry.
  - .2 Section 06 20 00 - Finish Carpentry.
  - .3 Section 06 41 00 - Architectural Wood Casework.
  - .4 Section 09 21 16 - Gypsum Board Assemblies.
- 1.2 REFERENCES
  - .1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
  - .2 ANSI A208.1-2009: Particleboard.
  - .3 ASTM A424/A424M-18: Standard Specification for Steel, Sheet, for Porcelain Enameling.
  - .4 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
  - .6 PEI 1002: Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.
  - .7 CAN/ULC-S102-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .8 CAN/ULC-S706.1-2020: Standard for Wood Fibre Insulating Boards for Buildings.
- 1.3 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating materials, layouts, component dimensions and thicknesses, details of connections and fastening, trim, hardware, and shop-applied finishes.
- 1.4 CLOSE-OUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard maintenance and cleaning guidelines; sufficient quantity for inclusion in the operation and maintenance manual.
  - .3 Apply removable maintenance instruction labels to each markerboard.
- 1.5 MOCK-UPS
  - .1 Construct mock-ups as specified in Section 01 40 00.
  - .2 Mock-Up Panel: One 1 000 x 1 000 mm size mock-up panel; comprised of one markerboard and one tackboard; demonstrating quality of materials, trim pieces, and method of joining adjacent panels.
  - .3 Accepted mock-ups will be used as the standard for acceptance of the Work.
  - .4 Remove and replace installed Product that does not conform to accepted mock-up.
  - .5 Remove mock-ups from Place of the Work upon Ready-for-Takeover.

## 1.6 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: Warrant markerboards for a period of 10 years against defects other than those due to normal usage and wear, including fading, crazing, chipping, peeling, and the surface becoming slick, glassy or otherwise unsuitable for use.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 ASI Visual Display Products, Inc.
  - .2 Claridge.
  - .3 Delta Products, Ltd.
  - .4 Global School Products Inc.
  - .5 Martack Specialties Ltd.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 DESCRIPTION

- .1 Use only matching components from a single manufacturer's series of Products.

### 2.3 REGULATORY REQUIREMENTS

- .1 Test Products for surface burning characteristics to CAN/ULC-S102.

### 2.4 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper.
- .2 Porcelain Enameled Sheet Steel: To ASTM A424/A424M, Type I, Commercial Steel.
- .3 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS), Types A, B, and C; galvanized.
- .4 Cork: Natural cork, Tan colour.
- .5 Fibreboard: To CAN/ULC-S706.1, Type I; impregnated, sound absorbing type.
- .6 Particleboard: To ANSI A208.1, Grade M-2.

### 2.5 MANUFACTURED UNITS

- .1 Markerboard: Sandwich type construction, as follows:
  - .1 Face Panel: 0.76 mm thick porcelain enameled sheet steel; writable and washable surface, acid-resistant; White colour.
  - .2 Core: 11 mm thick fibreboard.
  - .3 Back-up Balancing Sheet: 0.4 mm thick sheet steel.
- .2 Tackboard: 13 mm thick; factory laminated; as follows:
  - .1 Tackable Surface: 6 mm thick cork.
  - .2 Back-up Panel: 6 mm thick particleboard.
- .3 Aluminum Trim: 1.5 mm thick extruded aluminum profiles; eg. Series 9800 by ASI Visual Display Products, Inc., comprised of:
  - .1 Perimeter and divider trim,
  - .2 Map rail, with integral tan cork insert, end stops and two combination roller map hooks for every 1 830 mm of map rail,

- .3 Concealed mechanical joining system, including 25 mm wide integrally slotted PVC inserts laminated into ends of panels, and 2.0 mm thick galvanized steel splines.
- .4 Marker tray, with contour fitting end castings; non-protruding type.

## 2.6 FABRICATION

- .1 Markerboards: Factory laminate core to face panel and back-up balancing sheet under heat and pressure.
- .2 Tackboards: Factory laminate tackable surface to back-up panel under mechanical pressure, using waterproof adhesive.

## 2.7 FINISHES

- .1 Anodized Coating on Extruded Aluminum: To AAMA 611, AA-A41 Clear etched and anodized satin finish, free from extruding draw marks and surface scratches.
- .2 Porcelain Enamel Coating on Sheet Steel: To PEI 1002; having gloss factor between 6-8 when measured with 45 degree glossometer.
- .3 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF120; wiped zinc-iron alloy coating, with streak-free matte grey appearance.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify millwork units designated to incorporate visual display surfaces are installed.

### 3.2 INSTALLATION

- .1 Install components to ensure a rigid, straight, square, plumb installation with horizontal lines level.
- .2 Securely attach aluminum trims, ensuring fastenings are concealed.
- .3 Adhere tackboards to wall surface with approved adhesive in egg-size blobs at approximately 200 mm OC. Press tackboards firmly into adhesive, ensuring proper adhesion.
- .4 Join markerboards together using concealed mechanical joining system. Ensure flush, butted joint, with hairline appearance.

### 3.3 ADJUSTING

- .1 Leave visual display boards in a state suitable for immediate use by Owner.

### 3.4 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean down, remove dirt and leave elements in first class condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 08 13 13 - Hollow Metal Doors.
- .3 Section 08 14 00 - Wood Doors.
- .4 Section 09 21 16 - Gypsum Board Assemblies.
- .5 Section 10 14 53 - Traffic Signage.

1.2 ALLOWANCES

- .1 Contract Price includes a stipulated sum cash Allowance as specified in Section 01 21 00.
- .2 Cash Allowance: Cost for supply and installation of:
  - .1 Interior graphic vinyl films,
  - .2 Interior door signage, and
  - .3 Interior wayfinding signage and directories.

1.3 REFERENCES

- .1 AAMA 611-20: Voluntary Specification for Anodized Architectural Aluminum.
- .2 AAMA 2605-22: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .4 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.
- .5 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .6 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- .7 ASTM B85/B85M-18e1: Standard Specification for Aluminum-Alloy Die Castings.
- .8 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .9 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .10 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .11 ASTM D3363-20: Standard Test Method for Film Hardness by Pencil Test.
- .12 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
- .13 ASTM F844-19: Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

#### 1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, thicknesses, design style, fonts and font sizes, finishes, methods of attachment and special details.

#### 1.5 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: One full size sample of each sign type, illustrating size, thickness, method of attachment, font style, font size, and factory-applied finishes.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Maintenance Data: Manufacturer's standard care, maintenance, and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

#### 1.7 QUALIFICATIONS

- .1 Manufacturer: A firm specializing in manufacturing signage, having minimum 5 years documented experience.

### 2 Products

#### 2.1 DESCRIPTION

- .1 Braille: Raised bead type, to AODA requirements.

#### 2.2 MATERIALS

- .1 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 316.
- .2 Stainless Steel Bar and Shapes: To ASTM A276/A276M, Type 316.
- .3 Sheet Steel: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel.
- .4 Extruded Aluminum: To ASTM B221M, 6061 alloy, T6 temper.
- .5 Cast Aluminum: To ASTM B85/B85M, 6063 alloy, T5 temper.
- .6 Sheet Aluminum: To ASTM B209/B209M, 5005-H32 alloy.
- .7 Fasteners: Countersunk screw-type with tamperproof heads, complete with plastic wall plugs when required for securement to wall surfaces; suitable sizes for intended application. Do not use through-fastening types.
- .8 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.
- .9 Hardened Washers: To ASTM F436/F436M, Type 1; hardened steel; circular, bevelled and clipped types as required.
- .10 Unhardened Washers: To ASTM F844; punched from cold-rolled steel, plain (flat) type; diameter to suit bolt size; galvanized.
- .11 Adhesive: As recommended by sign manufacturer.

## 2.3 MANUFACTURED UNITS

- .1 Text Door Sign Plates: Surface engraved type; 2.0 mm thick dual-layered acrylic with 30 degree bevelled edges; as follows:
  - .1 Length: As required to fit text, minimum 300 mm.
  - .2 Height: 57.2 mm.
  - .3 Text: 25 mm high Helvetica upper and lower case letters.
  - .4 Fastening: Pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges.
  - .5 Colours: As selected by Consultant.
  - .6 Text: As determined by Owner.
- .2 Pictogram Door Sign Plates: 3.2 mm thick plexiglass, square edged, hot stamped or silk screened image on rear face, 150 mm high; pre-drilled 5 mm OD holes to accommodate countersunk fasteners, centered along left and right edges; sizes, colours, and graphic symbols as selected by Consultant.
- .3 Graphic Vinyl Film: Self-adhering type, with shop-applied graphic designs as indicated on Drawings.

## 2.4 FABRICATION

- .1 Fabricate sign plates with letters and numbers centered within sign plate's length and height.
- .2 Provide countersunk holes for screw fasteners.

## 2.5 FINISHES

- .1 Stainless Steel: To AISI No. 6 - Matte.
- .2 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.
- .3 Anodized Coating on Aluminum: To AAMA 611, AA-M10C21A31, Class II Clear Anodic Oxide coating No. 17.
- .4 Monochromatic Paint Coating on Aluminum: To AAMA 2605; three-coat thermosetting fluoropolymer PVDF liquid extrusion and coil coating, factory-applied to 0.04 mm dry film thickness; eg. Duranar XL by PPG Industries, Inc.; colour as selected by Consultant.
- .5 Powder Coated Finish on Metal Components: To AAMA 2605; electrostatically sprayed polymer powder, factory-applied to 0.075 mm dry film thickness, with 4H Hardness rating to ASTM D3363; colour as selected by Consultant.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install signs straight, plumb, level, and secured in a manner to prevent distortion or displacement.
- .2 Finished work shall be free of defects, warping, open seams, and rattles.
- .3 Provide double-sided foam tape adhesive on rear face of sign plates prior to securing with mechanical fasteners.
- .4 Provide routing or mortising for items required to be mortised, rebated or otherwise housed within material.
- .5 Replace Products that are bent, scratched or damaged.

- .6 Provide fasteners to the full required complement, properly tightened.
- .7 Exposed fasteners shall be neatly executed and shall match adjacent surfaces.
- .8 Install braille signage adjacent to sign plates.
- .9 Do not fasten signage through acoustically-rated or fire-rated doors.
- .10 Securely adhere graphic vinyl films to cleaned substrates, in locations and patterns indicated on Drawings. Ensure no air pockets, creases, folds, marks, delaminations, or other visual disfigurements appear in completed application.

### 3.2 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect installed Products with temporary removable film.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 10 14 00 - Signage.
- 1.2 ALLOWANCES
  - .1 Contract Price includes a stipulated sum cash Allowance as specified in Section 01 21 00.
  - .2 Cash Allowance: Cost for supply and installation of exterior traffic and emergency identification signage.
- 1.3 REFERENCES
  - .1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
  - .2 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .4 ASTM A307-21: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
  - .5 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
  - .6 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .7 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
- 1.4 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating sign design and layout, materials, sizes, thicknesses, methods of attachment, and special details.
- 1.5 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Maintenance Data: Manufacturer's standard installation and maintenance instructions, sufficient quantity for inclusion in operation and maintenance manual.
- 2 Products
- 2.1 DESCRIPTION
  - .1 Traffic and Emergency Signage: Sheet steel, conforming to local municipal standards; reflective baked enamel finish; sufficient quantity to conform to requirements of authorities having jurisdiction; designs as indicated on Drawings.



## 2.2 MATERIALS

- .1 Galvanized Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B, and C; cold-rolled sheet steel; galvanized.
- .2 Bolts: To ASTM A307, Grade A; carbon and alloy steel, galvanized.
- .3 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel, galvanized.
- .4 Washers: To ASTM F436/F436M, Type 3; hardened steel; circular, bevelled and clipped types as required.
- .5 Adhesive: As recommended by sign manufacturer.

## 2.3 MANUFACTURED UNITS

- .1 Sign Posts: Galvanized steel, square-shaped stakes; complete with regularly spaced drilled holes for attachment of signage; suitable length to accommodate buried depth of not less than 1 000 mm and sign mounting height in accordance with authority having jurisdiction; eg. Telespar Sign Post by Unistrut Service Company.

## 2.4 FINISHES

- .1 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating grade 55; hot dipped zinc alloy coating.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation Z275; hot dipped zinc alloy coating.
- .4 Reflective Coating on Metal Components: Clean and degrease metal surface; apply one coat of zinc oxide primer sprayed and baked; two coats of semi-gloss reflective enamel sprayed and baked; symbols and colours as required by authorities having jurisdiction.
- .5 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; symbols and colours as required by authorities having jurisdiction.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install traffic signage in accordance with applicable regulatory requirements.
- .2 Provide routing or mortising as required.
- .3 Bury support stakes minimum 1 000 mm below finished grade.
- .4 Replace Products that are bent, scratched or otherwise damaged.
- .5 Properly install and tighten fasteners to full required complement.

3.2 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect surfaces with removable protective covering.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 05 50 00 - Metal Fabrications.
- .3 Section 09 21 16 - Gypsum Board Assemblies.
- .4 Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

- .1 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .2 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A653/A653M-23: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .5 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .6 ASTM E84-23d: Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, sizes and thicknesses, typical panel construction, hardware and accessories.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating partition layouts, dimensions, no sightline privacy fittings, door swings, internal reinforcement and details of supports.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Do not deliver Products until Project is enclosed, with complete protection from outside weather.
- .3 Store Products indoors in manufacturer's original containers and packaging, with labels clearly identifying Product name and manufacturer.
- .4 Lay cartons flat, with adequate support to ensure flatness and prevent damage.
- .5 Do not store Products where ambient air temperature is less than 16 degrees C or exceeds 49 degrees C.

1.6 AMBIENT CONDITIONS

- .1 Maintain ambient air temperature, relative humidity, and ventilation within limits recommended by manufacturer for optimum results.

- .2 Do not install Products under environmental conditions beyond manufacturer's absolute limits.

## 1.7 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Manufacturer's Extended Warranty: For a period of 10 years, covering against delamination, breakage or corrosion under normal operating conditions.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 ASI Group Global.
  - .2 Hadrian Manufacturing Inc.
  - .3 Mills Partitions.
  - .4 Scranton Products.

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

### 2.2 DESCRIPTION

- .1 Toilet Compartments: Solid polymer construction, floor-mounted headrail-braced design; complete with no sightline privacy option.

### 2.3 REGULATORY REQUIREMENTS

- .1 Surface Burning Characteristics (ASTM E84): Class B.

### 2.4 MATERIALS

- .1 Solid Polymer: Single sheet solid, homogeneous high density polyethylene plastic, formed from waterproof, non-absorbent HDPE resins; mark-resistant, self-lubricating surface; Pebble face texture with Smooth edges; colour as selected by Consultant.
- .2 Stainless Steel Sheet and Plate: To ASTM A240/A240M, Type 304.
- .3 Stainless Steel Bar and Shape: To ASTM A276/A276M, Type 304.
- .4 Sheet Steel: To ASTM A653/A653M, Commercial Steel (CS) Types A, B and C; galvanized.
- .5 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy, unless noted otherwise.
- .6 Fasteners: Stainless steel; tamper-resistant; complete with plastic anchors.

### 2.5 COMPONENTS

- .1 Doors - Standard Stalls: 610 mm wide, 1 397 mm high; 25 mm thick solid polymer with 6 mm radius machined edges.
- .2 Doors - Accessible Stalls: 860 mm wide, 1 397 mm high; 25 mm thick solid polymer with 6 mm radius machined edges.
- .3 Panels: 1 379 mm high, width to suit application; 25 mm thick solid polymer with 6 mm radius machined edges.
- .4 Privacy / Urinal Screens: 610 mm wide, 1 220 mm high, 25 mm thick solid polymer with 6 mm radius machined edges.
- .5 Pilasters: Floor-to-ceiling height, width to suit application; 32 mm thick solid polymer with 6 mm radius machined edges.

- .6 Head Rails: Hollow, 32 x 62 mm size aluminum tubing, with anti-grip strips and cast socket wall brackets.
- .7 Heat Sink: Extruded aluminum U-channel profile.
- .8 Floor Mounting Bar: 6 x 25 mm stainless steel mounting bar.
- .9 Pilaster Shoes: 125 mm high, formed chrome-plated stainless steel.
- .10 Splash Plates: 760 mm wide, 1 066 mm high; 1.2 mm thick stainless steel sheet; rounded corners; for double-sided tape application.
- .11 Hinges: 203 mm wrap-around aluminum hinge, fabricated from heavy duty 6463-T5 alloy extruded aluminum with brush anodized finish; complete with adjustable nylon cams capable of being set in 30 degree increments.
- .12 Latch: Extruded aluminum, anodized finish; with housing, slide bolt and button.
- .13 Strike and Keeper: 152 mm wrap-around flanges fabricated from heavy duty 6463-T5 alloy extruded aluminum, brushed anodized finish.
- .14 Privacy Astragal: Chrome-plated non-ferrous metal privacy astragal; sizes and profiles to suit application.
- .15 Door Pull: Chrome-plated cast zinc alloy handle; through-door fastening.
- .16 Panel and Pilaster Brackets: 3.0 mm thick heavy-duty extruded aluminum stirrup brackets, 50 mm long; pre-drilled; brightened and polished finish.
- .17 Headrail Brackets: Die cast aluminum alloy brackets, pre-drilled.
- .18 Door Bumper: Chrome-plated non-ferrous casting with rubber shock absorbing bumper insert.

## 2.6 FABRICATION

- .1 Mount brackets and reinforcements securely to panels.
- .2 Provide heat sinks securely fastened to bottom of doors and panels.
- .3 Fabricate doors, pilasters and panels to receive no sightline privacy fittings.
- .4 Fabricate accessible stall doors to swing out.

## 2.7 FINISHES

- .1 Stainless Steel: To AISI No. 4 - Brushed.
- .2 Galvannealed Coating on Sheet Steel: To ASTM A653/A653M, Coating Designation ZF03; zinc-iron coating with streak-free matte grey appearance.
- .3 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.

## 3 Execution

### 3.1 PREPARATION

- .1 Clean surfaces thoroughly prior to installation.

### 3.2 INSTALLATION

- .1 Install partitions secure, plumb and level.

- .2 Attach panel brackets securely to walls using anchor devices.
- .3 Install splash panels on compartment panels located adjacent to urinals. Fasten with double-sided tape.
- .4 Anchor privacy / urinal screens to walls with two panel brackets and vertical upright consisting of tubular head rail stock and sockets rigidly anchored to floor and ceiling.
- .5 Provide headrail fitted snugly over top of each pilaster and secured to pilasters and wall using recommended fittings.
- .6 Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- .7 Equip each door with two hinges, one door latch and one door bumper.
- .8 Provide continuous full-height privacy astragals on pilasters and panels as follows:
  - .1 At door latch side.
  - .2 At door hinge side.
  - .3 Where panels meet adjacent wall surfaces.
  - .4 Where pilasters meet adjacent wall surfaces.
  - .5 Where panels meet adjacent pilasters.
- .9 Surface mount and through bolt hinges to panels and doors.
- .10 Install door strike keeper on pilasters in alignment with door latch.
- .11 Equip out-swinging doors with two door pulls, mounted one on each side.

### 3.3 TOLERANCES

- .1 Deviation From Plumb and Level:  $\leq 3.2$  mm.
- .2 Clearance Between Wall Surface and Panels and Pilasters: 38 mm.

### 3.4 ADJUSTING

- .1 Adjust and align hardware to uniform clearance at vertical edge of doors.
- .2 Adjust adjacent components for consistency of line or plane.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean finish surfaces prior to Ready-for-Takeover.

### 3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect installed Products from damage.
- .3 Remove factory-applied protective coverings, and Make Good damage prior to Ready-for-Takeover.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 92 00 - Joint Sealants.
- .4 Section 08 80 00 - Glazing.
- .5 Section 09 21 16 - Gypsum Board Assemblies.
- .6 Section 09 30 00 - Tiling.
- .7 Section 10 14 00 - Signage.
- .8 Section 10 21 13.21 - Solid Plastic Toilet Compartments.

1.2 REFERENCES

- .1 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A240/A240M-22b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .4 ASTM A269/A269M-22: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .5 ASTM A276/A276M-17: Standard Specification for Stainless Steel Bars and Shapes.
- .6 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- .7 ASTM B456-17(2022): Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, sizes, finishes, details of function, and attachment methods.

1.4 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Selection Samples: Duplicate sets of 300 x 300 mm size samples, demonstrating available colours and finishes.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.

- .2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and standard care, maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.
  - .3 Keys: Two keys for each lockable accessory, master keyed.
- 2 Products
- 2.1 OWNER-SUPPLIED PRODUCTS
- .1 Refer to Section 01 11 00.
  - .2 Owner-supplied Products: Paper towel dispensers, toilet paper dispensers, soap dispensers, and sanitary napkin disposal bins.
- 2.2 MANUFACTURERS
- .1 Manufacturers having Product considered acceptable for use:
    - .1 ASI Group Canada.
    - .2 Bobrick Washroom Equipment, Inc.
    - .3 Bradley.
    - .4 Frost Products Limited.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.3 MATERIALS
- .1 Steel Sheet: To ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; cold-rolled steel sheet in thicknesses as specified below.
  - .2 Stainless Steel Plate, Strip and Sheet: To ASTM A240/A240M, Type 304; sizes and thicknesses as specified below.
  - .3 Stainless Steel Tubing: To ASTM A269/A269M, Grade TP316; thicknesses, diameters, and sizes as specified below.
  - .4 Stainless Steel Bars and Shapes: To ASTM A276/A276M, Type 304; sizes and profiles as indicated.
  - .5 Mirrored Glass: Type GL-2 as specified in Section 08 80 00.
  - .6 Adhesive: Two-component epoxy type, waterproof.
  - .7 Fasteners, Screws, and Bolts: Galvanized steel, tamper-proof, security type; sizes to suit applications.
  - .8 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.
  - .9 Joint Sealant: Interior mildew-resistant sealant, Type SEAL-INT-MR as specified in Section 07 92 00.
- 2.4 MANUFACTURED UNITS
- .1 Grab Bars: 38 mm OD, 1.2 mm thick stainless steel tubing; peened non-slip finish; round or oval concealed flange attachments, straight and L-shaped configurations in sizes indicated on Drawings.
  - .2 Waste Receptacle: Semi-recessed design; 438 mm wide, 762 mm high, 100 mm deep; 0.76 mm thick stainless steel body; 50 L capacity removable waste bin; eg. Code 330 by Frost Products Ltd.



- .3 Flat Framed Mirror: 610 x 915 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; vandal-resistant three-way mounting; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941-2436 by Frost Products Ltd.
- .4 Fixed-Tilt Framed Mirror: 406 x 762 mm size, one piece stainless steel frame with mitred corners and bright annealed finish; fixed tilt; 4 mm thick mirrored glass with shock resistant primary back and fully galvanized back panel; eg. Code 941FT by Frost Products Ltd.
- .5 Garment Hook: Stainless steel with maximum 50 mm projection, with snap down safety hook; eg. Code 1150 by Frost Products Ltd.
- .6 Stainless Steel Shelf: 460 mm long, 140 mm deep, 102 mm high; 0.76 mm thick stainless steel with rounded corners, surface mounted; eg. Code 950-18 by Frost Products Ltd.
- .7 Custodial Utility Shelf: 1.2 mm thick stainless steel, 914 x 203 mm size, surface mounted; complete with 3 mop/broom holders, two pail hooks and one 8 mm OD chrome plated drying rod; eg. Code 1115 by Frost Products Ltd.

## 2.5 FABRICATION

- .1 Weld and grind smooth, joints of fabricated components.
- .2 Use mechanical fasteners only where approved.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Do not apply manufacturer's or brand names on face of units.

## 2.6 FINISHES

- .1 Shop Primed Coating on Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- .2 Galvanized Coating on Steel Components: To ASTM A123/A123M, Coating Grade 55; hot dipped zinc alloy coating.
- .3 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .4 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2; electrodeposited nickel plus chromium coating; Polished.
- .5 Stainless Steel: To AISI No. 4 - Brushed.
- .6 Baked Enamel Coating on Steel Components: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

## 3 Execution

### 3.1 PREPARATION

- .1 Provide templates and rough-in measurements as required.

### 3.2 INSTALLATION

- .1 Install Products and Owner-supplied Products rigidly in place using tamper-proof fasteners, as follows:
  - .1 Stud Walls: Install steel back plate to stud prior to application of wall board. Provide plate with threaded studs or plugs.
  - .2 Hollow Masonry Units: Use toggle bolts drilled into cell or wall cavity.
  - .3 Solid Masonry Units or Concrete: Use bolt with lead expansion sleeve set into drilled hole.
  - .4 Toilet Compartments: Use male-female through bolts.
- .2 Set square items plumb.
- .3 Install grab bars using built-in anchors.
- .4 Install framed mirrors on concealed wall hangers, secured in place with theft-proof locking screws.

### 3.3 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect Product surfaces with removable protective film.

END OF SECTION

1 General

1.1 REFERENCES

- .1 ASTM A1008/A1008M-23e1: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

1.2 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating materials, shelving layouts, dimensions, component sizes, anchorage and installation details.

1.3 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's instructions as specified in Section 01 78 00.
- .2 Manufacturer's Instructions: Manufacturer's standard assembly and installation instructions, complete with parts listings; sufficient quantity for inclusion in operation and maintenance manual.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 North American Steel.
  - .2 Redirack.
  - .3 Sturdymet.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Storage Shelves: Modular, bolt-less design; 2 400 mm high assembly; complete with metal adjustable shelves, metal frame connectors, standard and base plate beam with safety clips, foot plates and post caps; eg. Easy-Up 5000 Shelving by North American Steel.

2.3 MATERIALS

- .1 Sheet Steel: To ASTM A1008/A1008M; Commercial Steel (CS) Types A, B, and C; cold-rolled steel, free from imperfections; thicknesses as specified below.

2.4 COMPONENTS

- .1 Metal Shelves (MS-1): 1.9 mm thick sheet steel with U-shaped front edge; 455 x 915 mm; with a shelf capacity of 270 kg uniformly distributed load.
- .2 Metal Shelves (MS-2): 1.9 mm thick sheet steel with U-shaped front edge; 610 x 915 mm; with a shelf capacity of 180 kg uniformly distributed load.
- .3 Beam: 1.9 mm thick prefinished steel, double locking clip V-type design, 25 mm high.
- .4 Posts and Cross-Members: Prefinished square posts and Z-shaped cross members; slotted at 25 mm OC on 3 sides, clean front view.
- .5 Frame Connectors: 1.9 mm thick prefinished steel, triple locking clip V-type design, 305 mm high.

- .6 Accessories: Spring-like safety clips, foot plates, post extenders and post caps, as recommended by shelf system manufacturer.

## 2.5 FINISHES

- .1 Baked Enamel Coating on Metal Components: Electrostatically sprayed and baked-on alkyd enamel finish; Almond Beige colour.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify site dimensions prior to fabrication.

### 3.2 INSTALLATION

- .1 Install Products true to dimensions, straight, square, plumb and level, to a rigid structure.
- .2 Conform to accepted Shop Drawings.
- .3 Determine shelving height by clearance required for major obstruction at ceiling unless otherwise instructed by Consultant.
- .4 Seat uprights in foot plates.
- .5 Cap uprights with post caps.
- .6 Provide safety clips.
- .7 Accurately fit members with hairline joints, properly secured.
- .8 Construct shelving units free from distortion and defects detrimental to appearances and performance.

### 3.3 ADJUSTING

- .1 Touch-up damaged surfaces with one coat of spray touch-up paint matching factory-applied finish.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 07 51 00 - Built-up Bituminous Roofing.
- .2 Section 07 92 00 - Joint Sealants.
- .3 Section 09 81 00 - Acoustic Insulation.

1.2 REFERENCES

- .1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .2 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A153/A153M-23: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .4 ASTM A449-14(2020): Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
- .5 ASTM A563/A563M-23: Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .6 ASTM A780/A780M-09(2015): Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .7 ASTM C423-17: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .8 ASTM D7803-19: Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.
- .9 ASTM E90-09(2016): Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .10 ASTM F436/F436M-19: Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
- .11 CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel.
- .12 CSA G40.21-13 (R2018): Structural Quality Steel.
- .13 CSA S16:19: Design of Steel Structures.
- .14 OPSS.MUNI 760 (April 2019): Construction Specification for Noise Barrier Walls.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, component sizes and thicknesses. Include acoustical performance test results.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.

- .2 Shop Drawings: Project-specific drawings, illustrating layouts, dimensions, anchorage details, and connection details for component parts. Include design calculations.
  - .3 Shop Drawings and design calculations must be stamped, signed and dated by fabricator's design engineer.
- 1.5 SAMPLES
- .1 Submit samples as specified in Section 01 33 00.
  - .2 Samples: Duplicate 50 x 50 mm size samples, illustrating full range of colour and finish selections.
- 1.6 QUALIFICATIONS
- .1 Fabricator's Design Engineer: A professional structural engineer experienced in designing sound barrier walls with structural steel support framing, licensed to practice at Place of the Work.
  - .2 Fabricator: A firm specializing in fabricating sound barrier walls, having minimum 5 years documented experience.
- 1.7 DELIVERY, STORAGE AND HANDLING
- .1 Refer to Section 01 60 00.
  - .2 Deliver Products to Place of the Work in clearly labelled protective cartons or wrappings.
  - .3 Store Products sufficiently off ground and cover with weatherproof, flame-resistant sheeting.
  - .4 Handle Products in a manner to prevent racking.
- 2 Products
- 2.1 MANUFACTURERS
- .1 Manufacturers having Product considered acceptable for use:
    - .1 Silentium Group Inc.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 DESIGN CRITERIA
- .1 Design Products to withstand seismic, wind and snow loads in accordance with applicable regulatory requirements.
  - .2 Design structural components to CSA S16.
- 2.3 PERFORMANCE CRITERIA
- .1 Allowable Deflection:
    - .1 Structural Members: L/180.
    - .2 Sound Barrier Panels: L/240.
  - .2 Panel Acoustical Performance:
    - .1 Noise Reduction Coefficient (ASTM C423):  $NRC \geq 0.95$ .
    - .2 Sound Transmission Class (ASTM E90):  $STC = 33$ .
- 2.4 MATERIALS
- .1 Vinyl: Extruded rigid polyvinyl chloride, with integral colour.
  - .2 Structural Steel: To CSA G40.20, and CSA G40.21, Grade 350W.

- .3 Bolts: To ASTM A449, Type 3; quenched and tempered steel hex bolts.
- .4 Nuts: To ASTM A563/A563M, Grade A, Hex Style; carbon and alloy steel.
- .5 Washers: To ASTM F436/F436M, Type 3; hardened steel; circular, bevelled and clipped types as required.
- .6 Screws: TEKS self-drilling screws, sizes as recommended by manufacturer.
- .7 Acoustic Insulation: As specified in Section 09 81 00.
- .8 Joint Sealant: Exterior weatherseal sealant, Type SEAL-EXT as specified in Section 07 92 00.

## 2.5 COMPONENTS

- .1 Acoustic Panels: Double walled, acoustically insulated panels; 70 mm thick, 406 mm wide, 3 050 mm long; and comprised as follows:
  - .1 Outer Wall: Vinyl, with perforated slots.
  - .2 Panel Core: Acoustic insulation.
  - .3 Inner Wall: Vinyl, with perforated slots.
  - .4 Panel Edges: Tongue on one long edge, and groove on opposite long edge.
  - .5 Cap Panel Edges: Groove on bottom edge, smooth on top edge.
  - .6 Colour: As selected by Consultant.
  - .7 Manufacturer and Product Name: PVC Noise Barrier System by Silentium Group Inc.

## 2.6 FABRICATION

- .1 Fabricate Products free from distortion and effects detrimental to appearance and performance.
- .2 Fabricate Products as modular components, designed to easily and accurately fit during field assembly.

## 2.7 FINISHES

- .1 Galvanized Coating on Structural Steel Components: To ASTM A123/A123M, Coating Grade 100; hot dipped zinc alloy coating.
  - .1 Prepare hot dip galvanized coatings to ASTM D7803 for subsequent powder coating application.
- .2 Galvanized Coating on Steel Hardware: To ASTM A153/A153M, Classes B3, C or D; hot dipped zinc alloy coating.
- .3 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colour as selected by Consultant.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install Products to OPSS.MUNI 760.
- .2 Install Products straight, plumb and level.
- .3 Erect supporting structure in accordance with accepted Shop Drawings.
- .4 Install panels horizontally within support framing.
- .5 Install panels with uniform joints.
- .6 Install cap panels along upper course.

- .7 Cut and trim components during erection as recommended by manufacturer.

3.2 ADJUSTING

- .1 Remove and replace members where site-cutting or trimming has impaired strength or appearance of assembly.
- .2 Remove and replace damaged panels.
- .3 Make Good damaged or defective galvanized coatings to ASTM A780/A780M.

END OF SECTION



- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 26 01 16 - Electrical General Requirements.
- 1.2 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, available sizes and configurations, power requirements, and available finishes.
- 1.3 MANUFACTURER'S INSTRUCTIONS
  - .1 Submit manufacturer's instructions as specified in Section 01 33 00.
  - .2 Manufacturer's Instructions: Manufacturer's printed installation instructions, and templates required for installation.
- 1.4 DELIVERY, STORAGE AND HANDLING
  - .1 Refer to Section 01 60 00.
  - .2 Package, crate and brace Products to prevent distortion in shipment and handling.
  - .3 Protect Products with sturdy wrappings.
  - .4 Label packages and crates with manufacturer's name, model number, quantity and shipment date.
- 2 Products
- 2.1 MANUFACTURERS
  - .1 Manufacturers having Product considered acceptable for use:
    - .1 Da-Lite Screens Inc.
    - .2 Draper.
  - .2 Substitution Procedures: Refer to Section 01 25 00.
- 2.2 COMPONENTS
  - .1 Screen: 3 200 x 4 200 mm size viewing surface, heavy duty matte white; 1 000 mm black top skirt, black masking borders; 10 mm OD tubular steel bottom slat, with baked enamel finish and plastic end caps.
  - .2 Enclosure: Sealed and fire retardant design for use in plenum spaces, flat back design, rectangular steel case, baked enamel finish; with fully automatic ceiling closure doors, and in-the-roller motor mounting system; one required for each screen.
  - .3 Motors: Dual motors, one motor operating closure door and second motor operating screen; capacities as recommended by screen manufacturer.
    - .1 Power Supply: 110V AC, single phase, 60 Hz.
  - .4 Remote Control System: Dual motor low voltage control system with three-button wireless radio frequency remote receiver and transmitter; separate UP, DOWN and STOP commands, complete with control module, 3-button keyed wall switch, box, cover plate, and 3-button control radio frequency transmitter with receiver; one unit required for each screen.

3 Execution

3.1 INSTALLATION

- .1 Install Products for long life under hard use.
- .2 Install Products level, true, and tightly fitted to adjacent surfaces.
- .3 Connect power-operated components to designated power source. Coordinate with Section 26 01 16.

3.2 ADJUSTING

- .1 Verify installed Products function properly and smoothly.
- .2 Adjust equipment to ensure proper and smooth operation.
- .3 Make Good damaged and defective Products so that no variation in surface appearance is discernible.
- .4 Refinish Products at Place of the Work only when approved by Consultant.

3.3 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Demonstrate operation and maintenance of equipment.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 04 22 00 - Concrete Unit Masonry.
  - .2 Section 05 10 00 - Structural Metal Framing.
  - .3 Section 09 65 66 - Resilient Athletic Flooring.
  - .4 Section 11 66 53 - Gymnasium Dividers.
  - .5 Section 26 01 16 - Electrical General Requirements.
- 1.2 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, components, component sizes and features, size and shape of backboards and available finishes.
- 1.3 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, locations, attachment heights and methods, power requirements, loads and other miscellaneous details.
  - .3 Shop Drawings for backstops are to be stamped, signed and dated by manufacturer's design engineer.
- 1.4 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit field quality control submittals as specified in Section 01 40 00.
  - .2 Manufacturer Report: A written report issued by manufacturer's design engineer certifying completed installation is structurally safe and conforms to accepted Shop Drawings.
- 1.5 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Special Tools: Two removable winch handles for manually-operated backstops.
- 1.6 QUALIFICATIONS
  - .1 Manufacturer's Design Engineer: A professional structural engineer experienced in designing, fabricating and installing gymnasium equipment, and licensed to practice at Place of the Work.
- 2 Products
- 2.1 MANUFACTURERS
  - .1 Manufacturers having Product which is considered acceptable for use:
    - .1 Forum Athletic Products.
    - .2 Gymnasium and Health Equipment Limited.
    - .3 Kodiak Industries Limited.
    - .4 Lolimpin Gym Equipment.
    - .5 Porter Athletic, Inc.

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

## 2.2 MANUFACTURED UNITS

- .1 Basketball Backstop - Main Court: Swing-forward, ceiling-suspended; power-operated; and as follows:
  - .1 Steel Frame: 3.2 mm thick steel tubing in sizes indicated on accepted Shop Drawings; baked enamel finish; eg. BB-17RG by Gymnasium & Health Equipment Ltd.
  - .2 Safety Strap: Rated to support 450 kg suspended load; tripping speed sudden free fall of 0.6 m/s, with self-checking with fail-safe feature; complete with mounting kit; eg. BB-49 Posilock by Gymnasium & Health Equipment Ltd.
  - .3 Backboard: 1 067 x 1 829 mm size; 13 mm thick tempered glass set in extruded aluminum frame; official border and target area fired into glass; eg. BB-29-RG2 by Gymnasium & Health Equipment Ltd.
  - .4 Cushion Edge Padding: Pre-moulded urethane foam, purpose made to fit along lower edge of glass backboard, complete with fixing hardware; colour as selected by Consultant; eg. BB-44 by Gymnasium & Health Equipment Ltd.
  - .5 Goal: 457 mm OD, front-mounted shock absorber goal, with completely enclosed positive locking mechanism; baked enamel finish; eg. BB-33B by Gymnasium & Health Equipment Ltd.
  - .6 Net: 120 count nylon, hourglass design, official anti-whip net; eg. BB-41 by Gymnasium & Health Equipment Ltd.
  - .7 Operator Controls: Key-operated 3-position control (up-stop-down); flush wall-mounted design.
  - .8 Electric Winch: 1 HP electrically operated winch mechanism; Model TW2000 by Gymnasium & Health Equipment Ltd.
- .2 Basketball Backstop - Practice Court: Wall-mounted, fixed design; height adjustable; and as follows:
  - .1 Steel Frame: 3.2 mm thick steel tubing, 51 x 51 mm size, extension as indicated on Drawings; complete with safety cable supports; baked enamel finish; eg. BB-12 by Gymnasium & Health Equipment Ltd.
  - .2 Height Adjustable Adapter Framing: Two 38 mm square steel tubing guide rails extending 114 mm in front of backstop framing, complete with height adjuster crank handle; capable of adjusting net height from 2 440 mm to 3 100 mm above finished floor; baked enamel finish; eg. BB-3 by Gymnasium & Health Equipment Ltd.
  - .3 Backboard: 1 372 x 889 mm size; 2.7 mm thick steel, fan-shaped with smooth rounded corners; baked enamel finish; eg. BB-22 by Gymnasium & Health Equipment Ltd.
  - .4 Goal: 457 mm OD, back-mounted goal; baked enamel finish; eg. BB-30 by Gymnasium & Health Equipment Ltd.
  - .5 Net: 120 count nylon, hourglass design, official anti-whip net; eg. BB-41 by Gymnasium & Health Equipment Ltd.
- .3 Floor Socket: 60 mm ID brass floor socket and flush socket lid; eg. Model FS-2 by Gymnasium & Health Equipment Ltd.
- .4 Adapter Bushing: 48 mm ID heavy duty plated steel socket; eg. Model AD-93BAB Adapter Bushing by Gymnasium & Health Equipment Ltd.
- .5 Wall Padding: 1 220 x 1 830 mm size, 50 mm thick; comprised of 3 equal panels; high density polyurethane foam with 610 g/m<sup>2</sup> fire-retardant PVC vinyl cover; complete with 50 mm wide velcro strips on 4 sides; eg. WP-2004 by Gymnasium & Health Equipment Ltd., colour as selected by Consultant.

- .6 Volleyball Post: 60 mm OD steel tube combination posts, pre-drilled for ratchet attachment; refer to Drawings for quantities; baked enamel finish; types as follows:
  - .1 VP-1: Complete with eye hooks; eg. Model VB-92 by Gymnasium & Health Equipment Ltd.
  - .2 VP-2: Complete with pulleys; eg. Model VB-92P by Gymnasium & Health Equipment Ltd.
- .7 Volleyball Post Padding: Vinyl-covered ethafoam padding, designed to cover all braces and posts; refer to Drawings for quantities; eg. Model VB-755SP End Post Safety Padding by Gymnasium & Health Equipment Ltd.
- .8 Badminton Post: 38 mm OD steel tube end post; baked enamel finish; refer to Drawings for quantities; eg. Model BN-93B by Gymnasium & Health Equipment Ltd.
- .9 Handle Ratchet: Standard safety volleyball and badminton ratchet with fold-away handle; refer to Drawings for quantities; Model WN-150 by Gymnasium & Health Equipment Ltd.
- .10 Volleyball Net: 3 mm braided nylon netting, 9 144 mm long; Olympic Model; refer to Drawings for quantities; eg. Model VBN-750/30 by Gymnasium & Health Equipment Ltd.
- .11 Badminton Net: 800 x 6 100 mm size, knotless heavy black nylon netting; fully taped; with cable top; refer to Drawings for quantities; eg. Model BN-250 by Gymnasium & Health Equipment Ltd.

### 2.3 ACCESSORIES

- .1 Hoisting Cable: 6 mm OD, 7 x 19 aircraft hoisting cable.
- .2 Cable Clip: To Fed. Spec. FF-C-450, Type 1, Class 1.
- .3 Swivel Pulley and Beam Clamp: With Proof of Load Testing at 4 090 kg each.
- .4 Velcro Strip: 3 050 mm long extruded aluminum wall hanger, complete with velcro strip insert; eg. VEL-69A Velcro Strip Complete by Gymnasium & Health Equipment Ltd.
- .5 Fasteners: Grade 5 bolts.
- .6 Anchors: Through-wall bolt type complete with anchor plates on both ends.

### 2.4 FABRICATION

- .1 Conform to OASBO Health and Safety Committee recommendations.
- .2 Use only closed type connectors. S-hooks, J-bolts and other open-style connectors will be rejected.
- .3 Provide stop clamps and markings on hoisting cables, indicating when to stop.
- .4 Terminate hinge points with 13 mm bolts, complete with cotter pins.
- .5 Do not use secondary chains.
- .6 Fabricate pulleys from machined steel complete with oil impregnated bearings.

### 2.5 FINISHES

- .1 Baked Enamel Coating on Metal Components: Primer and two coats of factory-applied baked enamel, colour as selected by Consultant.

- 3 Execution
- 3.1 PREPARATION
  - .1 Supply floor inserts for placement during concrete pour.
  - .2 Supply through wall anchors for placement by Section 04 22 00.
  - .3 Provide supplementary structural support for installation above bottom chord of roof joists.
- 3.2 INSTALLATION
  - .1 Install Products rigidly in place, straight, level and plumb.
  - .2 Install backstop supports with welded or bolted connections to form a rigid structure.
  - .3 Suspend ceiling-mounted backstops from supplementary structural supports, clear of light fixtures.
  - .4 Mount backstops and rings square and true to required court locations.
  - .5 Locate manual winches to one side.
  - .6 Install winches, motors, transmitters and other related equipment.
  - .7 Coordinate connection of motors, winches, transmitters, controls and other electrically-operated equipment with Section 26 01 16.
  - .8 Install wall-mounted key switches 1 350 mm above finished floor.
  - .9 Install velcro strip wall hangers where indicated on Drawings, aligned with top of wall padding at 2 200 mm above finished floor.
- 3.3 MANUFACTURER SERVICES
  - .1 Arrange for manufacturer's design engineer to periodically inspect installation to ensure compliance with manufacturer's installation guidelines and accepted Shop Drawings.
  - .2 Prepare manufacturer's report, confirming completed installation conforms to accepted Shop Drawings.
- 3.4 DEMONSTRATION
  - .1 Refer to Section 01 79 00.
  - .2 Demonstrate operation and maintenance of power-operated and manually-operated basketball backstops.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 05 10 00 - Structural Metal Framing.
  - .2 Section 11 66 23 - Gymnasium Equipment.
  - .3 Section 26 01 16 - Electrical General Requirements.
- 1.2 REFERENCES
  - .1 ANSI/CAN/UL 325-2017: Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
  - .2 CAN/ULC-S102.2-2018 (REV1): Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
  - .3 CAN/ULC-S109-14 (R2019): Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.
- 1.3 PRODUCT DATA
  - .1 Submit Product data as specified in Section 01 33 00.
  - .2 Product Data: Manufacturer's standard data sheets, indicating materials, thicknesses, components, component sizes, power requirements, and available colours and finishes.
- 1.4 SHOP DRAWINGS
  - .1 Submit Shop Drawings as specified in Section 01 33 00.
  - .2 Shop Drawings: Project-specific drawings, illustrating materials, dimensions, configurations, attachment heights and methods, power requirements, loads, and other miscellaneous details.
  - .3 Shop Drawings are to be stamped, signed and dated by manufacturer's design engineer.
- 1.5 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit field quality control submittals as specified in Section 01 40 00.
  - .2 Manufacturer Report: A written report issued by manufacturer's design engineer certifying completed installation is structurally safe and conforms to accepted Shop Drawings.
- 1.6 CLOSEOUT SUBMITTALS
  - .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and maintenance and cleaning guidelines; sufficient quantities for inclusion in operation and maintenance manual.
- 1.7 TOOLS
  - .1 Submit special tools as specified in Section 01 78 00.
  - .2 Special Tools: Four keys for controlling each divider curtain.

## 1.8 QUALIFICATIONS

- .1 Manufacturer's Design Engineer: A professional structural engineer experienced in designing, fabricating and installing gymnasium dividers, licensed to practice at Place of the Work.

## 1.9 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of 5 years, covering against failure of curtain divider to operate smoothly and fully within design parameters, and against damage to curtain and netting fabric.

## 2 Products

### 2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Forum Athletic Products.
  - .2 Gymnasium & Health Equipment Limited.
  - .3 Lolimpin Gym Equipment.
  - .4 Porter Athletic, Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

### 2.2 EQUIPMENT

- .1 Divider Curtain: Vertically-acting, center-rolling gymnasium divider curtain; as follows:
  - .1 Weight: 610 g/m<sup>2</sup> polyester reinforced vinyl on bottom 3 000 mm with 373 g/m<sup>2</sup> vinyl coated polyester mesh on upper section;
  - .2 ULC labelled to CAN/ULC-S109 and CAN/ULC-S102.2; with maximum flame spread index of 75.
  - .3 Roll Rate: 6 400 mm per minute.
  - .4 Drive Tube: 125 mm OD extruded aluminum tubing.
  - .5 Bottom Batten: 41 mm OD steel pipe.
  - .6 Motor: To ANSI/CAN/UL 325; twin synchronized internal tubular motors for long curtains, and single internal tubular motor for short curtains; compatible with 120V AC, single phase, 60 cycle power supply; permanently lubricated; and with built-in thermal overload protection.
  - .7 Winch: Complete with limit switches to control upper and lower limit of curtain travel; externally located at end of drive tube.
  - .8 Emergency Safety Brake: Self-activating to avoid free-fall of curtain in case of equipment failure.
  - .9 Control Station: Key lock, three-position momentary contact wall switch, with safety delay, and fit in a general purpose masonry-style switch box and polished stainless steel wall plate.
  - .10 Curtain Colour: As selected by Consultant.
  - .11 Product and Manufacturer: eg. Model F3505 Centre Drive Divider Curtain by Forum Athletic Products.

## 3 Execution

### 3.1 INSTALLATION

- .1 Install supports with welded or bolted connections to form a rigid structure.
- .2 Install Products for long life under hard use.



- .3 Coordinate connection of motors, controls, winches and other electrically-operated equipment to power supply with Section 26 01 16.

### 3.2 MANUFACTURER SERVICES

- .1 Arrange for manufacturer's design engineer to periodically inspect installation to ensure compliance with manufacturer's installation guidelines and accepted Shop Drawings.
- .2 Prepare manufacturer's report, confirming completed installation conforms to accepted Shop Drawings.

### 3.3 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Demonstrate maintenance of gymnasium divider curtains.
- .3 Demonstrate operation of divider curtain, illustrating Open and Closing operations.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 09 21 16 - Gypsum Board Assemblies.
- .4 Section 12 24 13.16 - Manual Roller Window Shades.
- .5 Section 26 01 16 - Electrical General Requirements.

1.2 REFERENCES

- .1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .2 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .4 NFPA 701-2004: Methods of Fire Tests for Flame Propagation of Textiles and Films.
- .5 CAN/ULC-S109-14 (R2019): Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, components and accessories, component sizes, available fabrics and finishes, and installation instructions.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating wall opening dimensions, shade sizes and shapes, operator details, top rail, anchorage details, joint locations, hardware and accessory details, conditions between adjacent units, corner conditions, required clearances, and electrical operating mechanisms and connections.

1.5 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: Duplicate samples of the following:
  - .1 Shade Fabric: 200 x 200 mm size samples of each specified fabric.
  - .2 Visually-Exposed Components: 300 mm long samples of each visually-exposed component, illustrating material, colour, surface texture and sheen.
  - .3 Prefinished Metal: 50 x 100 mm size samples, illustrating specified finish and colour.

1.6 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control submittals as specified in Section 01 33 00.
- .2 Fire Test Reports: Manufacturer's standard fire test reports, prepared by independent testing agency deemed acceptable by authorities having jurisdiction, indicating fire hazard classification of shade fabric meets regulatory requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.

1.8 QUALIFICATIONS

- .1 Supplier: A manufacturer-certified firm, approved to supply specified Products, and honour warranty claims.
- .2 Installer: A manufacturer-certified firm, trained and experienced in installing specified Products.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 01 60 00.
- .2 Protect Products with suitable heavy weight wrapping before delivery to Place of the Work.
- .3 Store Products at Place of the Work in a designated area, allowing for natural ventilation over finished surfaces.

1.10 WARRANTY

- .1 Submit extended warranty in accordance with General Conditions of the Contract.
- .2 Extended Warranty: For a period of 10 years, covering complete replacement cost of defective Product, including removal and disposal of defective assembly, and installation of replacement Product. Covered defects to include the following:
  - .1 Fading of shade fabric colour,
  - .2 Shrinkage of shade fabric,
  - .3 Loss of flame-retardant properties of shade fabric,
  - .4 Punctures, rips or tears in shade fabric, and
  - .5 Mechanical failure of operating mechanisms.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers having Product considered acceptable for use:
  - .1 Altex Decorations Ltee.
  - .2 Concord Shading Systems Inc.
  - .3 Hunter Douglas Architectural.
  - .4 Legrand Canada.
  - .5 MechoShade Systems, Inc.
  - .6 Sun Glow Window Covering Products of Canada Ltd.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Roller Window Shades (RWS-1): Motor-operated single roller shade, rectangular-shaped, completely concealed from view when retracted; each unit consisting of two end brackets, motorized roller tube, cable guide system and side channels, cassette fascia, concealed hembar and sun control fabric; with switched operation; sizes as indicated on Drawings.

## 2.3 PERFORMANCE CRITERIA

- .1 Fire Classification of Fabrics: Flame-retardant and fire-resistant to CAN/ULC-S109 and NFPA 701.

## 2.4 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063 alloy, T5 temper; unless specified otherwise.
- .2 Sheet Aluminum: To ASTM B209/B209M, 3003-H14 alloy.
- .3 Sun Control Fabric: Vinyl-coated polyester yarn, consisting of 79 percent vinyl and 21 percent denier polyester core yarn; 3 percent openness factor; complete with antimicrobial coating; tensioned prior to heat setting; colour as selected by Consultant.
- .4 Bituminous Coating: Fibrous asphalt emulsion.
- .5 Screw Fasteners: Non-corrosive type, size as recommended by shade manufacturer.

## 2.5 COMPONENTS

- .1 Motors: Asynchronous capacitor start and run, 120V AC, single phase, 60 Hz; planetary type gears, solenoid activated disc brakes and built-in limit switch units; thermally protected, tubular in shape and totally enclosed within roller tube; rated at 38 RPM; UL recognized and CSA certified for safe operation.
- .2 Motorized Roller Tube: 62 mm OD, 1.6 mm thick grooved 6005-T5 alloy extruded aluminum; apply a double-sided adhesive strip for exact and firm mounting of fabric. Ensure minimum one turn of fabric will be placed on roller before working section of fabric starts.
- .3 Motorized Idle End Cap: Injection molded polymer plug with a spring-loaded bearing shaft that will allow easy but positive locking of roller tube into idle end bracket.
- .4 Cassette: Two-piece interlocking 1.9 mm thick extruded aluminum housing, rectangular profile.
- .5 Fascia Mounting Brackets: For motor and idler end, stainless steel. Provide decorative endcaps in matching finish for outside mount applications.
- .6 Fascia: 1.7 mm thick extruded aluminum complete with three continuous screw flute.
- .7 Side Channels: 25 x 38 mm size, 1.6 mm thick extruded aluminum, U-shaped.
- .8 Cable Guide System: Polymer coated steel cable, attached at top to shade bracket and at bottom to independent brackets; tension adjusted at bottom bracket.
- .9 Concealed Hem Bar: 3 x 32 mm size flat extruded aluminum bar; length to suit shade width.
- .10 Operating Switches: Manufacturer's standard switch assembly, colour as selected by Consultant.

## 2.6 FINISHES

- .1 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colour as selected by Consultant.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.

- .2 Verify wall openings and power supply are ready to receive installation.

### 3.2 PREPARATION

- .1 Apply heavy coat of bituminous paint on surfaces of aluminum placed in contact with concrete, mortar, plaster or dissimilar metals.
- .2 Provide fastenings and anchors required to be built-in to adjacent work to other Sections.

### 3.3 INSTALLATION

- .1 Install Products in window openings level, plumb and square.
- .2 Install Products parallel to window plane.
- .3 Ensure Products are rigidly coupled and adequately anchored.
- .4 Maintain uniform clearances, and accurate alignment levels.
- .5 Provide electrical control equipment, shades and accessories for complete installation and single source responsibility.
- .6 Install hembar in fabric hem pocket and secure to avoid displacement.

### 3.4 TOLERANCES

- .1 Gap Variation Along Perimeter:  $\leq 6$  mm per 2 440 mm of shade height.
- .2 Offset from Level:  $\leq 3$  mm.
- .3 Conform to manufacturer's edge clearance requirements for shades exceeding 1:3 width-to-height ratio.

### 3.5 ADJUSTING

- .1 Adjust Products to ensure smooth and trouble free operation without binding.
- .2 Adjust shade and fabric to hang flat without buckling or distortion.

### 3.6 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean exposed surfaces using non-abrasive materials and methods.

### 3.7 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Demonstrate proper operation and maintenance of roller shades.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 06 20 00 - Finish Carpentry.
- .4 Section 09 21 16 - Gypsum Board Assemblies.
- .5 Section 12 24 13.13 - Motorized Roller Window Shades.

1.2 REFERENCES

- .1 AAMA 2604-22: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).
- .2 ASTM B209/B209M-21a: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM B221M-21: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .4 NFPA 701-2004: Methods of Fire Tests for Flame Propagation of Textiles and Films.
- .5 CAN/ULC-S109-14 (R2019): Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.
- .6 ANSI/WCMA A100.1-2018: American National Standard for Safety of Corded Window Covering Products.

1.3 PRODUCT DATA

- .1 Submit Product data as specified in Section 01 33 00.
- .2 Product Data: Manufacturer's standard data sheets, indicating materials, components and accessories, component sizes, available fabrics and finishes, and installation instructions.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating wall opening dimensions, shade sizes, operator details, top rail, anchorage details, joint locations, hardware and accessory details, conditions between adjacent units, corner conditions, and required clearances.

1.5 SAMPLES

- .1 Submit samples as specified in Section 01 33 00.
- .2 Verification Samples: Duplicate samples of the following:
  - .1 Fabric: 200 x 200 mm size samples of each specified fabric.
  - .2 Visually-Exposed Components: 300 mm long samples of each visually-exposed component, illustrating material, colour, surface texture and sheen.
  - .3 Prefinished Metal: 50 x 100 mm size samples, illustrating specified finish and colour.

1.6 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control submittals as specified in Section 01 33 00.

- .2 Fire Test Reports: Manufacturer's standard fire test reports, prepared by independent testing agency deemed acceptable by authorities having jurisdiction, indicating fire hazard classification of shade fabric meets regulatory requirements.
- 1.7 CLOSEOUT SUBMITTALS
- .1 Submit closeout submittals as specified in Section 01 78 00.
  - .2 Operation and Maintenance Data: Manufacturer's standard operating instructions, and maintenance and cleaning guidelines; sufficient quantity for inclusion in operation and maintenance manual.
- 1.8 QUALIFICATIONS
- .1 Supplier: A manufacturer-certified firm, approved to supply specified Products and honour warranty claims.
  - .2 Installer: A manufacturer-certified firm, trained and experienced in installing specified Products.
- 1.9 DELIVERY, STORAGE AND HANDLING
- .1 Refer to Section 01 60 00.
  - .2 Protect Products with suitable heavy weight wrapping before delivery to Place of the Work.
  - .3 Store Products at Place of the Work in a designated area, allowing for natural ventilation over finished surfaces.
- 1.10 WARRANTY
- .1 Submit extended warranty in accordance with General Conditions of the Contract.
  - .2 Extended Warranty: For a period of 10 years, covering complete replacement cost of defective Product, including removal and disposal of defective assembly, and installation of replacement Product. Covered defects to include the following:
    - .1 Fading of shade fabric colour,
    - .2 Shrinkage of shade fabric,
    - .3 Loss of flame-retardant properties of shade fabric,
    - .4 Punctures, rips or tears in shade fabric, and
    - .5 Mechanical failure of operating mechanisms.
- 2 Products
- 2.1 MANUFACTURERS
- .1 Manufacturers having Product considered acceptable for use:
    - .1 Altex Decorations Ltee.
    - .2 Concord Shading Systems Inc.
    - .3 Elite Shades.
    - .4 Hunter Douglas Architectural.
    - .5 Legrand Canada.
    - .6 MechoShade Systems, Inc.
    - .7 Sun Glow Window Covering Products of Canada Ltd.
  - .2 Substitution Procedures: Refer to Section 01 25 00.

## 2.2 DESCRIPTION

- .1 Roller Window Shades (RWS-2): Manual pull-down and retracting operation, single sprocket roller shade, rectangular-shaped, with infinite positioning; each unit consisting of two end brackets, shade roller tube, cassette fascia, exposed hembar, and sun control fabric; sizes as indicated on Drawings.
- .2 Roller Window Shades (RWS-3): Manual pull-down and retracting operation, dual sprocket roller shade, rectangular-shaped, with infinite positioning; each unit consisting of two end brackets, shade roller tubes, cassette fascia, exposed hembars, one roller for blackout fabric and one roller for sun control fabric; sizes as indicated on Drawings; complete with channels.

## 2.3 DESIGN CRITERIA

- .1 Design manual roller window shades to operate without any exposed cords or chains, in accordance with ANSI/WCMA A100.1.

## 2.4 PERFORMANCE CRITERIA

- .1 Fire Classification of Fabrics: Flame-retardant and fire-resistant to CAN/ULC-S109 and NFPA 701.

## 2.5 MATERIALS

- .1 Extruded Aluminum: To ASTM B221M, 6063-T5 alloy, unless specified otherwise.
- .2 Sheet Aluminum: To ASTM B209/B209M, 3003-H14 alloy.
- .3 Plastic: ABS type.
- .4 Blackout Fabric: Totally opaque, first quality materials with no pinholes, breaks or cracks; 4-ply opaque close woven fiberglass base textile with sun resistant vinyl film; Black colour.
- .5 Sun Control Fabric: Vinyl-coated polyester yarn, consisting of 79 percent vinyl and 21 percent denier polyester core yarn; one percent openness factor, complete with antimicrobial coating; tensioned prior to heat setting; colour as selected by Consultant.
- .6 Bituminous Coating: Fibrous asphalt emulsion.
- .7 Screw Fasteners: Non-corrosive type, size as recommended by shade manufacturer.

## 2.6 COMPONENTS

- .1 End Bracket: 77 x 96 mm, two-piece moulded ABS construction; 64 mm OD nylon drive sprocket; finish to match fascia colour.
- .2 Shade Roller Tube: 1.52 mm thick extruded aluminum with three internal 4.82 mm high continuous fins spaced 120 degrees apart.
- .3 Cassette: Two-piece interlocking 1.9 mm thick extruded aluminum housing, rectangular profile.
- .4 Fascia: 1.7 mm thick extruded aluminum complete with three continuous screw flute.
- .5 Drive Assembly: Factory set for size and travel of shades, field adjustable; complete with built-in shock absorber.
- .6 Hem Bar: 32 x 19 mm size, extruded aluminum, with upper groove to secure shading fabric; complete with high-impact nylon plugs inserted into each end.



## 2.7 FINISHES

- .1 Powder Coated Finish on Metal Components: To AAMA 2604; electrostatically sprayed polymer powder, factory-applied to 0.05 mm dry film thickness; colour as selected by Consultant.

## 3 Execution

### 3.1 PREPARATION

- .1 Apply heavy coat of bituminous paint on aluminum surfaces placed in direct contact with concrete, mortar, plaster, or dissimilar metals.
- .2 Provide fastenings and anchors required to be built in to adjacent work to other Sections.

### 3.2 INSTALLATION

- .1 Install Products inside window openings, level, plumb and square.
- .2 Install Products parallel with window plane.
- .3 Install Products rigidly coupled and adequately anchored.
- .4 Maintain uniform clearances and accurate alignment levels.
- .5 Conform to manufacturer's Product data and accepted Shop Drawings.
- .6 Conceal brackets and rollers with closure panels for full width of opening.

### 3.3 TOLERANCES

- .1 Gap Variation Along Perimeter:  $\leq 6$  mm per 2 440 mm of shade height.
- .2 Offset from Level:  $\leq 3$  mm.
- .3 Conform to manufacturer's edge clearance requirements for shades exceeding 1:3 width-to-height ratio.

### 3.4 ADJUSTING

- .1 Adjust Products to ensure smooth and trouble free operation without binding.
- .2 Adjust shade and fabric to hang flat without buckling or distortion.

### 3.5 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean exposed surfaces using non-abrasive materials and methods.

### 3.6 DEMONSTRATION

- .1 Refer to Section 01 79 00.
- .2 Demonstrate proper operation and maintenance of roller shades.

END OF SECTION

## **PART 1 – GENERAL**

### **1.1 Work Included**

- .1 Provision of all labour, equipment, material, machines, tools, services, and incidentals to supply and install all items specified in this Section.
- .2 Related Work Specified Elsewhere:  
Various Sections - for installation

### **1.2 Shop Drawings**

- .1 Submit manufacturer's shop drawings of all items specified in this Section, including plans, elevations and overall dimensions.

### **1.3 Samples**

- .1 Submit manufacturer's samples of materials, finishes and colours.

### **1.4 Co-ordination**

- .1 Co-ordinate supply and installation of all specified items.
- .2 Where manufacturer installs, clarify with contractor before submitting tenders.
- .3 Supply sleeves, bolts, anchors, templates and other items required to other trades, for building in of units specified in this Section.

### **1.5 Manufacturers**

- .1 Each item is specified by manufacturer's name and catalogue number.

### **1.6 Delivery, Storage and Handling**

- .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- .2 Store materials in a clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original unopened containers and packaging until installation.
- .3 Protect materials and finishes during handling and installation to prevent damage.

## **PART 2 – PRODUCTS**

### **2.1 Waste Receptacle**

- .1 Model "Scarborough" by Landscape Forms  
Surface mounted, with stainless steel fasteners  
Top opening litter receptacle, height 838cm, top 635mm.  
Surface mounted, with tamper proof fasteners.  
Colour: moss green, powdercoat finish.  
Quantity: (1) one.

Contact: Tracy Cook, Landscape Forms Inc.  
800 430 6206, ext, 1345  
(cell 647-407-4944)  
Email: [tracyc@landscapeforms.com](mailto:tracyc@landscapeforms.com)  
[www.landscapeforms.com](http://www.landscapeforms.com)

### **PART 3 – INSTALLATION**

- .1 Strictly adhere to Manufacturer's requirements and instructions and as shown on Drawings.

#### **3.1 Examination**

- .1 Examine areas to receive site furnishings. Notify Consultant of conditions that would adversely affect installation or subsequent use.
- .2 Do not begin installation until unacceptable conditions are corrected.

#### **3.2 Adjusting**

- .1 Finish damage: repair minor damages to finish in accordance with manufacturer's instructions and as approved by Consultant.
- .2 Component Damage: remove and replace damaged components that cannot be successfully repaired as determined by Consultant.

#### **3.3 Cleaning**

- .1 Clean site furnishings promptly after installation in accordance with manufacturer's instructions.
- .2 Do not use harsh cleaning materials or methods that could damage finish.

#### **3.4 Protection**

- .1 Protect installed litter receptacles to ensure that, except for normal weathering, receptacles will be without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL PROVISIONS**

- .1        This section covers items common to all sections of Mechanical Division.
- .2        Conform to Division 1 General Conditions.
- .3        Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.
- .4        Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

**1.2                INTENT**

- .1        Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.
- .2        Where used, words "Section" and "Division" shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3        Where used, word "supply" shall mean furnishing to site in location required or directed complete with accessory parts.
- .4        Where used, word "install" shall mean secured in place and connected up for operation as noted or directed.
- .5        Where used, word "provide" shall mean supply and install as each is described above.

**1.3                REGULATIONS, PERMITS, AND FEES**

- .1        All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.
- .2        Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.
- .3        In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor's expense.
- .4        Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

#### **1.4 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 fittings.
- .3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.
- .5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels, and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .8 Relocate equipment and/or material installed but not 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 COORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to consultant.
- .5 Due to the nature of the building and the complexity of the building systems provide the following:
  - .1 Interference drawings, showing coordination of architectural, structural, mechanical, and electrical systems for the consultant's review prior to fabrication.
  - .2 Detailed layout drawings, clearly showing fasteners and hangers.
- .6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

#### **1.6 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 Reviews
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

## **1.9 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 REQUEST FOR INFORMATION (RFI) PROCEDURES**

- .1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit an RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.
- .2 All RFIs will be submitted with the following information:
  - .1 RFI number
  - .2 Name of project
  - .3 Date of initiation
  - .4 Date response required by (minimum two (2) weeks)
  - .5 Subject
  - .6 Submitter's name
  - .7 Drawing/specification reference



- .8 Photograph of the issue (if applicable)
- .9 Description of the issue
- .10 Contractor's proposed resolution

**1.11 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)
  - Demolition
  - Inside buried plumbing and drainage
  - Above grade rough-in plumbing and drainage
  - Roof drainage system
  - Plumbing Fixtures
  - Plumbing Equipment
  - Heating piping
  - Piping Insulation
  - Ductwork
  - Duct Insulation
  - Grilles & Diffusers
  - Fire Stopping
  - Fans & Equipment
  - Building Automation Systems
  - Testing Adjusting and Balancing
  - HVAC system commissioning
  - Mechanical contractor closeout requirements (min. of 3% for the first \$500,000.00, 1% from \$500,000.00 to \$5,000,000.00, and 0.5% beyond. Shall not be less than \$5,000.00)
- .5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.
- .6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

**1.12 COMMISSIONING CONTRACT BREAKDOWN**

- .1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

**1.13 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.
- .2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.

- .3 Provide a complete list of shop drawings to be submitted prior to first submission.
- .4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.
- .5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.
- .6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or their Engineer shall not supersede Contract Documents.
- .8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
- .9 Check work described by catalog data with Contract Documents for deviations and errors.
- .10 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g., access door swing spaces.
- .11 Shop drawings and product data shall be accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify as to current model production.
  - .5 Certification of compliance to applicable codes.
- .12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
- .13 Shop drawings shall be submitted electronically as per the following directions:
  - .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

- .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
- .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
- .5 Submissions shall contain multiple files according to section names as they appear in Specification.
- .6 File names shall include consultant project number and description of shop drawing section submitted.
- .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
- .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
- .9 Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.
- .2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.
- .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
- .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
- .5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.
- .6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

**1.14 OPERATION AND MAINTENANCE MANUAL**

- .1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

- .3 Submit 1 copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant. Submission can be done electronically in pdf format or as a hardcopy.
  - .1 Electronic submission/pdf file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.
  - .2 Hardcopy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as 'Operation and Maintenance Manual' with project name and location. Dividers are to be used for binder organization.
- .4 Make changes as required and re-submit as directed by Consultant.
- .5 Operation data to include:
  - .1 Control schematics for each system including environmental controls.
  - .2 Description of each system and its controls.
  - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for each system and each component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
  - .8 Spare parts equipment list.
  - .9 Manufacturers standard or extended warranty information.
- .6 Maintenance data shall include:
  - .1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .7 Performance data to include:
  - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified elsewhere.
  - .4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.
  - .5 Copy of all substantial performance final certificates.
- .8 Miscellaneous data to include:
  - .1 Letter of contractor's warranty and guarantee.
  - .2 Index sheet.
  - .3 Tabbed format for each section.
  - .4 Manufacturers approved shop drawings.
  - .5 Spare parts list and source.
  - .6 List of Manufacturers and suppliers address for each piece of equipment.

- .9 Final Submittals:
  - .1 Upon acceptance of Operation and Maintenance Manual by the Consultant provide the following:
    - .1 Provide two (2) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and as-built drawings.

### 1.15 AS-BUILT DRAWINGS

- .1 Site records:
  - .1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 As-Built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .3 TAB to be performed using as-built drawings.
    - .1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.
    - .2 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals. **Writer to Select:** UGDSB: Submit approved completed reproducible paper as-built drawings as well as a scan pdf of **each** drawing file on USB stick (note pdf's cannot be combined).

### 1.16 WARRANTIES

- .1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
- .2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.
- .3 If mechanical sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local mechanical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.

- .4 Contractor shall rectify any installation deficiencies in the boiler or pressurized other systems identified by a TSSA Inspector for a period of three (3) years from ready for takeover.
- .5 Warranty period shall start from date of ready for takeover.

**1.17 READY FOR TAKEOVER**

- .1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.
  - .1 As-Built Drawings.
  - .2 Maintenance Manuals
  - .3 System Start up
  - .4 TAB Reports
  - .5 HVAC System Commissioning
  - .6 Instructions to Owners
  - .7 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
    - .2 Mandatory TSSA Gas Pressure Test (CSA B149.1)
    - .3 Backflow Test Certificate (for all testable devices)
    - .4 Mechanical Seismic Restraint Engineers' Letter

**1.18 OCCUPANCY REQUIREMENTS**

- .1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:
  - .1 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3).
    - .2 Mandatory TSSA Gas Pressure Test (CSA B149.1).
    - .3 Backflow Test Certificate (for all testable devices).
    - .4 Mechanical Seismic Restraint Engineers' Letter.

**1.19 REVISION TO CONTRACT**

- .1 Provide the following:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/supplier's invoice if requested.

**1.20 DELIVERY, STORAGE, AND HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

**1.21 DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS**

- .1 If designated substances and/or hazardous materials are suspected or identified cease all work in the immediate area in accordance with OSHA and notify consultant.
- .2 Each contractor and on site employee of the contractor shall have "asbestos awareness training".
- .3 The Contractor shall ensure that employees who may come into contact with designated substances and/or hazardous materials due to the nature of the work that they perform, have received training that enables them to recognize designated substances and/or hazardous materials and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with designated substances and/or hazardous materials occur during the course of their work.
- .4 It is the responsibility of the contractor to review the designated substances and/or hazardous materials book in the building prior to starting any work.
- .5 Existing occupied buildings (depending upon their age) may contain designated substances and/or hazardous materials in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain designated substances and/or hazardous materials and shall not be disturbed.

**1.22 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.

**1.23 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

**1.24 CONFINED SPACES**

- .1 Certain areas of the building may be defined as a "Confined Space". Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.
- .2 Refer to building documentation for any spaces deemed "Confined Space".

**1.25 ENERGY EFFICIENCY**

- .1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.
- .2 All equipment, products, and installations must conform to the Codes and Standards.

**END OF SECTION**



**Part 1            General**

**1.1                TESTS**

- .1      Give 48 hours written notice of date for tests.
- .2      Insulate or conceal work only after testing and approval by Consultant.
- .3      Conduct tests in presence of Consultant.
- .4      Bear costs including retesting and making good.
- .5      Piping:
  - .1      General: maintain test pressure without loss for 4 h unless otherwise specified.
  - .2      Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
  - .3      Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.
  - .4      Test fuel oil systems to CSA B139 1976, CSA B139S1-1982 and authorities having jurisdiction.
  - .5      Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
  - .6      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.
  - .7      Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.
- .6      Equipment: test as specified in relevant sections.
- .7      Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

**1.2                SYSTEM START UP**

- .1      Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.
- .2      Provide consultant with written notice verifying all equipment operation and installation is complete.
- .3      Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .4      Simulate system start up and shut down and verify operation of each piece of equipment.
- .5      Arrange with all parties and provide 72 hours notice for start up procedure.
- .6      Arrange with building automation systems contractor to sequence all components and ensure system operation.

### 1.3 COMMISSIONING

- .1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.
- .2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.
- .3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process*. The commissioning plan may be modified to reflect the actual construction schedule and design.
- .4 Provide a pre-functional test of all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:
  - .1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.
  - .2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.
  - .3 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .4 Controls calibration to be completed in accordance with the specification.
  - .5 The TAB shall be done in accordance with the specifications.
- .5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests, and test the systems through all possible modes of operation.
- .6 Reports:
  - .1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.
  - .2 All data must be recorded as soon as possible during the course of the inspection and testing.
  - .3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.
  - .4 All test instruments shall be documented for valid calibration.
  - .5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the owner's representative prior to the start of the testing.
  - .6 Include all commissioning documentation in the maintenance manuals.

- .7 Mechanical System Execution:
  - .1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.
  - .2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.
  - .3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.
  - .4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.
  - .5 All special testing materials and equipment shall be provided by the appropriate contractor.
  - .6 Provide three copies of all test reports and records to the consultant.
- .8 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:
  - Equipment Checklist
  - Rooftop Heating/Cooling Unit(s)
  - Exhaust Fans
  - Controllers/Valves/Dampers
  - Relays/Sensors/Transducers

#### **1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION**

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.
- .3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

**1.5 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.

**1.6 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.

**1.7 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.

**1.8 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

- .3 Install mechanical equipment at following heights unless indicated otherwise.
- |     |                                      |   |
|-----|--------------------------------------|---|
| .1  | Standard water closets               | 350 (14") to top of bowl  |
| .2  | Barrier-free water closets           | 400 (16") to top of bowl  |
| .3  | Barrier-free water closets           | 450 (18") to top of seat lid  |
| .4  | Wall hung lavatory                   | 787 (31") to rim  |
| .5  | Barrier-free wall hung lavatory      | 840 (33") max to top of rim<br>737 (29") min underside of rim front<br>685 (27") clear at 400 (8") from basin front<br>350 (14") min clear under waste trap |
| .6  | Urinals (Adult)                      | ± 600 (24)  |
|     | Urinals (Senior Elementary)          | 475 (19") to rim  |
|     | Urinals (Junior Elementary)          | 425 (17") to rim  |
|     | Urinals (Barrier-free)               | 425 (17") to rim  |
|     | Urinals (Barrier-free)               | 1000 (40") to flush lever or sensor   |
| .7  | Fire extinguisher                    | 1350 (4'- 0") to hanger   |
| .8  | Fire extinguisher cabinets           | 1500 (5'- 0") to top of cabinet   |
| .9  | Hydronic heating elements            | 200 mm (8") to bottom of cabinet  |
| .10 | Backflow preventors                  | 900 – 1200 (3'- 4') to centerline of unit   |
| .11 | Thermostats: Barrier Free (operable) | 1200 mm (47.25")  |
|     | Non Barrier Free                     | 1500 mm (59")   |

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

### **1.9 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation by other divisions.

### **1.10 PROTECTION OF OPENINGS**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### **1.11 ELECTRICAL**

- .1 Electrical work to conform to Electrical Division including the following:
- .1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings
  - .2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Follow Electrical Division for quality of materials and workmanship.

- .3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.
- .4 All starters for mechanical equipment to be provided by this contractor. Wired by Electrical Division.

#### **1.12 CONTROL WIRING**

- .1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer's requirements and recommendations.
- .2 All electrical wiring, mechanical wiring and installations shall comply with local and national electrical and mechanical codes.
- .3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.
- .4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.
- .5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in mechanical or service rooms.
- .6 Free-run plenum rated cable shall be run in cable hangers where provided by electrical division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring "as the crow flies".

#### **1.13 MOTORS**

- .1 Provide high efficiency motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.
- .4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

#### **1.14 BELT DRIVES**

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under 7.5 kW 10 hp: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

- .4 For motors 7.5 kW 10 hp and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.
- .7 Provide sheave changes as required for final air balancing.

**1.15 GUARDS**

- .1 Provide guards for unprotected devices.
- .2 Guards for belt drives:
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm (18 gauge) thick sheet metal tops and bottoms.
  - .3 40 mm (1 1/2") diameter holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
  - .1 "U" shaped, minimum 1.6 mm (16 gauge) thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
  - .1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.
- .7 Duct Openings in Floor
  - .1 Provide reinforced expanded mesh grating, style 3 (3 lbs/sq.ft.) cover on accessible unprotected duct openings over 300 mm (12") wide and as indicated. This includes all ductwork terminating in air handling units and plenums.
  - .2 Securely Fasten in place.
  - .3 Removable for servicing.

**1.16 PIPING AND EQUIPMENT SUPPORTS**

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Division.
- .2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.
- .4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

**1.17 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.

**1.18 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 Alternate Manufacturers to approval of local authority:  
Minnesota Mining and Manufacturing
- .16 Fryesleeve Industries Inc.  
General Electric Pensil Firestop Systems  
International Protective Coatings Corp.  
Rectorseal Corporation (Metacaulk)  
Proset Systems  
3M  
AD Systems  
Hilti
- .17 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

**1.19 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.

**1.20 PAINTING**

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.
- .4 Prime and touch up marred finished paintwork to match original.
- .5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.
- .6 All exposed ductwork, grilles, hangers, supports, etc shall be painted to match the color and finish of area/room where it is installed. Refer to architectural drawings and specification for any additional color and finish requirements.

**1.21 SPARE PARTS**

- .1 Furnish spare parts in accordance with general requirements and as follows:
  - .1 One set of packing/mechanical seals for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.
  - .4 One glass for each gauge glass.
  - .5 One set of belts for each type or each size of machinery.
  - .6 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

**1.22 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.

**1.23 ACCESS DOORS**

- .1 Provide access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

- .3 Material:
  - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
  - .2 Remaining areas: use prime coated steel.
  - .3 Fire rated areas: provide ULC listed access doors.
  - .4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.
- .4 Installation:
  - .1 Locate so that concealed items are accessible.
  - .2 Locate so that hand or body entry (as applicable) is achieved.
- .5 Acceptable materials:
  - Le Hage
  - Zurn
  - Acudor
  - Nailor Industries Inc.

#### **1.24 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.

#### **1.25 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.

#### **1.26 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.

**1.27 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.

**1.28 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

**1.29 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.

**1.30 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.

**1.31 DEMOLITION**

- .1 The general requirements are indicated on the drawings and on the outline specification in Division 1.
- .2 The general execution of the demolition is to be carried out in a clean and efficient manner.
- .3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.
- .4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.
- .6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.
- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

**1.32 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 USB.
- .2 This contractor shall flush the new and existing storm and sanitary system to remove all debris prior to final video taping of systems.
- .3 Provide 1 copy of USB.
- .4 Identify video routing on As-built drawings.

**1.33 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.

**1.34 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.

**1.35 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.

#### **1.36 CONFINED SPACES**

- .1 Certain areas of the building may be defined as a "Confined Space". Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.
- .2 Refer to building documentation for any spaces deemed "Confined Space".

#### **1.37 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

#### **1.38 INTEGRATED LIFE SAFETY SYSTEMS TESTING**

- .1 Mechanical systems in this building, including but not limited to smoke control dampers, smoke control fans, high speed low velocity ceiling fans, makeup air units, heat tracing for fire protection systems and fire protection system components may be subject to Integrated Life Safety Systems testing.

- .2 The Mechanical Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:
  - .1 Confirm which mechanical systems are to be included as part of the testing process.
  - .2 Verify in writing to the Integrated Life Safety Systems Testing Agent that mechanical commissioning of the affected systems/devices is complete prior to the scheduled testing date(s).
  - .3 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all associated systems.
  - .4 This contractor shall work with the Integrated Life Safety Systems Testing Agent to reset all systems back to normal operating mode after the testing is complete.
- .3 Include all costs associated with Integrated Life Safety System Testing in the tender value.
- .4 Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL PROVISIONS**

- .1        Conform to the General Provisions of General Requirements Section.
- .2        This project is one of a retrofit nature in part, and which will require some demolition.
- .3        Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

**1.2                RELATED WORK SPECIFIED ELSEWHERE**

- .1        Electrical Division.

**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 and dispose (or pipe freeze as required) all existing domestic and hydronic 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 National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

**1.2                DESIGN REQUIREMENTS**

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit shop drawings and product data for following items:
  - .1 All bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

**1.4                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2 Products**

**2.1 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

**2.2 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: to ANSI & ULC requirements
  - .2 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 10 mm (3/8") UL listed
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.
- .4 Upper attachment to concrete.
  - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are 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.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.
- .10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A 563.
  - .1 Finishes for steel pipework: black
  - .2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

### **2.3 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>2</sup> (13.12 lbs/ft<sup>2</sup>) 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.

### **2.4 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.

## **2.5 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.

## **2.6 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.

## **2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.8 OTHER EQUIPMENT SUPPORTS**

- .1 From structural grade steel meeting requirements of structural steel section specified herein.
- .2 Submit structural calculations with shop drawings.

## **2.9 MANUFACTURER**

- .1 Acceptable materials:
  - .1 Grinnell
  - .2 Anvil
  - .3 Myatt
  - .4 Taylor

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 15 mm (1/2") or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25% of total load.

### **3.2 HANGER SPACING**

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').
- .4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').
- .5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

- .6 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

- .7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

### 3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do "NOT" support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

### 3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.
- .2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.5 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.

- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.
- .5 CSA B272-93 – Prefabricated Self-Sealing Roof Vent Flashings
- .6 CRCA (Canadian Roofing Contractor’s Association)
- .7 SPRI (Single Ply Roofing Institute)
- .8 CUFCA (Canadian Urethane Foam Contractor’s Association) and CGSB-51-GP-46MP, Manual for “Installers of Spray Polyurethane Foam Thermal Insulation”
- .9 CSA G40.21-M1987, M350W, and M300W (Structural Quality Steels)
- .10 CSA W47.1-1983 (Certificate of Companies for Fusion Welding of Structural Steel)
- .11 CSA W59-M1989 (Welded Steel Construction – Metal Arc Welding)
- .12 CSA G164-M1981 (Hot Dip Galvanizing of Irregularly Shaped Articles)

**1.2                DESIGN REQUIREMENTS**

- .1 Construct support systems to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Design supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

**1.3 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.
- .3 Manufacturer's installation instruction.

**1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.5 QUALITY ASSURANCE**

- .1 Roof accessories manufactures to have minimum five (5) years documented experience in the design and fabrication of roofing specialties and accessories.

**1.6 SPECIAL WARRANTY**

- .1 Warrant products installed under this section of work to be free of leaks, condensation, and defects in materials and/or manufacture for a period of twenty (20) years when installed in accordance with the manufacturer's written instructions.

**Part 2 Products**

**2.1 PIPE/SUPPORT**

- .1 Pipe/Support:
  - .1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51mm) diameter.
- .2 Stack Jack Flashing:
  - .1 Height to suit application.
  - .2 Fully urethane insulated.
  - .3 Aluminum construction.
  - .4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.
- .3 Provide appropriate stainless steel mounting hardware to suit supported pipe/equipment.
- .4 Provide appropriate system support as specified in this section to suit application.
  - .1 Single Plain Pipe: Type 304 stainless steel pipe roller assembly to suite actual O.D pipe.
  - .2 Double Plain Pipe: Type 304 stainless steel pipe roller assemblies sized to suit actual O.D pipe.

- .3 Single Insulated Pipe: Type 304 stainless steel pipe cradle assembly sized to suit actual O.D of insulated pipe.
- .4 Double insulated Pipe: Type 304 stainless steel pipe cradle assemblies sized to suit actual O.D of insulated pipe.
- .5 Basis of design/Acceptable Manufacturer
  - .1 Thaler MERS 600 series.
  - .2 Acceptable equals if submitted during tender period.

## 2.2 DUCT SUPPORT

- .1 Duct support:
  - .1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51mm) diameter.
- .2 Stack Jack Flashing:
  - .1 Height to suit application.
  - .2 Fully urethane insulated.
  - .3 Aluminum construction.
  - .4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.
- .3 Provide appropriate stainless steel mounting hardware to suit application.
- .4 Cross-bar carrier assembly of length to suit application with EPDM end caps.
- .5 Basis of design/Acceptable Manufacturer
  - .1 Thaler MERS-800 series.
  - .2 Acceptable equals if submitted during tender period.

## 2.3 ROOFED IN MECHANICAL UNIT SUPPORT (SMALL UNITS)

- .1 Mechanical Unit supports:
  - .1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51mm) diameter.
- .2 Stack Jack Flashing:
  - .1 Height to suit application.
  - .2 Fully urethane insulated.
  - .3 Aluminum construction.
  - .4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.
- .3 Provide appropriate stainless steel mounting hardware to suit application.
- .4 Cross-bar carrier of length to suit application with EPDM end caps, anti-vibration pads and 1 1/2" (38mm) diameter pipe section reinforcing ties.

.5 Basis of design/Acceptable Manufacturer:

- .1 Thaler MERS-900 series.
- .2 Acceptable equals if submitted during tender period.

## **2.4 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

.1 Provide templates to ensure accurate location of anchor bolts.

## **2.5 ROOF CURB MOUNTED EQUIPMENT**

- .1 Install as per manufacturer's instructions on roof curbs provided by manufacturer as indicated.
- .2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

## **2.6 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

## **2.7 ALUMINUM ROOF SUPPORTS**

- .1 450 mm high aluminum pipe support.
- .2 Adjustable leg assembly, base plate, roller assembly.
- .3 Acceptable material:  
Thaler Mers-600A Series.

## **2.8 PIPING THROUGH ROOF**

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

## **2.9 ROOF MOUNTED DUCT SUPPORT**

- .1 Provide zero penetration duct support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.

- .4 Provide shop drawings as specified. Install to manufacturers recommendations.

Acceptable materials:

Portable pipe hanger

Bigfoot systems

Miro rooftop support

Trikon Systems

Walravin BIS Yeti

Ecofoot

## **2.10 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.

Acceptable material:

Portable pipe hanger

Bigfoot systems

Miro rooftop supports

Walravin BIS Yeti

Ecofoot

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Roof support install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
  - .2 Provide protection against deterioration due to contact of dissimilar metals.
- .2 Flashing Installation:
  - .1 Install roof support flashing in accordance with manufacturer's printed instructions.
- .3 Vibration Control Devices:
  - .1 Install as indicated and at all roof mounted mechanical equipment that is not internally isolated.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

**3.2 PIPE SUPPORT SPACING**

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Gas and fuel oil piping: every 1.8 m (6').
- .3 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').
- .4 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

- .5 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

**3.3 EXAMINATION**

- .1 Report to the contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of work will imply acceptance of prepared work.

**3.4 ADJUSTING**

- .1 Verify that all manufactured units have been installed in accordance with specifications and details and will function as intended. Adjust any items where necessary to ensure proper operation.

**3.5 CLEANING**

- .1 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaning techniques which could impair performance of the roofing system.

**END OF SECTION**

**Part 1            General**

**1.1            APPLICATION**

- .1    Seismic restraint is becoming more prominent with improved soil testing equipment. Seismic requirement is not site specific by geographical area but determined by site soil conditions.
- .2    Where the structural engineer or architect documents have  $I_e \cdot S_a(0.2) \cdot F_a < 3.5$  seismic is not required on the mechanical, electrical, or plumbing systems.
- .3    Where the structural engineer or architect documents have  $I_e \cdot S_a(0.2) \cdot F_a \geq 3.5$  seismic is required on the mechanical, electrical, plumbing, or fire protection systems.
- .4    When it is unclear in the tender documents request information from the structural engineer or architect for clarification.

**1.2            SECTION INCLUDES**

- .1    Seismic Requirements for single rod hanger support for conduit, pipe and other similar systems.
- .2    Seismic Requirements for trapeze type supports for cable tray, conduit, pipe and other similar systems.
- .3    Seismic requirements for all mechanical equipment and piping.

**1.3            RELATED WORK SPECIFIED ELSEWHERE**

- .1    Vibration Isolation Measures.

**1.4            REFERENCE STANDARDS**

- .1    All codes, standards, etc. as referenced shall be the latest edition.
- .2    National Building Code of Canada (NBC).
- .3    Canadian Standards Association
  - .1    CSA S832, Seismic Risk Reduction of Operation and Functional Components (OFCs) of Buildings.
  - .2    CAN/CSA-S16.1 Limit States Design of Steel Structures
  - .3    CAN3-S136 Design of Cold Steel Structural Members
  - .4    CSA W47.1 Certification of Companies for Fusion Welding of Steel
  - .5    CSA W59 Welded Steel Construction
- .4    SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems
- .5    Canadian Institute of Steel Construction
- .6    Canadian General Standards Board
- .7    Underwriter Laboratories of Canada
- .8    Workers Compensation Board of BC

- .9 American Society of Testing and Materials
  - .1 ASTM A653/S653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (galvannealed) by the Hot Dip Process.
  - .2 ASTM A879M Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
  - .3 ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A325M Specification for Structural Bolts, Heat Treated 830MPa Minimum Tensile Strength.
- .10 All local codes.
- .11 NFPA-13: Installation of Fire Sprinkler Systems.
- .12 FEMA: Federal Emergency Management Activity.
- .13 FEMA: Seismic Restraint Installation Manuals 412. 413. & 414
  - .1 FEMA 412: Installing Seismic Restraints for Mechanical Equipment
  - .2 FEMA 413: Installing Seismic Restraints for Electrical Equipment
  - .3 FEMA 414: Installing Seismic Restraints for Duct and Pipe
- .14 ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.).
- .15 ASHRAE Applications Handbook; Seismic and Wind Restraint Design Chapter.

## 1.5 DEFINITIONS

- .1  $A_v$ : Effective peak velocity related acceleration coefficient BOCA, SBC Code.
- .2  $S_1$ : Mapped Long Period Seismic Acceleration Coefficient IBC, TI-809-04, ASCE7.
- .3  $S_s$ : Mapped Short Period Seismic Acceleration Coefficient IBC, TI-809-04, ASCE7.
- .4  $v$ : Zonal Velocity Coefficient NBC-Canada.
- .5 VISCMA: The Vibration Isolation and Seismic Control Manufacturers Association has developed Testing and Rating Standards for Seismic Restraint Components that comply with Code and ASHRAE based requirements.
- .6 VISCMA 102-2007: Static Qualification Standards for Obtaining a VISCMA Compliant Seismic Component Rating.
- .7  $Z$ : Seismic Zone defines Seismic Coefficient  $C_a$  used by UBC Code.

## 1.6 PERFORMANCE REQUIREMENTS

- .1 Design Ground Acceleration Coefficient ( $A_v$ ,  $S_s$ ,  $v$ , or  $Z$  depending on Code = X.XX).
- .2 (If IBC or TI-809-04) Design Long Period Ground Acceleration Coefficient ( $S_1 = X.XX$ ).
- .3 Design Soil Type = ( $S_a$ ,  $S_b$ ,  $S_c$ ,  $S_d$ ) as appropriate. (If NBC Canada, the Foundation Factor).



- .4 Importance or Performance Factor appropriate to structure =  $I_p = X.XX$ .
- .5 If UBC Zone 4, Proximity to Fault and, if less than 10km, Fault Type.
- .6 Schedule or drawings indicating critical ( $I_p = 1.5$ ) Duct/Piping systems, including systems whose importance factor may be increased by proximity to critical components.

## 1.7 DESCRIPTION OF SYSTEM

- .1 It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.
- .2 The work under this section shall include furnishing all labour, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications.
- .3 All seismic snubber restraint assemblies shall meet the following minimum requirements:
  - .1 The snubber/restrained isolator for isolated equipment shall include a resilient element that will ensure that no un-cushioned shock can occur (this does not include cable restraints).
  - .2 It shall be possible to visually inspect the resilient material for damage and allow for replacement, if necessary.
  - .3 All snubbers are to include a maximum air gap of 0.25 in (6 mm).
  - .4 Seismic restraint systems shall be designed to offer seismic restraint in all directions, unless otherwise noted.
  - .5 Seismic restraint capacities to be verified by an independent test laboratory or certified by a registered Professional Engineer to ensure that the design intent of this specification is realized. Verification shall be by one of the following methods:
    - .1 An NRTL (National Recognized Testing Laboratory), or laboratory recommended by VISCMA.
    - .2 Certified by a Professional Engineer with at least 5 years of experience, using industry standard methods of analysis, which employ common engineering practices. Adherence to the ratings standard within ASHRAE SPC171 and VISCMA 102-2007 is required.
    - .3 By a nationally recognized agency, such as VISCMA, that has reviewed and approved the restraint.

## 1.8 SYSTEM DESIGN

- .1 Seismic restraint manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers/restraints to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.

- .2 The contractor shall furnish, to the seismic restraint manufacturer, a complete set of approved shop drawings of all equipment that is to be restrained, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length, and width dimensions, and installed operating weights of the equipment to be restrained.
- .3 All piping, ductwork and equipment is to be restrained to meet code requirements. At a minimum, the seismic restraint manufacturer shall provide documentation on maximum restraint spacing for various restraint sizes and anchors, as well as "worst case" reaction loads for each restraint and/or anchor size.
- .4 The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly dowelled to the building structure, so as to withstand calculated seismic forces. In addition, the size of the housekeeping pad is to be coordinated with the seismic restraint manufacturer to ensure that adequate edge distances exist in order to obtain the desired equipment anchor capacities.

#### **1.9 SEISMIC BRACING AND SUPPORT DESIGN REQUIREMENTS**

- .1 Seismic restraint designer shall co-ordinate all attachments with the structural engineer of record.
- .2 Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
- .3 Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
- .4 All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 3.01.
- .5 Friction from gravity loads shall not be considered resistance to seismic forces.
- .6 Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14. Sway bracing used for seismic restraint purposes must be fitted with provisions to resist the vertical force component of the diagonal brace. Single diagonal brace for seismic restraint will not be approved.

#### **1.10 QUALITY ASSURANCE**

- .1 The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.
- .2 System Supports/Restraints: Firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.
- .3 Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

- .4 Only companies experienced in performing the work of this section shall do the installation.
- .5 All seismic restraint installations shall be independently reviewed by the Owners Representative for compliance with project specifications.

### **1.11 SUBMITTALS**

- .1 Product Data: Include Seismic Rating Curve for each seismically rated isolator or restraint component.
- .2 Samples: The contractor shall submit samples of specified seismic snubber devices for approval.
- .3 Shop Drawings shall include the following:
  - .1 Design Calculations: Calculate requirements for selecting seismically rated vibration isolators and seismic restraints. Certification documents to be signed and sealed by a qualified Professional Engineer with at least 5 years of experience in the design of seismic restraints. Professional engineer shall have local jurisdiction and provide periodic field review and final certification upon completion of the project. All costs and fees associated with the engineering shall be the responsibility of this contractor.
  - .2 Vibration Isolation Bases: Dimensional drawings including anchorage and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads.
  - .3 Seismic-Restraint Details: Detailed submittal drawings of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors. Include ratings for loads.
  - .4 Equipment Manufacturer Seismic Qualification Certification: The Equipment Manufacturer must submit certification that each piece of provided equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
    - .1 Basis for Certification: Indicate whether the "withstand" certification is based on actual test assembled components or on calculations.
    - .2 Indicate the equipment is certified to be durable enough to:
      - .1 structurally resist the design forces and/or
      - .2 will remain functional after the seismic event.
  - .5 Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - .6 Detailed description of the assumed equipment anchorage devices on which the certification is based.

### **1.12 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver strut systems, pipe hangers and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.
- .2 Store strut systems, pipe hangers and components in original cartons and in clean dry space; protect from weather and construction traffic.

**1.13 WORK FURNISHED BUT NOT INSTALLED**

- .1 The materials and systems specified in this section shall be purchased by the mechanical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.
- .2 The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the mechanical equipment, piping, or ductwork.

**1.14 COORDINATION**

- .1 Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the consultant.
- .2 Coordinate with seismic restraint manufacturer to locate and size structural supports underneath seismically restrained equipment (e.g. roof curbs, cooling towers, and other similar equipment).

**1.15 INSTALLATION**

- .1 Installation of all seismic restraint materials specified herein shall be accomplished following the manufacturer's written instructions. Installation instructions shall be submitted to the engineer for approval prior to the beginning of the work.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Unless otherwise specified materials used in the Work shall conform to the following:
  - .1 All steel rolled sections and steel plates shall conform to CAN/CSA G40.21M-300W
  - .2 All steel hollow structural steel sections shall conform to CAN/CSA G40.21-350W Class C
  - .3 Structural steel bolts, nuts and washers shall conform to ASTM A325M
  - .4 Weld electrodes shall be SMAW-E-E480XX and SAW-F480-EXXX.

**2.2 ACCEPTABLE MANUFACTURERS**

- .1 All seismic snubbers and combination restraint/vibration isolation materials specified herein shall be provided by a single manufacturer to assure sole source responsibility for the proper performance of the materials used. Manufacturer is to be a member of VISCMA.
- .2 Anchor types and sizes are to be per the design data as provided by the seismic restraint manufacturer.

- .3 Materials and systems specified herein and detailed or scheduled on the drawings are based upon materials manufactured by Kinetics Noise Control Inc. Materials and systems provided by other manufacturers are acceptable, provided that they meet all requirements as listed in this specification.
- .4 Kinetics Noise Control Inc.
- .5 Cooper 'B' Line.
- .6 Unistrut Building Systems.
- .7 Mason Industries.

## 2.3 SEISMIC SNUBBER TYPES

### GENERAL

(Isolator/Snubber Types contained herein are per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Handbook, HVAC Applications, Seismic and Wind Restraint Design)

- .1 Type A, Coil Spring Isolator Incorporated Within a Ductile Iron or Cast Aluminum Housing.
  - .1 Cast iron or aluminum housings are brittle when subjected to shock loading and are therefore not approved for seismic restraint applications.
- .2 Type B, Coil Spring Isolator Incorporated Within A Steel Housing
  - .1 Spring isolators shall be seismic control restrained spring isolators, incorporating a single or multiple coil spring element, having all of the characteristics of free standing coil spring isolators as specified in the vibration isolation portion of this specification. Springs shall be restrained using a housing engineered to limit both lateral and vertical movement of the supported equipment during an earthquake without degrading the vibration isolation capabilities of the spring during normal equipment operating conditions.
  - .2 Vibration isolators shall incorporate a steel housing and neoprene snubbing grommet system designed to limit motion to no more than  $\frac{1}{4}$ " (6 mm) in any direction and to prevent any direct metal-to-metal contact between the supported member and the fixed restraint housing. The restraining system shall be designed to withstand the seismic design forces in any lateral or vertical direction without yield or failure. Where the capacity of the anchorage hardware in concrete is inadequate for the required seismic loadings, a steel adapter base plate to allow the addition of more or larger anchors will be fitted to fulfill these requirements. In addition to the primary isolation coil spring, the load path will include a minimum  $\frac{1}{4}$ " (6 mm) thick neoprene pad.
  - .3 Spring elements shall be colour coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy powder coated and shall have a minimum of a 1000-hour rating when tested in accordance with ASTM B-117.

- .4 To facilitate servicing, the isolator will be designed in such a way that the coil spring element can be removed without the requirements to lift or otherwise disturb the supported equipment.
  - .5 Spring isolators shall be Model FHS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (2).
- .3 Type C, Coil Spring Isolator Incorporated Within a Steel Housing
- .1 Spring isolators shall be seismic control restrained spring isolators, incorporating one or more coil spring elements, having all the characteristics of free standing coil spring isolators per the vibration isolation section of this specification, for equipment which is subject to load variations and/or large external forces. Isolators shall consist of one or more laterally stable steel coil springs assembled into fabricated welded steel housings designed to limit movement of the supported equipment in all directions.
  - .2 Housing assembly shall be made of fabricated steel members and shall consist of a top load plate complete with adjusting and leveling bolts, adjustable vertical restraints, isolation washers, and a bottom load plate with internal non-skid isolation pads and holes for anchoring the housing to the supporting structure. Housing shall be hot dipped galvanized for outdoor corrosion resistance. Housing shall be designed to provide a constant free and operating height within  $\frac{1}{8}$ " (3 mm).
  - .3 The isolator housing shall be designed to withstand the project design seismic forces in all directions.
  - .4 Coil spring elements shall be selected to provide static deflections as shown on the vibration isolation schedule or as indicated or required in the project documents. Spring elements shall be colour coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy powder coated and shall have a minimum of a 1000-hour rating when tested in accordance with ASTM B-117.
  - .5 Spring isolators shall be Model FLS and FLSS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (3).
- .4 Type D, Coil Spring Isolator Incorporated with Integral Seismic Restraint
- .1 Spring isolators shall be single or multiple coil spring elements which have all of the characteristics of freestanding coil spring isolators as specified in the vibration isolation portion of this specification, incorporating lateral and vertically restrained seismic housing assemblies. Spring elements shall be readily replaceable without the need to list or remove the supported equipment.

- .2 Restraint housing shall be sized to meet or exceed the force requirements of the application and shall have the capability of accepting coil springs of various sizes, capabilities, and deflections as required to meet the required isolation criteria. All spring forces shall be contained within the coil/housing assembly, and the restraint anchoring hardware shall not be exposed to spring generated forces under conditions of no seismic force. Spring element leveling adjustment shall be accessible from above and suitable for use with a conventional pneumatic or electric impact wrench.
- .3 Restraint element shall incorporate a steel housing with elastomeric elements at all dynamic contact points. Elastomeric elements shall be replaceable. Restraint shall allow  $\frac{1}{4}$ " (6 mm) free motion in any direction from the neutral position. Restraint shall have an overturning factor (ratio of effective lateral snubber height to short axis anchor spacing) of 0.33 or less to ensure optimum anchorage capacity.
- .4 Spring isolators shall be Model FMS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (4).
- .5 Type E, All Direction Neoprene Isolator
  - .1 Vibration Isolators shall be neoprene, molded from oil resistant compounds, designed to operate within the strain limits of the isolator so to provide the maximum isolation and longest life expectancy possible using neoprene compounds. Isolators shall include encapsulated cast-in-place top steel load transfer plate for bolting to equipment and a steel base plate with anchor holes for bolting to the supporting structure. Ductile iron or cast aluminum components are not acceptable alternatives and shall not be used due to brittleness when subjected to shock loading.
  - .2 Isolator shall be capable of withstanding the design seismic loads in all directions with no metal-to-metal contact.
  - .3 Isolator shall have minimum operating static deflections as shown on the project Vibration Isolation Schedule or as otherwise indicated in the project documents and shall not exceed published load capacities.
  - .4 Neoprene isolators shall be Model RQ as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections .2.01, 2.02 and 2.03 (5).
- .6 Type F, Light Capacity All Direction 3-Axis External Seismic Snubber Assembly
  - .1 Equipment shall be restrained against excessive movement during a seismic event by the use of 3-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all three directions, and additional snubbers shall be used as required by seismic design conditions.
  - .2 Snubbers shall be of interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral and vertical equipment movement at each snubber location to a maximum of  $\frac{1}{4}$ " (6 mm) in any direction.

- .3 Snubbers shall include a minimum  $\frac{1}{4}$ " (6 mm) thick resilient neoprene pads to cushion any impact and to avoid any potential for metal-to-metal contact. Maximum neoprene bearing pressure shall not exceed 1500 pounds / sq. inch (10.4 N / sq. mm). Snubber shall be capable of withstanding an externally applied seismic force of up to 3,000 pounds (1360 kg) in any direction. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.
- .4 Three-axis seismic snubbers shall be Model HS-5 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and 2.01, 2.02, and 2.03 (6).
- .7 Type G, Lateral 2-Axis External Seismic Snubber Assembly
  - .1 Equipment shall be restrained against excessive lateral movement during a seismic event by the use of 2-axis horizontal resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all horizontal directions, and additional snubbers shall be used as required by seismic design conditions.
  - .2 Snubbers shall be interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral equipment movement at each snubber location to a maximum of  $\frac{1}{4}$ " (6 mm).
  - .3 Snubbers shall include a minimum of  $\frac{1}{4}$ " (6 mm) thick resilient neoprene pads to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.
  - .4 Two-axis lateral seismic snubbers shall be Model HS-2 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (7).
- .8 Type H, Heavy Capacity All Direction 3-Axis External Seismic Snubber Assembly
  - .1 Equipment shall be restrained against excessive vertical and horizontal movement during a seismic event by the use of 3-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all three directions, and additional snubbers shall be used as required by seismic design conditions.
  - .2 Snubbers shall be of welded interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral and vertical equipment movement at each snubber location to a maximum of  $\frac{1}{4}$ " (6 mm) in any direction.



- .3 Snubbers shall include resilient neoprene pads with a minimum thickness of ¼" (6 mm) to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be capable of withstanding an externally applied seismic force up to 10,000 pounds (4,540 kg) in any direction. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.
  - .4 Three-axis seismic snubbers shall be Model HS-7 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (8).
- .9 Type I, Horizontal 1-Axis External Seismic Snubber Assembly
- .1 Equipment shall be restrained against excessive horizontal one-axis movement during a seismic event by the use of single-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of four (4) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all lateral directions.
  - .2 Snubbers shall be of steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral equipment movement at each snubber location in the direction of impact to a maximum of ¼" (6 mm).
  - .3 Snubbers shall include resilient neoprene pads with a minimum thickness of ¼" (6 mm) to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to eliminate any contact during normal equipment operation.
  - .4 Single-axis seismic snubbers shall be Model HS-1 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (9).
- .10 Type J, Cable Restraints for Suspended Piping and Ductwork
- .1 Seismic wire rope cable restraints shall consist of steel wire strand cables, sized to resist project seismic loads, arranged to offer seismic restraint capabilities for piping, ductwork, and suspended equipment in all lateral directions.
  - .2 Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.
  - .3 Restraints shall be sized to the capacity of the cable or to the capacity of the anchorage, whichever is lesser.
  - .4 Seismic wire rope connections shall be made using overlap wire rope "U" clips or seismically rated tool-less wedge insert lock connectors.

- .5 Vertical suspension rods shall be braced as required to avoid potential for buckling due to vertical “up” forces. Braces shall be structural steel angle uniquely selected to be of sufficient strength to prevent support rod bending. Brace shall be attached to the vertical suspension rod by a series of adjustable straps. Clips shall be capable of securely locking brace to suspension rod without the need for hand tools.
- .6 Where clevis hanger brackets are used for seismic restraint attachment, they will be fitted with clevis internal braces to prevent buckling of the hanger brackets.
- .7 Seismic cable shall be as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.03 through 1.07 inclusive, and sections 2.01, 2.02, and 2.03 (10).
- .8 Seismic cable building and equipment attachment brackets shall be Model KSCA, KSCU, or KSCC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).
- .9 Seismic cable concrete anchor bolts shall be Model KCAB Wedge, Model KCCAB Cracked Concrete, or Model KUAB Undercut, as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).
- .10 Seismic wire rope connectors shall be (Model KWRC - 'U' clamp) / (Model KWGC - Tool-less wedge lock) as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).
- .11 Seismic vertical suspension stiffener rod clips shall be Model KHRC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).
- .12 Clevis Internal Braces shall be Model KCHB as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

## **2.4 SEISMIC BRACING COMPONENTS**

- .1 Steel strut shall be 1-5/8 wide in varying heights and mig-welded combinations as required to meet load capacities and designs. A material heat code, part number, and manufacturer’s name shall be stamped on all strut and fittings to maintain traceability to material test reports.
- .2 Material for epoxy painted strut: ASTM A1011, SS, Grade 33.
- .3 Material for pre-galvanized strut: ASTM A653, SS, Grade 33.
- .4 Material for hot-dip galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.
- .5 Material for fittings and accessories: ASTM A907, Grade 33, Structural Quality or ASTM A1011, SS, Grade 33.
- .6 Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

## **2.5 UNIFORM BUILDING CODE REQUIREMENTS**

- .1 Seismic Zone Factor to Table 16-I for area of jurisdiction.
- .2 Soil Profile Type to Table 16-J for area of jurisdiction.
- .3 Seismic Importance Factor to Table 16-K for area of jurisdiction.
- .4 Component Amplification Factor to Table 16-O for area of jurisdiction.
- .5 Component Response Mod. Factor to Table 16-O for area of jurisdiction.
- .6 Seismic Coefficient to Table 16-Q for area of jurisdiction.
- .7 The total height of the structure ( $h_r$ ) and the height of the system to be restrained within the structure ( $h_x$ ) shall be determined in co-ordination with architectural plans and the General Contractor.
- .8 Forces shall be calculated for individual supports using the above information. Exceptions to Table 16-O may be utilized. However, all use of exceptions shall be noted on submitted seismic bracing plan documents.

## **Part 3 Execution**

### **3.1 GENERAL INSTALLATION**

- .1 Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions.
- .2 Refer to FEMA Manuals 412, 413, and 414 for typical industry standard installation guidelines.
- .3 Upon completion of installation of all seismic restraint materials and before start-up of restrained equipment, all debris shall be cleaned from beneath all protected equipment, leaving equipment free to contact snubbers/restraints.
- .4 Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.
- .5 All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data.
- .6 Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- .7 Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
- .8 Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- .9 Do not brace a system to two independent structures such as ceiling and wall.
- .10 Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

- .11 Seismic restraint cables shall be adjusted such that they are not visibly slack, or the flexibility is approximately 25mm under thumb pressure for a 1500mm cable length (equivalent ratio for other cable lengths).
- .12 All seismic restraint cables shall be at least 25mm clear of all other equipment and services.

### **3.2 EQUIPMENT INSTALLATION**

- .1 All external utility connections to restrained equipment shall be designed to allow differential seismic motion without damage to the equipment or utility connections.
- .2 Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.
- .3 After equipment installation is completed, adjust limit stops following manufacturer's written instructions so that they are out of contact during normal operation.
- .4 Adjust snubbers according to manufacturer's written instructions.
- .5 Installation of seismic restraints shall not cause any change in position of equipment, resulting in stresses or misalignment.
- .6 No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system specified.
- .7 Do not install any seismic restraint for equipment, cable trays or conduit that compromises isolation specified.

### **3.3 PIPING INSTALLATION**

- .1 Hold down clamps must be used to attach pipe to all trapeze members before applying restraints.
- .2 Branch lines may not be used to restrain main lines.
- .3 Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.
- .4 Attach piping to the trapeze per seismic restraint manufacturer's design. Install cables so they do not bend across sharp edges of adjacent equipment or building structures.

### **3.4 FASTENING TO STRUCTURE**

- .1 Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.
- .2 Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

- .3 Coring is not permitted for the installation of concrete anchors. Use ground penetrating radar or equivalent method of embedment item detection to locate all embed items including reinforcing steel and electrical conduits. Concrete reinforcing steel and electrical conduits shall not be cut or damaged under any circumstances.
- .4 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.
- .5 If mounting hole diameter exceeds bolt diameter by more than 0.125" (3 mm), reduce clearance in hole with epoxy grout, flanged elastomeric bushings or welded washer.
- .6 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

### **3.5 INSPECTION**

- .1 The contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.
- .2 Upon completion of the installation of all seismic restraint devices herein specified, the local representative of the seismic restraint manufacturer shall, at the contractor's request, inspect the completed system and report in writing any installation errors, improperly selected snubber devices, or other fault in the system which could affect the performance of the system.
- .3 The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

### **3.6 PIPING**

- .1 Seismically restrain all piping listed below. Use Type J Cable Restraints for all piping supported by vibration isolation hanger assemblies, including:
  - .1 Natural gas piping, medical gas piping, vacuum piping, petroleum based liquid piping, and compressed air piping equal to or greater than 1" (25 mm) in inside diameter.
  - .2 Brace remainder of piping to code requirements (IBC or TI-809-04) on in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) "Seismic Restraint Manual Guidelines for Mechanical Systems", Second Edition (Remaining Codes).

**3.7 DUCTWORK**

- .1 Seismically restrain all ductwork listed below. Use Type J Cable Restraints for all ductwork supported by vibration isolation hanger assemblies, including:
  - .1 All rectangular and oval ducts with cross sectional area equal to or greater than 6 sq. ft. (0.55 sq. meters).
  - .2 All round ducts with diameters equal to or greater than 32" (812 mm).
  - .3 Brace remaining ductwork to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) "Seismic Restraint Manual Guidelines for Mechanical Systems", Second Edition (Remaining Codes).

**3.8 CONDUIT**

- .1 Seismically restrain all electrical conduit listed below. Use Type J Cable Restraints for all conduit supported by vibration isolation hanger assemblies, including:
  - .1 All round ducts with diameters equal to or greater than 32" (812 mm).
  - .2 Brace all conduit to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) "Seismic Restraint Manual Guidelines for Mechanical Systems", Second Edition (Remaining Codes).

**3.9 ROOF MOUNTED EQUIPMENT**

- .1 Provide seismic restraint for all isolated and non-isolated roof curbs and associated equipment.
- .2 Provide seismically restrained steel coil spring isolation systems where isolation curbs are indicated and non-isolated seismic restraints for all other roof curb systems."

**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.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:
  - .1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.
  - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

**3.2 SITE VISIT**

- .1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.
- .2 Provide Consultant with notice 24 h in advance of visit.
- .3 Make adjustments and corrections in accordance with written report.

**3.3 TESTING**

- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.
- .2 Vibration measurements shall be taken for equipment-listed below:
- .3 Provide Consultant with notice 48 h in advance of commencement of tests.
- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.
- .5 Submit complete report of test results including sound curves.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA).
  - .1 Natural Gas and Propane Installation Code CSA B149.1.
- .4 National Fire Protection Association
  - .1 NFPA 13, Installation of Sprinkler Systems.
  - .2 NFPA 14, Standpipe and Systems.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

**1.3                PRODUCT LITERATURE**

- .1 Submit product literature in accordance with General Requirements.
- .2 Product literature to include nameplates, labels, tags, lists of proposed legends.

**Part 2            Products**

**2.1                MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

**2.2                SYSTEM NAMEPLATES**

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
  - .1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: Use size #5.
  - .2 Equipment in Mechanical Rooms: Use size #9.
  - .3 Roof top equipment: use size #9.
  - .4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

### **2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES/FIRE SMOKE DAMPER**

- .1 Colours:
  - .1 Black letters, yellow background.
- .2 Construction:
  - .1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.
- .3 Locations:
  - .1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

### **2.4 EXISTING IDENTIFICATION SYSTEMS**

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.

- .4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may 'NOT' be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.
- .5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

## **2.5 PIPING SYSTEMS GOVERNED BY CODE**

- .1 Identification:
  - .1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
  - .2 Sprinklers: To NFPA 13.
  - .3 Standpipe and hose systems: To NFPA 14.

## **2.6 IDENTIFICATION OF PIPING SYSTEMS**

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
  - .2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
  - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).
- .6 Colours and Legends:
  - .1 Where not listed, obtain direction from Consultant.
  - .2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

**.7 Pictograms:**

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.8 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR	
	MARKING	LEGEND
City water	Green	CITY WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Glycol heating water supply	Yellow	GLYCOL HEATING WATER SUPPLY
Glycol heating water return	Yellow	GLYCOL HEATING WATER RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Domestic tempered supply	Green	DOM. TEMPERED
Trap Primer	Green	TRAP PRIMER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Condensate	Green	CONDENSATE
Natural gas	Yellow	NATURAL GAS
Gas regulator vents		to Codes
Instrument air	Green	INSTRUMENT AIR
Control air tubing	White	CONTROL AIR
Conduit for low voltage		
Control wiring	White	CONTROL WIRING ___ VOLTS

**2.7 IDENTIFICATION DUCTWORK SYSTEMS**

.1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

**2.8 VALVES, CONTROLLERS**

.1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

## **2.9 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.
- .3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

## **2.10 LANGUAGE**

- .1 Identification to be in English.

## **Part 3 Execution**

### **3.1 TIMING**

- .1 Provide identification only after all painting specified has been completed.

### **3.2 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

### **3.3 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
  - .1 Do not paint, insulate or cover in any way.

### **3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.
- .7 At beginning and end points of each run and at each piece of equipment in run.

- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.5 VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

**END OF SECTION**



**Part 1 General****1.1 GENERAL**

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.
- .2 This contractor must co-ordinate their work with that of the TAB contractor.

**1.2 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 Air Adjustments & Balancing Inc.  
P.O. Box 176,  
Schomberg, Ontario  
L0G 1T0  
(416) 254-3004

**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 Access doors, installed, closed.
    - .7 All outlets installed, volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled, vented.
    - .2 Isolating and balancing valves installed, open.
    - .3 Calibrated balancing valves installed, at factory settings.
    - .4 Chemical treatment systems complete, operational.
    - .5 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 The following additional information shall be provided for all air systems:
  - .1 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE occupied ventilation requirements.
  - .2 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE unoccupied ventilation requirements.
  - .3 Static pressure reading for each HVAC/AHU unit with VAV/VVT boxes open to 80% of design airflow and bypass damper closed to 0%. Provide reading at normal MAD/economizer damper position, dampers fully closed and dampers fully open.
- .3 TAB report to show all results in SI or imperial units as indicated on plans and to include:
  - .1 Project as-built drawings.
  - .2 System schematics.

**1.16 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, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.
  - .2 At each controller, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

**1.20 HYDRONIC SYSTEMS**

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, glycol systems.
- .2 Standard: TAB to be the most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .3 TAB for hydronic system is limited to existing services affected due to renovation.
- .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 convectors, 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.

**1.21 DUCT LEAKAGE TESTING**

- .1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

**1.22 DOMESTIC HWC SYSTEMS**

- .1 Meet all requirements as specified for hydronic systems.
- .2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.
- .3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

**1.23 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 Building pressure conditions:
    - .1 Adjust HVAC systems, equipment, controls to ensure pressure conditions.
    - .2 TAB procedures:
 

<u>Positive</u>	<u>Negative</u>
Corridors	Washrooms
Cafeteria	Cafeteria Kitchen (Kitchen maximum -0.02 inches w.c.)
Corridors	Industrial Areas

**END OF SECTION**

**Part 1 General****1.1 GENERAL**

- .1 The Mechanical Contractor shall provide the labour and material to conduct the closeout process as outlined in this specification section.
- .2 The mechanical contractor shall perform the closeout requirements specified in conjunction with the independent commissioning consultant (CC) retained by the owner.

**Part 2 Products****2.1 GENERAL**

- .1 The mechanical contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Mechanical Contractor shall advise the Mechanical Consultant of instrumentation to be used and the dates the instruments were calibrated.

**Part 3 Execution****3.1 THE CONTRACT CLOSE OUT PROCESS**

- .1 The mechanical contractor close out process shall consist of:
  - Shop Drawings and As-built Drawings
  - Installation inspection and equipment verification
  - Plumbing and drainage system testing
  - Testing of piping systems
  - Independent contractor balancing of water systems
  - Testing of air systems
  - Independent contractor balancing of air systems
  - Testing of equipment and systems
  - BAS Commissioning
  - Commissioning Consultant performance testing
  - Commissioning meetings
  - Operating and maintenance manuals
  - Training
  - Systems Demonstration and turnover
  - Testing forms
  - Warranties
  - Contractor to provide list of equipment maintenance including schedule of maintenance parts, quantities, and model fixtures, etc.

**3.2 SHOP DRAWINGS AND AS-BUILT DRAWINGS**

- .1 Conform to General Requirements Section for shop drawings and as-built drawings requirements.

**3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION**

- .1 The Mechanical Contractor shall co-ordinate with the Consultant who will inspect the mechanical installation.
- .2 The Mechanical Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:
  - Manufacturers name, address and telephone number
  - Distributors name, address and telephone number
  - Make, model number and serial number
  - Pumps - RPM, impeller sizes, rated flow
  - Fans - belt type and size, shive type and size
  - Electrical - volts, amps, fuse size, overload size
  - Any other special characteristics.

**3.4 PLUMBING AND DRAINAGE SYSTEM TESTING**

- .1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the specification.
- .2 The Mechanical Contractor shall notify the Building Inspector when systems are available for testing. The Mechanical Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Consultant.

**3.5 THE CONTRACTOR'S TESTING OF PIPING SYSTEMS**

- .1 Test all piping systems in accordance with all applicable plumbing codes and General Requirements section.
- .2 All tests for the systems shall be performed in the presence of the Consultant or Commissioning Consultant. Complete the testing forms and forward to the Consultant.

**3.6 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF WATER SYSTEMS**

- .1 Conform with the specification section, Testing, Adjusting and Balancing.
- .2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

**3.7 THE CONTRACTORS TESTING OF AIR SYSTEMS**

- .1 Conform with the specification section, Testing, Adjusting and Balancing.
- .2 All tests shall be performed in the presence of the Mechanical Consultant or the Commissioning Consultant. Complete the testing forms and forward to the Consultant.

**3.8 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF AIR SYSTEMS**

- .1 Conform with specification section, Testing, Adjusting and Balancing.
- .2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.



### **3.9 TESTING OF EQUIPMENT AND SYSTEMS**

- .1 General:
  - .1 The Mechanical Contractor shall hire the services of the manufacturers technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms. The tests shall be witnessed by the Consultant or Owners representative. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms. A copy of the forms shall be forwarded to the Consultant. The original shall be inserted into the operating and maintenance manual.
  - .2 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed.
  - .3 Tests which have not been witnessed shall not be accepted and shall be repeated.
  - .4 The equipment and systems to be tested shall include:
    - Heat Pumps
    - Condensing Units
    - Boilers and Pumps
    - Air Handling Units
    - Cooling Tower
    - Life Safety and Fire Protection Systems
    - Water Treatment Systems
    - Building Automation Systems (BAS)
- .2 BAS Testing:
  - .1 The BAS Contractor shall test the system as described in General Requirements and/or Controls Sections.
  - .2 Co-ordinate with the Consultant and submit completed test forms monthly.
  - .3 Demonstrate to the Owner and Consultant the operation of the BAS when all tests have been completed.

### **3.10 CLOSEOUT SCHEDULE**

- .1 The Mechanical Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.
- .2 All testing forms and reports associated with the mechanical systems shall be directed to the Consultant with copies to the Owner and Consultant.
- .3 The forms and reports to be issued shall include:
  - Shop drawings, issued and accepted
  - Equipment verification forms
  - Testing forms
  - Reports resulting from tests
  - Testing schedule
  - Equipment Start-up Forms

**3.11 OPERATION AND MAINTENANCE MANUAL**

- .1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

**3.12 OPERATOR TRAINING**

- .1 Conform to General Requirements section for requirements for Instruction to Operating Staff.
- .2 The training shall be conducted in a classroom and at the equipment or system.
- .3 Training will begin when the operating and maintenance manuals have been delivered to The Owner and approved by the Consultant.
- .4 Each training session shall be structured to cover:

The operating and maintenance manual

- Operating procedures
- Maintenance procedures
- Trouble-shooting procedures
- Spare parts required
- Submit a course outline to the Mechanical Consultant before training commences. Provide course documentation for up to eight people.

- .5 The training sessions shall be scheduled and co-ordinated by the Mechanical Contractor.
- .6 Training shall be provided for the following systems:

<u>System</u>	<u>Minimum Training Times</u>
Condensing Units	2 hours
Boilers	2 hours
Air Handling Units	2 hours
Life Safety & Fire Protection Systems	2 hours
Water Treatment Systems	2 hours
The Mechanical System	8 hours
Boilers	½ hour
Life Safety & Fire Protection	½ hour

- .7 The minimum training for the BAS shall be 16 hours. The training shall include:
  - A walk through of the installation for the Building Owner to review the installation and equipment
  - Operation of the central computer
  - Operation of portable terminals
  - Control sequences
  - Report set-up and generation
  - Managing the system
  - Maintenance requirementsRefer to Controls specification section for further information.

- .8 The training requirement for the mechanical system shall include a walk-through of the building by the Mechanical Contractor. During the walk through the Mechanical Contractor shall:
- Identify equipment
  - Identify starters associated with equipment
  - Identify valves and balancing dampers
  - Identify access doors
  - Review general maintenance of equipment
  - Review drain points in pipework systems
  - Identify maintenance items
- .9 When each training session has been completed The Owner shall sign the associated form to verify completion.

### **3.13 COMMISSIONING CONSULTANT**

- .1 A Commissioning Consultant (CC) reports to the Owner.
- .2 The CC responsibilities shall include:
- preparing the commissioning plan
  - co-ordinating with the contractor to schedule tests
  - preparing a test form manual
  - witnessing selected tests
  - receiving all test forms
  - conducting performance test
  - co-ordinating the contractors training
  - chair commissioning meetings
- .3 The Mechanical Contractor shall co-operate with the CC.
- .4 The Mechanical Contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each mechanical system shall be tested in the operational mode.
- .5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Contractor and the Consultant has completed their final review.

### **3.14 MECHANICAL SYSTEM DEMONSTRATION AND TURNOVER**

- .1 Refer to General Requirements section, Mechanical Project Completion.
- .2 The system demonstration and turnover to The Owner shall occur when:
- The installation is complete
  - The acceptance test conducted by the Mechanical Consultant has been completed successfully
  - The Commissioning Consultant system performance testing has been completed successfully
  - Training has been completed
  - Operating and Maintenance Manuals have been accepted
  - Shop-drawings have been updated
  - As-built drawings have been completed

- .3 The systems demonstration shall be conducted by the Mechanical Contractor and the manufacturers. The demonstration shall cover a demonstration of equipment installation and operation.

**3.15 TESTING FORMS**

- .1 The Mechanical Contractor and manufacturers shall provide forms for testing. The forms must be approved by the Consultant and The Owner before they are used.

**3.16 WARRANTIES**

- .1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by The Owner.
- .2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.
- .3 Refer to the general conditions specification section for the requirements during the warranty period.

**3.17 CLOSEOUT PROCESS ALLOCATION**

- .1 The mechanical contractor closeout process shall be shall be as follows:
  - .1 3% for the first \$500,000 of contract value.
  - .2 1% of the contract value for value between \$500,000 to \$5,000,000.
  - .3 0.5% of contract value for the value in excess of \$5,000,000.
  - .4 Minimum Allocation for Close Out Documents is \$5,000.
- .2 The Mechanical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.
- .3 The monies shall not be paid out until the performance testing, O & M manuals, systems demonstration, and training including all required paperwork have been completed to the satisfaction of the consultant. Refer to General Requirements section for contract breakdown.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
  - .1 ASTM C547, Type I and IV, Standard Specifications for Mineral Fibre Pipe Insulation.
  - .2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .3 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded Hot-Plate Apparatus.
  - .4 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.
  - .5 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  - .6 ASTM C1695, Standard Specification for Fabrication of Flexible, Removable, and Reusable Blanket Insulation for Hot Service.
  - .7 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC), North American Commercial and Industrial Insulation Standards.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

- .3 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

### **1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

### **1.4 QUALIFICATIONS**

- .1 Installer to have successfully completed apprenticeship program.
- .2 Installer to be specialist in performing work of this section and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

### **1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
  - .3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.
  - .4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

## **Part 2 Products**

### **2.1 MATERIAL LIMITATIONS**

- .1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

## 2.2 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

## 2.3 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTM C177 or ASTM C518.
- .3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C547 Type I and IV.
  - .2 Jacket: to ASTM C1136, Type I, II, III, IV, X.
  - .3 Maximum "k" factor: to ASTM C547.
- .4 Type A-2: Mineral fibre faced with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
- .5 Type A-3: Tubular flexible elastomeric closed cell foam.
  - .1 Insulation to ASTM C534 Type I.
  - .2 Maximum "k" factor: to ASTM C534.
  - .3 To be certified by manufacturer to be free of potential stress corrosion cracking corrodents.
- .6 Type A-4: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.
  - .2 Maximum "k" factor: to ASTM C553.
- .7 Type A-5: Fiberglass pipe and tank insulation:
  - .1 Segmented, flexible fiberglass board bonded to laminated vapor retarder, ASJ or FSK.
  - .2 Complying with ASTM C1393, Type II or Type III Category 2.
  - .3 Maximum "k" value:  $0.037W/M$  (or less)  $\times C^{\circ}@100^{\circ}F$  (38°C) is  $0.26BTU \times IN/H$   $FT^2 \times ^{\circ}F$
  - .4 Jacket: specified in 'Factory-Applied Jackets' Article

- .8 Materials:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - .1 Johns Manville
    - .2 Knauf
    - .3 Manson
    - .4 Owens Corning

## **2.4 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

## **2.5 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

## **2.6 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

## **2.7 INDOOR VAPOUR RETARDER FINISH**

- .1 Compatible with insulation.

## **2.8 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 Minimum thickness: 20 mm (0.020")
  - .2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .3 Colours: white.
  - .4 Minimum service temperatures: -29°C (-20°F).
  - .5 Maximum service temperature: 65°C (150°F).
  - .6 Moisture vapour transmission: 0.05 perm.
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks are not to be used below ambient temperature (cold) operating systems.
    - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
  - .1 To ASTM C 1729
  - .2 Thickness: 0.50 mm (0.020") sheet.
  - .3 Finish: Smooth.



- .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
- .5 Fittings: 0.50 mm (0.020") 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 (0.020") thick at 300 mm (12") spacing.
- .3 Pre-cured GRP:
  - .1 Non-metallic pipe cladding system constructed of pre-cured glass reinforced polyester resin composite system.
  - .2 Meets ASTM C450 and C585.
  - .3 UV resistant.
  - .4 Available in prefabricated tees, long elbows, and short elbows.
  - .5 Supply with manufacturer supplied wear pads.
  - .6 1.8mm thick

## **2.9 CAULKING FOR JACKETS**

- .1 Caulking: Silicone clear caulking.

## **Part 3 Execution**

### **3.1 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC, North American Commercial and Industrial Insulation Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .5 Below ambient/chilled water installation:
  - .1 All pipes, valves, strainers, flanges, unions, and other pipe system components and spec must be properly insulated with correctly completed vapor retarder applied.
  - .2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.
  - .3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a 0.02 or lower perm rating.

- .4 Vapor stops must be installed at 18' intervals at all pipe insulation termination points including fittings, flanges, and other changes in direction or other types of piping specialties.
- .5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricate from the same material as the pipe insulation. Full thickness must be maintained over all fitting surfaces. Blanket insulation with a factory applied vapor retarder facing is unacceptable.
- .6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder of the pipe insulation.
- .7 Additional fitting covers, PVC, or metal must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.
- .8 Additional field applied to jackets must not use staples, screws, tacks, or rivets for attachment to avoid puncturing vapor retarder underneath.
- .9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

### **3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Flexible removable blanket insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material, that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.
- .3 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .4 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: As per adjacent insulation.

### **3.4 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

### **3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.

- .4 Thickness of insulation to be as listed in following table:
- .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
  - .2 All storm piping including all vertical and horizontal piping shall be insulated.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Domestic Water Piping	A-1	25 (1")	25 (1")	40 (1½")	40 (1½")	40 (1½")
Storm Piping	A-1/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")
Roof Drain sumps	A-2/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Diesel Generator Exhaust system	A-4	65 (2½")	65 (2½")	80 (3")	90 (3½")	90 (3½")
Horizontal Cast Iron Sanitary Piping	A-1/A-5 N/A	N/A	N/A	25 (1")	25 (1")	25 (1")
Trap Primer Piping	A-1	15 (½")	15 (½")	25 (1")		

- .5 Finishes: Conform to the following table:

<u>Application</u>	<u>Piping</u>	<u>Valves &amp; Fittings</u>
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Generator	Aluminum	N/A
Exposed Outdoors	Aluminum or Precured GRP	Aluminum or Precured GRP

- .6 Connection: To appropriate TIAC code.
- .7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
- .3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).
- .7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

**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, Lead-Free.
- .2 Acceptable materials:  
Milwaukee  
Crane  
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

## **2.10 BALANCING VALVES**

- .1 Provide brass balancing valves suitable for potable water.
- .2 Brass body, EDPM O-Ring, Polytetrafluoroethylene slip washer and stainless steel spring.
- .3 Connect with dielectric connections.

## **2.11 CIRCUIT SETTER DOMESTIC WATER RECIRCULATING VALVE**

- .1 Acceptable Manufacturers:
  - .1 ThermOmegaTech Inc.
  - .2 CircuitSolver® Models CS, CSU, CSUA, CSUAS, CSUTD-D as well as associated accessories such as Model CSA and CSUATD-D and models with optional thermometer PEX ends or ProPress ends.

- .2 Components
  - .1 Thermostatic Balance Valve
    - .1 The valve shall be certified lead free according to NSF/ANSI 61 standards.
    - .2 The valve body shall be constructed out of stainless steel.
    - .3 The valve shall be rated for 200 PSIG working pressure and 250°F max. temperature.
    - .4 The valve shall have a fixed, non-adjustable (tamper proof) temperature setpoint; temperature setpoints range from 80°F (27°C) to 170°F (27°C) in 5°F (2.8°C) increments.
    - .5 The valve shall have a temperature accuracy of  $\pm 3.0^{\circ}\text{F}$  ( $\pm 1.7^{\circ}\text{C}$ ).
    - .6 The valve shall have a wax thermostatic element.
    - .7 The valve shall come in six (6) sizes: 1/2"; 3/4"; 1"; 1 1/4"; 1 1/2"; 2".
  - .3 Accessories
    - .1 PEX or ProPress ends as required.

### **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.
- .8 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

#### **3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of general requirements.
- .2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

### **3.4 FLUSHING AND DISINFECTING**

- .1 Maintain testable RP backflow preventor between municipal water and new plumbing system.
- .2 Ensure a minimum of 90% of plumbing fixtures are installed.
- .3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, and operate fixtures to ensure thorough flushing.
- .6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.
- .9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- .10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.
- .13 Take water samples at remote fixtures and service connections.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 PDI-WH201, Water Hammer Arresters.
- .5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

**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                WATER HAMMER ARRESTORS**

- .1 Copper construction, bellows type: to PDI-WH 201.
- .2 Acceptable material:
  - Zurn Z-1700
  - Mifab MWH-100
  - Ancon No. 15

**2.2                BACK FLOW PREVENTORS**

- .1 The backflow preventor shall prevent backflow by either backpressure or backsiphonage from a cross-connection between potable water lines and substances that are objectionable.
- .2 To CAN/CSA-B64.
- .3 Application: as indicated.

- .4 Reduced pressure principle type up to 50 mm (2") (RP):  
Rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be SILICONE. The first and second check shall be orientated at a 45° angle up-wards and accessible for maintenance without removing the relief valve. Supplied with an air gap adapter.
- .1 Acceptable materials:  
Watts 009 ½" - 2"  
Wilkins 975 XL ½" - 2"  
Conbraco 40-200 Series
- .5 Reduced pressure principle type from 65 mm (2½") to 250 mm (10") (RP):  
The reduced pressure principle backflow preventer shall be ASSE 1013 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The first and second checks shall be accessible for maintenance without removing the relief valve or the entire device from the line.  
If installed indoors, the installation shall be supplied with an air gap adapter, strainer, and integral monitor switch.
- .1 Acceptable materials:  
Watts 909 2½" - 10"  
Wilkins 975 2½"- 10" or 375 4" - 6"  
Conbraco 40-200 Series
- .6 Double check valve assembly (DCVA):  
The double check type backflow preventer shall be ASSE 1015 approved, and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat rings and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone. The first and second checks shall be accessible for maintenance without removing the device from the line.
- .1 Acceptable materials:  
Watts 007 ½" - 2"  
Wilkins 950XL ¾" - 2"  
Conbraco 40-100 Series
- .7 Double check valve assembly (DCVA)  
The double check backflow preventer shall be ASSE 1015 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line.
- .1 Acceptable materials:  
Watts 709 2½" - 10"  
Wilkins 950 2" - 10", 350 4" - 6"  
Conbraco 40-100 Series

- .8 Back flow preventor with intermediate atmospheric vent:
  - .1 Acceptable material:
    - Watts Series 9D
    - Wilkins 750
    - Conbraco 40-4A Series

### **2.3 VACUUM BREAKERS**

- .1 To CAN/CSA-B64 Series.
- .2 Atmospheric vacuum breaker (A-VB):
  - .1 Acceptable materials:
    - Watts 288A
    - Conbraco 38-103 Series
    - Wilkins 35
- .3 Hose connection vacuum breaker (HCVB):
  - .1 Acceptable materials:
    - Watts Series 8
    - Conbraco 38-304-AS
    - Wilkins BFP-8
- .4 Laboratory faucet intermediate vacuum breaker (LFVB):
  - .1 Acceptable materials:
    - Watts N-LF9
    - Conbraco 38-502-01

### **2.4 PRESSURE REGULATORS**

- .1 Capacity: as indicated.
  - .1 Inlet pressure: 1034 kPa (150 psi).
  - .2 Outlet pressure: 41 kPa (5.9 psi).
- .2 Up to NPS 40 mm (1 1/2") bronze bodies, screwed: to ASTM B62.
  - .1 Acceptable material:
    - Watts Series 25AUB (1/2" - 2")
- .3 NPS 50 mm (2") and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class [B].
  - .1 Acceptable materials:
    - Watts PV-10
    - Conbraco 36 Series
- .4 Semi-steel spring chambers with bronze trim.
  - .1 Acceptable materials:
    - Watts PV-10
    - Conbraco 36 Series

## **2.5 STRAINERS**

- .1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.
- .2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.
  - .1 Acceptable materials:  
Watts Series 777SI  
Crane/Powers  
Colton 125 YTB  
Wilkins S Series
- .3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.
  - .1 Acceptable materials:  
Watts 77F-D (77F-D-FDA for water service)  
Crane/Powers  
Colton 125 YTB  
Wilkins FS Series

## **2.6 SOLENOID VALVES**

- .1 Two (2) way normally closed all bronze construction.
- .2 Voltage shall be suitable for controlling function.
- .3 Acceptable material:  
Asco

## **2.7 OWNER SUPPLIED EQUIPMENT**

- .1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.
- .2 Provide flexible riser stops to all sinks and ball valves to all other equipment.
- .3 Provide backflow preventors on equipment required by the local plumbing inspector.
- .4 Provide flexible gas piping to all gas equipment.
- .5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.
- .6 Coordinate all rough-ins and connection with the supplier on site.
- .7 Owner supplied equipment includes existing relocated equipment.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

**3.2 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to each fixture or group of fixtures and where indicated.

**3.3 BACK FLOW PREVENTORS**

- .1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain and or service sink.
- .3 Provide test results in manual and leave tag with test results on device.

**3.4 STRAINERS**

- .1 Install with sufficient room to remove basket.
- .2 Strainer size to match pipe size.

**3.5 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Non-freeze wall, ground hydrants:
    - .1 Verify complete drainage.
    - .2 Verify operation of vacuum breaker.
  - .2 Water hammer arrestors:
    - .1 Verify accessibility.
  - .3 Backflow preventors, vacuum breakers:
    - .1 Verify installation of correct type to suit application.
    - .2 Adjust as necessary to ensure proper operation.
    - .3 Verify visibility of discharge.
  - .4 Pressure regulators:
    - .1 Adjust settings to suit installed locations, required flow rates.
  - .5 Hose bibbs, sediment faucets:
    - .1 Verify operation.
  - .6 Water make-up assembly:
    - .1 Verify operation.
  - .7 Water meters:
    - .1 Verify operation.
  - .8 Pipeline strainers:
    - .1 Verify accessibility of basket.
    - .2 Clean out during commissioning until system clean.

- .5 Commissioning reports:
  - .1 Record all results on approved report forms.
  - .2 Include signature of tester and supervisor.
  - .3 To be countersigned by Consultant.
- .6 Verification:
  - .1 Notify Consultant 48 h before commencing tests.
  - .2 All tests and procedures to be witnessed by Consultant.
  - .3 All reported results subject to verification by consultant.
- .7 Training:
  - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .8 Demonstrations:
  - .1 Demonstrate full compliance with Design Criteria.
  - .2 Demonstrations also to show completeness of O&M personnel training.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

**1.2                SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Data to include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.
  - .2 Details of operation, servicing, and maintenance.
  - .3 Recommended spare parts list.

**Part 2            Products**

**2.1                FLOOR DRAINS**

- .1 Floor drains and trench drains: to CAN/CSA-B79.
- .2 Type FD-1: general duty; cast iron body, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar. Use square strainer in tiled areas and round strainer elsewhere.
  - .1 Acceptable materials:
    - Zurn ZN-415-B
    - Mifab F1100C
    - Watts Drainage FD-100-C-AS-1 or FD-100-C-LS-1
    - Jay R. Smith 2005-AO5NB

## 2.2 CLEANOUTS

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .1 Acceptable material:  
Zurn ZSS-1469  
Mifab C1400-RD  
Watts CO-480-RD-3  
Jay R. Smith 4710
- .3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:  
Plugs: bolted bronze with neoprene gasket.
  - .1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.
    - .1 Acceptable material:  
Zurn ZN-1400 – HD or Zurn ZZN-1612  
Mifab C1100-XR-6  
Watts CO-200-RX-1-6  
Jay R. Smith SQ-4-1753-XNBCO-SP-U
  - .2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-Z  
Mifab C1100-UR-6  
Watts CO-200-U-1-6  
Jay R. Smith SQ-4-1753-NBRT-SP-U
  - .3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-T – HD  
Mifab C1100-TS-6  
Watts CO-200-TS-1-6  
Jay R. Smith 4200-U
  - .4 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.
    - .1 Acceptable material:  
Zurn ZN-1400 – T-HD or Zurn ZZN-1612  
Mifab C1100-S-6  
Watts CO-200-S-1-6  
Jay R. Smith SQ-4-1753-NBCO-SP-U-Y



.5 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

- .1 Acceptable materials:  
Zurn ZN-1400-HD-CM or ZN-1612-CM  
Mifab C1100C-S-1-6  
Ancon CO-200-RC-1-6  
Smith  
Contour C3000RMNB

### **2.3 PRESSURE DROP ACTIVATED TRAP SEAL PRIMER STATION**

- .1 Pressure drop activated, brass construction trap seal primer.
- .2 Provide complete with integral air gap, distribution head suitable to serve up to four (4) drains and low lead isolation ball valve.
- .3 Provide complete with powder coat steel wall mounting box and cover for easy inspection.
- .4 NPS 15 mm (1/2") solder end and NPS 15 mm (1/2") drip line connection.
- .5 All penetrations into enclosure to be sealed with water tight grommets.
- .6 Acceptable manufacturers:
- .1 Mifab MR-ENC-AG
- .2 Watts
- .3 Zurn

### **2.4 ELECTRONIC TRAP SEAL PRIMER STATIONS**

- .1 Provide trap primer stations where indicated complete with solenoid valve, backflow preventor, vacuum breaker, NPS 15 mm (1/2") solder ends, NPS 15 mm (1/2") drip line connections.
- .2 Solenoid valve electric characteristics shall be suitable for controlling function.  
Coordinate location and number of trap primer stations with Building Automation System (BAS) contractor.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.2 CLEANOUTS**

- .1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.

- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

### **3.3 TRAP SEAL PRIMER STATIONS**

- .1 Provide primer stations where indicated.
- .2 Install for all floor drains and elsewhere, as indicated.
- .3 Install copper piping to floor drains above grade. Install polypropylene piping to floor drains below grade.

### **3.4 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Floor, hub and trench drains:
    - .1 Verify proper operation of trap primer, flushing features.
    - .2 Verify security and removability of strainers.
  - .2 Cleanouts:
    - .1 Verify covers are gastight, secure and easily removable.
    - .2 Verify that cleanout rods can probe as far as next cleanout.
  - .3 Trap seal primers:
    - .1 Verify operation.
    - .2 Adjust flow rate to suit site conditions.
- .5 Commissioning reports:
  - .1 Record all results on approved report forms.
  - .2 Include signature of tester and supervisor.
  - .3 To be countersigned by Consultant.
- .6 Verification:
  - .1 Notify Consultant 48 h before commencing tests.
  - .2 All tests and procedures to be witnessed by Consultant.
  - .3 All reported results subject to verification by consultant.
- .7 Training:
  - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .8 Demonstrations:
  - .1 Demonstrate full compliance with Design Criteria.
  - .2 Demonstrations also to show completeness of O&M personnel training.

**END OF SECTION**

**Part 1 General****1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM B32, Specification for Solder Metal.
- .3 ASTM B306, Specification for Copper Drainage Tube (DWV).
- .4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .6 CAN/CSA-B125.3, Plumbing Fittings.

**Part 2 Products****2.1 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary, and vent, maximum 65 mm (2½") Type DWV copper to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CAN/CSA B125.3.
    - .2 Wrought copper: to CAN/CSA B125.3.
  - .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

**2.2 CAST IRON PIPING AND FITTINGS**

- .1 Above ground sanitary, and vent, minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.
  - .1 Mechanical joints (vents)
    - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
    - .2 Stainless steel clamps (2 band).
  - .2 Mechanical joints (sanitary)
    - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
    - .2 Stainless steel clamps (4 band min).

**2.3 VENT FLASHINGS**

- .1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

**2.4 FORCED MAINS**

- .1 Above and below ground sewage pump discharge, size as indicated, type 'L' copper to ASTM B88M.
- .2 Cast copper, solder fitting to ANSI B16.18.
- .3 Cast bronze threaded fittings, class 125 to ANSI/ASME B16.15.

**Part 3 Execution****3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50') of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.
- .4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.
- .5 Vent entire waste system to atmosphere.
  - .1 Discharge 500 mm (20") above roof. Join lines together in fewest practicable number before projecting above roof.
  - .2 Set back vent lines so they will not pierce roof near an edge or valley.
  - .3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.
  - .4 Provide copper vent piping through roof as per detail.
- .6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.
- .7 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.
  - .1 Flashing base shall be at least 600 mm (24") square.
  - .2 Flashing may be a 24 kg/m<sup>2</sup> (5 lb/ft<sup>2</sup>) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.
- .8 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Do not caulk threaded work.
  - .2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.
- .5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

**Part 2            Products**

**2.1                PIPING AND FITTINGS**

- .1 Buried sanitary, and vent piping to:
  - .1 80 mm (3") and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.
  - .2 100 mm (4") and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .2 Above grade sanitary and vent piping:
  - .1 80 mm (3") and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .2 100 mm (4") and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.
- .4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

**2.2                JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

### **2.3 EXPANSION**

- .1 Provide solvent welded expansion joints as required by manufacturer's recommendations.

### **2.4 VENT FLASHINGS**

- .1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.
- .2 Installation of underground pipe
  - .1 Provide all excavation, bedding, backfill, and compaction.
  - .2 Install materials in accordance with Manufacturer's instructions.
  - .3 Use jacks to make-up gasketed joints.
  - .4 Stabilize unstable trench bottoms.
  - .5 Bed pipe true to line and grade with continuous support from firm base.
    - .1 Bedding depth - 100 mm to 150 mm (4" to 6").
    - .2 Material and compaction to meet ASTM standard noted above.
  - .6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
  - .7 Trench width at top of pipe -
    - .1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.
    - .2 Maximum - Outside diameter of pipe plus 600 mm (24").
  - .8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
  - .9 Do not use back hoe or power equipment to assemble pipe.
  - .10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50 ft) of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

- .4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.
- .5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.
  - .2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.
- .6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to taken to accommodate ambient temperatures at time of install.
- .7 Vent entire waste system to atmosphere.
  - .1 Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.
  - .2 Set back vent lines so they will not pierce roof near an edge or valley.
  - .3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.
- .8 Flash pipes passing through roof with Thaler insulated Stack Jack flashing.
  - .1 Flashing base shall be at least 600 mm (24") square.
- .9 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM B32, Specification for Solder Metal.
- .3 ASTM B306, Specification for Copper Drainage Tube (DWV).
- .4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .6 CAN/CSA-B125.3, Plumbing Fittings.

**Part 2            Products**

**2.1                COPPER TUBE AND FITTINGS**

- .1 Above ground storm maximum 65 mm (2½") Type DWV copper to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CAN/CSA B125.3.
    - .2 Wrought copper: to CAN/CSA B125.3.
  - .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

**2.2                CAST IRON PIPING AND FITTINGS**

- .1 Above ground storm minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.
  - .1 Mechanical joints (storm)
    - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
    - .2 Stainless steel clamps (4 band min).

**Part 3            Execution**

**3.1                INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.



- .3 Every 15 m (50') of horizontal run.
- .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.
- .4 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.
- .5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
- .1 Do not caulk threaded work.
- .2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.
- .5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

**Part 2            Products**

**2.1                PIPING AND FITTINGS**

- .1 Buried storm piping to:
  - .1 80 mm (3”) and smaller: ABS drain pipe to CAN/CSA-B181.1.
  - .2 100 mm (4”) and larger: SDR-35 PVC drain pipe to CAN/CSA-B181.2.
- .2 Above grade storm piping:
  - .1 80 mm (3”) and smaller: IPEX: PVC-XFR fire rated drain storm pipe to CAN/CSA-B181.1.
  - .2 100 mm (4”) and larger: IPEX: PVC-XFR storm pipe to CAN/CSA-B181.2.
- .3 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

**2.2                JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Installation of underground pipe
  - .1 Provide all excavation, bedding, backfill, and compaction.
  - .2 Install materials in accordance with Manufacturer's instructions.
  - .3 Use jacks to make-up gasketed joints.

- .4 Stabilize unstable trench bottoms.
- .5 Bed pipe true to line and grade with continuous support from firm base.
  - .1 Bedding depth - 100 mm to 150 mm (4" to 6").
  - .2 Material and compaction to meet ASTM standard noted above.
- .6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
- .7 Trench width at top of pipe -
  - .1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.
  - .2 Maximum - Outside diameter of pipe plus 600 mm (24").
- .8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
- .9 Do not use back hoe or power equipment to assemble pipe.
- .10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50 ft) of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts
- .4 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.
  - .2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

**1.2                SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Data to include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

**Part 2            Products**

**2.1                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

## 2.2 CLEANOUTS

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .1 Acceptable material:  
Zurn ZSS-1469  
Mifab C1400-RD  
WATTS CO-480-RD-3  
Jay R. Smith SQ-A-1753-XNBCO-SP-U
- .3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:  
Plugs: bolted bronze with neoprene gasket.
  - .1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.
    - .1 Acceptable material:  
Zurn ZN-1400 – HD or Zurn ZZN-1612  
Mifab C1100-XR-6  
WATTS CO-200-RX-1-6  
Jay R. Smith SQ-4-1753-XNBCO-SP-U
  - .2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-Z  
Mifab C1100-UR-6  
WATTS CO-200-TS-1-6  
Jay R. Smith SQ-4-1753-NBRT-SP-U
  - .3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-T – HD  
Mifab C1100-TS-6  
WATTS CO-200-S-1-6  
Jay R. Smith 4200-U
  - .4 Cover for ceramic tile floors: 15 (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.
    - .1 Acceptable material:  
Zurn ZN-1400 – T-HD or Zurn ZZN-1612  
Mifab C1100-S-6  
WATTS CO-200-RC-1-6  
Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

- .5 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.
  - .1 Acceptable materials:
    - Zurn ZN-1400-HD-CM or ZN-1612-CM
    - Mifab C1100C-S-1-6
    - Ancon CO-200-RC-1-6
    - Smith
    - Contour C3000RMNB

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.
- .3 Install roof drains in lowest point of roof. Co-ordinate location with architectural, structural, and mechanical drawings.

**3.2 CLEANOUTS**

- .1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

**3.3 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Roof drains:
    - .1 Verify installation at low points in roof.
    - .2 Verify security and removability of dome.
    - .3 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**

**Part 1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 Conform to Sections of Division 1 and to General Mechanical Requirements Section.

**1.2 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Perform work in accordance with the recommendations of and the requirements of:
  - .1 Local and district bylaws and regulations.
  - .2 N.F.P.A.14 "Installation of Standpipe and Hose Systems".
  - .3 The Ontario Building Code.
  - .4 U.L.C. or Factory Mutual approval for hose, valve and extinguisher requirements.
  - .5 N.F.P.A.10 "Standard for Portable Fire Extinguishers".
  - .6 The Ontario Fire Code.

**1.3 SUBMITTALS**

- .1 Submit shop drawings and maintenance data in accordance with general requirements.

**1.4 COORDINATION**

- .1 Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.
- .2 Coordinate location of cabinet with other trades and provide protection against damage during construction.

**Part 2 Products**

**2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)**

- .1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:
  - .1 Kitchen Type 'K' 10 lb 20BC rating
  - .2 Servery Areas Type 'K' 10 lb 20 BC rating
  - .3 Mechanical Rooms 10 lb ABC rating
  - .4 Storage Rooms 10 lb ABC rating
  - .5 Corridor/Gym/Finished Areas 5 lb ABC rating complete with cabinet
  - .6 Acceptable materials:
    - .1 Wilson & Cousins
    - .2 National



## **2.2 CABINETS**

- .1 Recessed mounted type of a size sufficient to contain all necessary components. Tub to be constructed of 1.5 mm (16 gauge) steel and finished with Wilco "Pro-Tech" Premier white painted finish. Adjustable frame comprising of 180° opening door and trim to be separate assembly adaptable to any type of finished wall. Trim to have 6 mm (1/4") return on outer edges with full length semi-concealed piano hinge, and Corbin style latching device.
- .2 Doors and trim to be 1.5 mm (16 gauge) white painted finish. Door glass to be 6 mm (1/4") Duo Lite Safety Glass.
- .3 Cabinet to maintain fire resistive rating of construction in which they occur.
- .4 Do not provide cabinets for mechanical room and service area fire extinguishers unless indicated.
- .5 Acceptable material:
  - .1 Wilson & Cousins Model IE - 105R (5 and 10 lb. Class)
  - .2 National

## **2.3 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of NFPA 10.
- .2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

## **2.4 FIRE BLANKET**

- .1 100% non-combustible fire retardant glass fibre, non-toxic, non-conductor, cleanable complete with straps.
- .2 Size: 1 m x 1 m (40" x 40").
- .3 Cabinet to be surface mounted, 400 mm x 300 mm (16" x 12").
- .4 Mount on wall in kitchen area where indicated or directed on site by consultant.
- .5 Manufacturer:
  - .1 National FB 4040 blanket, FB 6078 MC cabinet.
  - .2 Wilson & Cousins.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.
- .2 Hang extinguishers in cabinets with wall mounting bracket.
- .3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').

- .4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.
- .5 Caulk perimeter of fire extinguisher cabinets after acceptance.

**3.2 TESTS**

- .1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

**3.3 FIRE BLANKET**

- .1 Hang blanket on wall in cabinet as indicated, to manufacturers' recommendations.
- .2 Fire blanket next to each NFPA 96 hood mounted on wall.

**END OF SECTION**

**Part 1 General****1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.
- .3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
- .4 CAN/CSA-B125.3, Plumbing Fittings.
- .5 CAN/CSA-B651, Accessible Design for the Built Environment.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate, for all fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 For water closets, urinals: minimum pressure required for flushing.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

**1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.
- .3 Equipment not installed.
  - .1 Capped with valves for future connection by others.

**Part 2 Products****2.1 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

## **2.2 FIXTURE CARRIERS**

- .1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.
- .2 Acceptable materials:
  - .1 Zurn
  - .2 Smith
  - .3 Ancon

## **2.3 PLUMBING FIXTURES**

- .1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

## **2.4 FIXTURE PIPING**

- .1 Hot and cold water supplies to each fixture/faucet:

Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

  - .1 Acceptable materials:
    - .1 Delta 47T900 Series
    - .2 McGuire
  - .2 Waste:

Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.

    - .1 Acceptable materials:
      - .1 Delta 33T200 Series
      - .2 McGuire
- .3 'P' Traps:

Cast brass P trap with cleanout on each fixture not having integral trap.

Chrome plated in all exposed places.

  - .1 Acceptable materials:
    - .1 Delta 33T300 Series
    - .2 McGuire

**Part 3 Execution****3.1 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.
  - .2 Wall-hung fixtures: measured from finished floor.
  - .3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.
- .2 Drinking fountains:
  - .1 In accordance with CAN/CSA B45S1.

**3.2 ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments.
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
  - .4 Adjust urinal flush timing mechanisms.
  - .5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.
  - .6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.
- .3 Checks.
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventors: operation under all conditions.
  - .4 Wash fountains: operation of flow-actuating devices.
  - .5 Refrigerated water coolers: operation, temperature settings.
- .4 Thermostatic controls.
  - .1 Verify temperature settings, operation of control, limit and safety controls.
- .5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make water tight, colour to match fixture.
- .6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.
  - .3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.
  - .4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM).
  - .1 ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Mean of the Guarded Hot-Plate Apparatus.
  - .2 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - .3 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.
  - .5 ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
  - .6 ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes And Tanks.
  - .7 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .8 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
  - .9 ASTM C 921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
  - .1 Thermal Insulation Association of Canada (TIAC)
  - .2 North American Commercial and Industrial Insulation Standards.

## **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.
- .3 Submit completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specification section.

## **1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

## **1.4 QUALIFICATIONS**

- .1 Installer to have successfully completed apprenticeship program.
- .2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

## **1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
  - .3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.
  - .4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.
  - .5 "FSK" – Foil Scrim Kraft – vapor retarder laminate of aluminium foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.
- .2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

## **1.7 QUALITY ASSURANCE**

- .1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.
- .2 Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold and formaldehyde free.
- .3 Recycled content: Mineral fiber products will contain a minimum of 50% recycled glass content certified and UL validated, and are to be constructed using bio-based thermosetting binder.

## **Part 2 Products**

### **2.1 LIMITATION ON MATERIALS**

- .1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

### **2.2 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.3 INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C177 or ASTM C518.
- .3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket meeting the requirement of ASTM C1136 Type II and IV (FSK):
  - .1 Jacket: to ASTM C1136 Type II and IV (FSK)
  - .2 Maximum "k" value: .033 W/M•°C (.23 BTU•IN/HR•FT<sup>2</sup>•°F)
- .4 Type C-2: Mineral fibre blanket to ASTM C553 Type I, II, and III, ASTM C1136 Type II and IV, and ASTM C1290 Type III:
  - .1 Jacket: to ASTM C1136, Type II and IV.
  - .2 Maximum "k" value: 042 W/M•°C (.29 BTU•IN/HR•FT<sup>2</sup>•°F)
- .5 Type C-3: High temperature fire rated duct wrap, ULC classified soluble amorphous wool blanket with factory applied flame resistant aluminum foil fiberglass reinforced facing.
  - .1 Acceptable Materials:
    - 3M
    - Morgan Firemaster Fastwrap XL
    - CL4 Fire



- .6 Type C-4: Non-NFPA 96 High temperature fire rated duct wrap, ULC classified soluble amorphous wool blanket with factory applied flame resistant aluminum foil fibreglass reinforced facing.
  - .1 CL4 Fire
  - .2 No alternates
- .8 Type C-6: Pipe and tank insulation: Fibreglass segmented board bonded to laminated vapor retarder:
  - .1 Mineral fibre: to ASTM C1393 type II or type IIIA, Category 2.
  - .2 Jacket: ASJ or FSK type
  - .3 Maximum "k" factor: 0.26 BTU • IN/HR • FT<sup>2</sup> • °F (0.037 W/M • °C) or less
- .9 Manufacturers:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - .1 Johns Manville
    - .2 Fibreglass Canada
    - .3 Knauf
    - .4 Manson
    - .5 Roxul

## 2.4 JACKETS

- .1 Canvas:
  - .1 220 g/m<sup>2</sup> (6 oz/yd<sup>2</sup>) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
  - .2 Lagging adhesive: Compatible with insulation.
- .2 Prefinished Steel
  - .1 To ASTM with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.5 mm (26 gauge) sheet.
  - .3 Finish: Smooth/Galvanised.
  - .4 Jacket banding and mechanical seals: 15 mm (1/2") wide, 0.50 mm (26 gauge) thick stainless steel.
- .3 Aluminum:
  - .1 To ASTM C1729 with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.5 mm (0.020") sheet.
  - .3 Finish: Smooth.
  - .4 Jacket banding and mechanical seals: 15 mm (1/2") wide, 0.5 mm (0.020") thick stainless steel.
  - .5 Provide exterior silicone sealant on all joints.

- .4 Stainless steel:
  - .1 Type: 304.
  - .2 Thickness: 0.25 mm (0.10") sheet.
  - .3 Finish: Smooth.
  - .4 Jacket banding and mechanical seals: 15 mm (1/2") wide, 0.5 mm (0.020") thick stainless steel.
  - .5 Colour: As selected by consultant.
- .5 Self adhesive aluminum:
  - .1 Aluminum skin with adhesive, minimum thickness 1.5 mm (60 mils).
  - .2 Modified SBS membrane.
  - .3 Ultra violet light resistance.
  - .4 Puncture and tear resistant.
  - .5 Multi standard colours (selected by architect).
  - .6 Overlap joints minimum of 50 mm (2").
  - .7 Acceptable manufacturer:  
Foilskin (Bakor)

## 2.5 ACCESSORIES

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 g/m<sup>2</sup> (6oz/yd<sup>2</sup>) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting Childers CP-82 or equal.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm (16 gauge) stainless steel.
- .9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation
- .10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.
- .11 Outdoor Vapour Retarder Mastic:
  - .1 Reinforcing fabric: Open weave fibreglass fabric, with maximum weave of 10x10 squares per inch.
- .12 Banding: 15 mm (1/2") wide, 0.5 mm (26 gauge) thick stainless steel.

**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure testing of ductwork systems to be complete, witnessed, and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

**3.2 INSTALLATION**

- .1 Install in accordance with North American Commercial and Industrial Insulation Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers in accordance with general requirements.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.
- .6 Provide rigid insulation for exposed ductwork.

**3.3 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thicknesses conform to following table:

<u>Application</u>	<u>Type</u>	<u>Thickness</u>
Rectangular supply air ducts	C-1	25 mm (1")
Round supply air ducts	C-2	25 mm (1")
Round supply/exhaust air ducts requiring additional finish/jacket	C-6	25 mm (1")
Supply, return and fan exhaust ducts exposed (visible) in space being served	none	
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	none	
Last 1.5m of Exhaust duct	C-1	25 mm (1")
Fire wrapped duct as indicated	C-3	To meet Fire Separation
Ventilation ductwork as indicated	C-4	To meet Fire Separation
Indoor AHU relief air ducts	C-1	25 mm (1")
Exterior ductwork	C-1	80 mm (3")

- .2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:
  - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct or type C-6.

- .3 Finishes: Conform to following table:

<u>Application</u>	<u>Rectangular</u>	<u>Round</u>
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas
Outdoor, exposed to Precipitation	Aluminum	Aluminum

### 3.4 FIRE BARRIER UTILITY SERVICE WRAP INSTALLATION

- .1 The Fire Barrier Utility Service Wrap and Fire Barrier Silicone Sealants must be stored in a dry warehouse environment. Pallets should not be stacked.
- .2 In order to install the utility service firestop system, the surfaces of all the openings and penetrating items need to be clean, dry, frost free and free of dust.
- .3 The Fire Barrier Utility Service Wrap blanket shall be wrapped around the perimeter of the duct and is cut to a length to overlap itself not less than 3 in. (76 mm). The overlap made by adjacent blankets shall form the "longitudinal" overlap. Aluminum foil tape is used to seal all cut edges of the blanket and any tears in the foil scrim.
- .4 Filament tape can be used to temporarily hold the blanket in place until the banding is applied. The steel banding is applied around the duct 1-1/2 in. (38 mm) from each edge of the blanket, and maximum 10-1/2 in. (26,7 cm) centers. The banding is placed around the material and tightened so as to sufficiently hold the Fire Barrier Utility Service Wrap in place against the duct, compressing the foil but not cutting the foil.
- .5 Additional Pinning to Prevent Sagging of the Wrap: For Ducts 24 in. (60 cm) and larger in width, additional pins are needed to support the blanket on the bottom horizontal surface and on the outside face of a vertical duct run. Space pins a maximum of 10-1/2 in. (26,7 cm) apart in the direction of the blanket width, and a maximum of 12 in. (30 cm) apart in the direction of the blanket length.
- .6 Support hanger systems shall be external of the duct wrap.
- .7 Provide four galvanized steel threaded rods, ¼ in. diameter (6,35 mm) by 4-1/2 in. to 5 in. long (114 mm to 127 mm) are welded to the duct at the corners of the door opening. Four steel tubes, each 3 in. (76 mm) long, are placed over the rods to act as protection for the Fire Barrier Utility Service Wrap when fastening the door. Four installation pins are welded to the door panel for installation of the blanket. One layer of Fire Barrier Utility Service Wrap shall be cut approximately the same size as the access panel and impaled over the insulation pins on the panel.  
It is essential that this layer fit tightly against the wrap surrounding the access door opening with no through openings. A second layer of Fire Barrier Utility Service Wrap shall be cut so as to overlap the first layer by a minimum of 1 in. (25,4 mm). The second layer is impaled over the pins and both layers are locked in place with galvanized speed clips.  
Pins that extend beyond the outer layer of Fire Barrier Utility Service Wrap shall be turned down to avoid sharp points on the door.
- .8 When the duct penetrates a fire rated wall, ceiling or floor, an approved firestop system must be constructed to manufactures recommendation.

**3.5 FIRE BARRIER UTILITY SERVICE WRAP INSTALLATION (NON-NFPA 96 DUCT WRAP)**

- .1 Th Fire Barrier Utility Service Wrap must meet the requirements of Canadian Construction Materials Centre (CCMC).

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        All codes, standards, etc. as referenced shall be the latest edition.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels, and Round Ducts.
- .3        Underwriters Laboratories of Canada (ULC)
  - .1        CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4        American Society for Testing and Materials (ASTM)
  - .1        ASTM C547, Type I and IV Standard Specification for Mineral Fiber Pipe Insulation.
  - .2        ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - .3        ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus to recognize the correct thermal insulation performance testing for blanket.
  - .4        ASTM C1393, Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks
  - .5        ASTM C1695, Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service.
  - .6        ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .7        ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  - .8        ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.
  - .9        ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .10      CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .5        American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1        ASHRAE Standard 90.1.
- .6        Manufacturer's Trade Associations
  - .1        Thermal Insulation Association of Canada (TIAC)
  - .2        North American Commercial and Industrial Insulation Standards

## **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.
- .3 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves, and jointing recommendations.

## **1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

## **1.4 QUALIFICATIONS**

- .1 Installer to have successfully completed apprenticeship program.
- .2 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

## **1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
  - .3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.
  - .4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

- .5 "FSK" – Foil Scrim Kraft – vapor retarder laminate of aluminum foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner liner.
- .6 "PSK" – Poly Scrim Kraft – vapor retarder laminate of polypropylene outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.
- .7 "PVC" – Poly Vinyl Chloride – polymer used to manufacture a non-metallic final protective finish jacket over insulation systems.

## **1.7 QUALITY ASSURANCE**

- .1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.
- .2 Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold and formaldehyde free.
- .3 Recycled content: Mineral fiber products will contain a minimum of 50% recycled glass content certified and UL validated and are to be constructed using bio-based thermosetting binder.

## **Part 2 Products**

### **2.1 MATERIAL LIMITATIONS**

- .1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

### **2.2 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.3 INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335, ASTM C177 or ASTM C518.
- .3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C547 Type I and IV.
  - .2 Jacket: to ASTM C1136, Type I, II, III, IV, X.
  - .3 Maximum "k" factor: to ASTM C547.
- .4 Type A-2: High temperature mineral fibre blanket:
  - .1 Mineral fibre: to ASTM C553, Type V, flexible, non-combustible.
  - .2 Jacket: to ASTM C1136, Type I, II, III, IV, X.
  - .3 Maximum "k" value: .040 W/M•°C@ 38C mean (.28 BTU•IN/HR•FT²•°F @ 100F mean)



- .5 Type A-3: Tubular flexible elastomeric closed cell foam:
  - .1 Insulation to ASTM C534 Type I.
  - .2 Maximum "k" factor: to ASTM C534.
  - .3 To be certified by manufacturer to be free of potential stress corrosion cracking corrodents.
- .6 Type A-4: Fire Rated mineral fibre-reinforced foil:
  - .1 Installed and tested to QAI listed system F405-1-4 and tested by RC Canadian Construction Materials Division for fire rated coverings.
  - .2 Materials:
    - .1 CL4 Fire
    - .2 No alternates
- .7 Type A-5: Fiberglass pipe and tank insulation:
  - .1 Segmented, flexible fiberglass board bonded to laminated vapor retarder, ASJ or FSK.
  - .2 Complying with ASTM C1393, Type II or Type III Category 2.
  - .3 Maximum "k" value: 0.037W/M (or less) x C° at 100°F (38°C) (0.26BTU x IN/HR/FT² at 38°C (100°F)
  - .4 Jacket: specified in 'Factory-Applied Jackets' Article
- .8 Materials:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - Knauf
    - Manson
    - Owens Corning

## 2.4 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5mm (16 gauge) diameter stainless steel.
- .5 Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (0.020") thick.

## 2.5 CEMENT

- .1 Thermal insulating and finishing cement:
  - .1 Air drying on mineral wool, to ASTM C 449M.
  - .2 Hydraulic setting on mineral wool, to ASTM C165

## 2.6 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

**2.7 INDOOR VAPOUR RETARDER FINISH**

- .1 Compatible with insulation.

**2.8 OUTDOOR VAPOUR RETARDER FINISH**

- .1 Compatible with insulation.
- .2 Reinforcing fabric: Open weave fibreglass fabric, with maximum weave of 10 x 10 squares per inch.

**2.9 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 Minimum thickness: 20mil (0.020")
  - .2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .3 Colours: white.
  - .4 Minimum service temperatures: -29°C (-20°F).
  - .5 Maximum service temperature: 65°C (150°F).
  - .6 Moisture vapour transmission: 0.05 perm.
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks (not to be used on below-ambient temperature systems)
    - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
  - .1 To ASTM C1729.
  - .2 Thickness: 0.50 mm (0.020") sheet.
  - .3 Finish: Smooth.
  - .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
  - .5 Fittings: 0.50 mm (0.020") 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 (0.020") thick at 300 mm (12") spacing.
- .3 Canvas:
  - .1 220 g/m<sup>2</sup> (6oz/sq yd) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
  - .2 Lagging adhesive: Compatible with insulation.
- .4 Stainless steel:
  - .1 Type: [304].
  - .2 Thickness: 0.25 mm (0.010").
  - .3 Finish: Smooth

- .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
- .5 Fittings: 0.50 mm (0.020") 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 (0.020") thick at 300 mm (12") spacing.
- .5 Pre-cured GRP:
  - .1 Non-metallic pipe cladding system constructed of pre-cured glass reinforced polyester resin composite system.
  - .2 Meets ASTM C450 and C585.
  - .3 UV resistant.
  - .4 Available in prefabricated tees, long elbows, and short elbows.
  - .5 Supply with manufacturer supplied wear pads.
  - .6 1.8mm thick
  - .7 Acceptable manufacturer:
    - .1 Proclad
    - .2 Consultant approved equal (prior to tender close)

## **2.10 CAULKING FOR JACKETS**

- .1 Caulking: Silicone clear caulking.

## **Part 3 Execution**

### **3.1 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

### **3.2 INSTALLATION**

- .1 Install in accordance with North American Commercial and Industrial Insulation Standards.
- .2 Provide continuous insulation for complete systems including all valves, air separators, fittings, and other equipment.
- .3 Apply materials in accordance with manufacturers' instructions and this specification.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

- .6 Below ambient/chilled water installation:
  - .1 All pipes, fittings, valves, strainers, flanges, unions, and other pipe system components and specialties must be properly insulated with correctly completed vapor retarded applied.
  - .2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.
  - .3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a .02 or lower perm rating.
  - .4 Vapor stops must be installed at 18' intervals, at all pipe insulation termination points, including fittings, flanges, and other changes in direction or other types of piping specialties.
  - .5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricated from the same material as the pipe insulation. Full thickness must be factory-applied, vapor-retarder facing is unacceptable.
  - .6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder or pipe insulation.
  - .7 Additional fitting covers, PVC or metal, must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.
  - .8 Additional field applied jackets must not use staples, screws, tacks or rivets for attachment, to avoid puncturing vapor retarder underneath.
  - .9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

### **3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Flexible removable insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.
- .3 Insulation:
  - .1 Insulation, fastenings, and finishes: same as system.
  - .2 Jacket: As per adjacent insulation.

### **3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges, air separators, and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")						
		to 25 (1")	32 (1¼")	40 (1½")	50 (2")	80 (3")	105 (4")	150 (6")
Hot Water Heating	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")	50 (2")	50 (2")
Glycol Heating	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")	50 (2")	50 (2")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Natural gas	A-4	To meet Fire Resistance Requirements						

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Within 300 mm (12") of boiler	CANVAS	CANVAS
Exterior piping	Stainless Steel/ Precured GRP	Stainless Steel/ Precured GRP
Exterior refrigerant piping	Aluminum	Aluminum

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch.
- .3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
- .6 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
- .7 ASTM A53/A53M, and A106, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded ERW and Seamless.
- .8 ASTM B32, Specification for Solder Metal.
- .9 ASTM B75M, Specification for Seamless Copper Tube [Metric].
- .10 CSA B149.1, Natural Gas and Propane Installation Code.
- .11 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings product data in accordance with general requirements.
- .2 Indicate on manufacturers catalogue literature.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2            Products**

**2.1                PIPE**

- .1 Steel pipe: to ASTM A106, Schedule 40, seamless as follows:
  - .1 NPS 15 mm to 50 mm (1/2" to 2"), screwed.
  - .2 NPS 65 mm (2 1/2") and over, plain end.
- .2 Buried pipe: CGA approved polypropylene complete with tracer wire and marker.
- .3 Copper tube: to ASTM B75M.

**2.2                JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.

- .3 Flange gaskets: nonmetallic flat.
- .4 Soldered: to ASTM B32, tin antimony 95/5.
- .5 Screwed brass fittings: Teflon Tape.

### **2.3 FITTINGS**

- .1 Steel pipe fittings, screwed, flanged or welded:
  - .1 Malleable iron: screwed, banded, Class 150.
  - .2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.
  - .3 Welding: butt-welding fittings.
  - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .5 Bolts and nuts: to ANSI B18.2.1.
  - .6 Nipples: schedule 40, to ASTM A53/A53M/A106.
- .2 Copper pipe fittings, screwed, flanged or soldered:
  - .1 Cast copper fittings: to ANSI B16.18.
- .3 Brass fittings: To ASTM B16.

### **2.4 BALL VALVES**

- .1 NPS 50 mm (2") and under:
  - .1 Body and cap: cast high tensile bronze to ASTM B62.
  - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
  - .3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders.
  - .4 Stem: tamperproof ball drive.
  - .5 Stem packing nut: external to body.
  - .6 Ball and seat: replaceable stainless steel solid ball and teflon seats.
  - .7 Stem seal: TFE with external packing nut.
  - .8 Operator: removable lever handle.

### **2.5 LUBRICATED PLUG VALVES**

- .1 All sizes
  - .1 Provincial Code approved, lubricated plug type.
  - .2 Body: cast iron to ASTM A 126 Class B semi-steel.
    - .1 Rating: Class 125 psig.
  - .3 Plug: tapered, with regular pattern port – 90 from full open to fully closed.
  - .4 Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.
  - .5 Lubrication system, nickel-plated.
  - .6 Lubricant: to suit type, temperature and pressure of contained fluid.

- .7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film.
- .8 Lubricant screw for lubrication.
- .9 O-rings between body and plug.
- .10 Operator: removable manual lever handle.
- .11 Acceptable materials:
  - Newman Hattersley
  - Crane
  - Jenkins
  - Milwaukee
  - Toya

## **2.6 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 TREATED WOOD ROOF SUPPORTS**

- .1 Wolmanized wood with blocking and styrofoam SM insulation, constructed as detailed on drawings.

## **2.8 MANUFACTURED ROOF SUPPORTS**

- .1 Single piece injection moulded polypropylene support.
- .2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.
- .3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.
- .4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.
- .5 Acceptable materials:
  - Quick Block
  - Erico

## **2.9 ALUMINUM ROOF SUPPORTS**

- .1 450 mm high aluminum pipe support.
- .2 Adjustable leg assembly, base plate, roller assembly.
- .3 Acceptable material:
  - Thaler Mers-600A Series.



**2.10 PIPING THROUGH ROOF**

- .1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

**Part 3 Execution**

**3.1 PIPING**

- .1 Install in accordance with applicable Provincial/Territorial Codes.
- .2 Install in accordance with CAN/CSA B149.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .5 Slope piping down in direction of flow to low points.
- .6 Install drip points:
  - .1 At low points in piping system.
  - .2 At each connection to equipment.
- .7 Use eccentric reducers at pipe size change installed to provide positive drainage.
- .8 Provide clearance for access and for maintenance.
- .9 Ream pipes, clean scale and dirt, inside and out.
- .10 Install piping to minimize pipe dismantling for equipment removal.
- .11 Install regulator vents to code. Terminate in open air with Gooseneck fitting complete with stainless steel screen.
- .12 Paint gas piping with two (2) coats yellow paint. Banding of gas will not be accepted.

**3.2 PIPING ON ROOF**

- .1 Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:
  - ≤ 40 mm (1½") 2.4 M (8' - 0") O.C.
  - ≥ 50 mm (2") 3.0 M (10' - 0") O.C.
- .2 Provide support at each elbow and fitting.
- .3 Provide support at each regular and/or isolating valve.
- .4 Provide support within 600 mm (24") of each piece of equipment.

**3.3 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.
- .2 Install valves at branch take-offs to isolate each piece of equipment, and as indicated.
- .3 Provide lubricated plug type when gas line is exterior of building or 65 mm (2½") and larger.
- .4 Provide ball valve when gas line is interior of building and 50 mm (2") or smaller.

**3.4 SUPERVISORY SWITCH**

- .1 Install on valves as indicated to monitor open/closed position of valve and send signal to fire alarm system. Install to manufacturer's recommendations.

**3.5 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.

**3.6 PURGING**

- .1 Purge after pressure test in accordance with CAN/CSA B149.

**3.7 GAS FIRED EQUIPMENT START-UP**

- .1 Start-up of all new and existing gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian Standards Association (CSA).
  - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .3 American National Standards Institute (ANSI).
  - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
  - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
  - .3 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS½ through NPS24 Metric/Inch.
  - .4 ANSI/ASME B16.9, Factory-Made Wrought Steel Butt welding Fittings.
  - .5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - .6 ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
  - .7 ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 American Society for Testing and Materials (ASTM).
  - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3 ASTM A536, Specification for Ductile Iron Castings.
  - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM E202, Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
  - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

## **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers' catalogue literature the following:
  - .1 Piping
  - .2 Valves
  - .3 Accessories

## **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

## **Part 2 Products**

### **2.1 STEEL PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 NPS 150 mm (6") and smaller: Schedule 40.
  - .2 NPS 200 mm (8") and [over,] [10] Schedule 30.
  - .3 NPS 300 mm (12") and over, 10 mm (3/8") wall thickness.
- .2 Final connection to copper heating elements.
  - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").
- .3 Pipe Joints
  - .1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.
  - .2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.
  - .3 Flanges: plain or raised face, slip-on.
  - .4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).
  - .5 Pipe thread: taper.
  - .6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.
- .4 Fittings
  - .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
  - .2 Pipe flanges and flanged fittings:
    - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
    - .2 Steel: to ANSI/ASME B16.5.
  - .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
  - .4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

## 2.2 VALVES

- .1 Connections:
  - .1 NPS 32 mm (1 1/4") and smaller: screwed ends.
  - .2 NPS 50 mm (2") and smaller: screwed ends.
  - .3 NPS 65 mm (2 1/2") and larger: flanged ends.
- .2 Gate valves: Application: Isolating equipment, control valves, pipelines:
  - .1 NPS 50 mm (2") and under:
    - .1 Mechanical Rooms: Class 125, rising stem, solid wedge disc.
    - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 Mechanical Rooms:
      - .1 Rising stem, solid wedge disc, bronze trim.
        - .1 Operators: handwheel.
      - .2 Non-rising stem, solid wedge disc, bronze trim.
        - .1 Operators: handwheel.
- .3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
  - .1 NPS 32 mm (1 1/4") and smaller: screwed ends.
  - .2 NPS 50 mm (2") and smaller: screwed ends.
  - .3 NPS 65 mm (2 1/2") and over: Flanged ends.
- .4 Globe valves: Application: Throttling, flow control, emergency bypass:
  - .1 NPS 50 mm (2") and under: (
    - .1 With PTFE disc, as specified. Bronze.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 With solid bronze disc, bronze trim, cast iron body.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.
- .6 Swing check valves:
  - .1 NPS 50 mm (2") and under:
    - .1 Class 150, swing, with PTFE disc, as specified. Bronze. Jenkins 4475TJ.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check.
- .7 Ball valves:
  - .1 NPS 80 mm (3") and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

- .3 Connections:
  - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
  - .2 NPS 65 mm (2½") and over flanged or grooved ends.
- .4 Stem: stainless steel tamperproof ball drive.
- .5 Ball and seat: replaceable stainless steel solid ball and teflon seats.
- .6 Operator: removable lever handle.
- .7 Extended handles on chilled water valves.
- .8 Full port.
- .8 All valves shall be of commercial grade and of same manufacturer.
- .9 Acceptable Manufacturers:
  - .1 Newman Hattersley Canada Ltd.
  - .2 Jenkins/Crane
  - .3 Milwaukee
  - .4 Toyo
  - .5 Kitz

## **2.3 BALANCING VALVES**

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (¼")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
  - .1 Bell & Gossett Circuit Setters
  - .2 Armstrong
  - .3 Taco
  - .4 Tour & Anderson
  - .5 Oventrop

## **2.4 AUTOMATIC AIR VENT**

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Plastic vents are not acceptable.
- .4 Acceptable materials:
  - .1 Maid-O-Mist No. 67
  - .2 Spirax Sarco

**Part 3 Execution**

**3.1 PIPING INSTALLATION**

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.
- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

**3.2 VALVE INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2½") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.
- .8 Provide ball valves for glycol service.

**3.3 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install ball valve on automatic air vent inlet.
- .3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

### **3.4 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations and flow balancing valves as indicated.
  - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc.).
  - .2 On return side of all water or glycol cooling coils.
  - .3 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Minimum valve size shall be one pipe size smaller than piping or 20 mm ( $\frac{3}{4}$ " ), whichever is larger.
- .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 as specified.
- .2 Co-ordinate filling of system with HVAC water treatment contractor.
- .3 Refill glycol heating system with 40% propylene glycol solution as specified.

### **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 GLYCOL CHARGING**

- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Consultant.
- .4 Maintain glycol level in storage tank until system is fully charged and has equalized throughout the entire system. Monitor system on bi-weekly basis until system is completely filled. Provide glycol solution as required.

### **3.8 FLUSHING AND CLEANING**

- .1 Scope:
  - .1 Drain and flush entire existing system and new piping.
- .2 Refer to Water Treatment Section
- .3 Procedure:
  - .1 Flushing and cleaning should only take place after successful piping pressure testing.



- .2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.
- .3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.
- .4 Timing:
  - .1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.
  - .2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.
  - .3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.
- .5 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.
- .6 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.
- .7 Flush and clean new piping system in presence of Consultant.
- .8 Flush after pressure test for a minimum of 4 hrs.
- .9 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.
- .10 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.
- .11 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .12 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
- .13 Drainage to include drain valves, dirt pockets, strainers, every low point in system.
- .14 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .15 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.

- .16 Repeat system drain and flush as often as necessary to have a clean system.
- .17 Disposal of cleaning solutions to be approved by authority having jurisdiction.
- .18 Isolate new piping system from existing system as required for system cleaning.
- .19 After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.
- .20 After glycol piping system is cleaned, refill with 50% glycol solution.

**3.9 EXISTING SYSTEM DISPOSAL**

- .1 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute (ANSI).
  - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
  - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
  - .3 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - .4 ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
  - .5 ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .3 American Society for Testing and Materials (ASTM).
  - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3 ASTM A536, Specification for Ductile Iron Castings.
  - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM E202, Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
  - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers' catalogue literature the following:
  - .1 Piping
  - .2 Valves
  - .3 Accessories

**1.3                CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2 Products**

**2.1 ACCEPTABLE MATERIALS**

- .1 Victaulic.
- .2 No alternates.

**2.2 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 NPS 150 mm (6") and smaller: Schedule 40.
  - .2 NPS 200 mm (8") and over, Schedule 30.
  - .3 NPS 300 mm (12") and over, 10 mm (3/8") wall thickness.
- .2 Final connection to copper heating elements.
  - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

**2.3 PIPE JOINTS**

- .1 NPS 32 mm (1 1/4") and smaller: screwed fittings with pulverized lead paste. Refer to Screwed Piping section.
- .2 NPS 40 mm (1 1/2") and larger: rolled grooved with Grade E (EPDM) gaskets.

**2.4 FITTINGS**

- .1 Rolled grooved fittings:
  - .1 Couplings shall be Victaulic Style 07 Zero-Flex with angled bolt pad design and must be installed with Grade E (EPDM) gaskets.
- .2 Flanges: Victaulic Style 741.
- .3 Hole Cut Products and Branch Connections:
  - Victaulic Style 920 Mech. Tee
  - Victaulic Style 923 Vic-Let Outlet
  - Victaulic Style 924 Vic-O-Well Thermometer Outlet

**2.5 VALVES**

- .1 Connections:
  - .1 NPS 50 mm (2") and smaller: screwed ends.
  - .2 NPS 65 mm (2 1/2") and larger: rolled grooved ends.
- .2 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
  - .1 NPS 50 mm (2") to 300 mm (12"): Victaulic Vic 300
  - .2 NPS 350 mm (14") and over: Victaulic Style 706  
Victaulic Style 709
- .3 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.

- .4 Check valves:
    - .1 NPS 50 mm (2") and under:
      - .1 Class 150, swing, with PTFE disc, as specified.  
Bronze. Jenkins 4475TJ.
    - .2 NPS 65 mm (2 1/2") and over: Victaulic Style 716 Vic – check.
  - .5 Ball valves:
    - .1 NPS 80 mm (3") and under:
      - .1 Body and cap: cast high tensile bronze to ASTM B62.
      - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
      - .3 Connections:
        - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
        - .2 NPS 65 mm (2½") and over flanged or grooved ends.
      - .4 Stem: stainless steel tamperproof ball drive.
      - .5 Stem packing nut: external to body.
      - .6 Ball and seat: replaceable stainless steel solid ball and teflon seats.
      - .7 Operator: removable lever handle.
      - .8 Extended handles on chilled water valves.
      - .9 Full port.
      - .10 Jenkins 201SJ.
  - .6 Strainers:
    - .1 Tee strainers: NPS 40 mm (1½") and over: Victaulic 730 Tee Type Vic-Strainer.
    - .2 Wye Strainer: NPS 50 mm (2") and over: Victaulic 732 Wye Type Vic-Strainer.
- 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: Victaulic Tour Anderson Series 789.
  - .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (¼") NPT tapped drain/purge ports, memory stop and calibrated nameplate.
  - .4 Acceptable materials:
    - .1 Tour & Anderson
    - .2 No alternates.
- 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 PIPE END PREPARATION**

- .1 Outside diameter of grooved pipe shall not vary more than the tolerance approved. For IPS pipe, the maximum allowable tolerance from square cut ends is 0.030" for ¾" through 3½", 0.045" for 4" through 6"; and 0.060" for sizes 8" O.D. and above; measured from true square line. Any internal or external weld bead or seams in the groove area must be ground smooth and flush. The end of the pipe internally must be cleaned of any material that might interfere with or damage the internal roll.
- .2 Pipe surface shall be free from indentations and projections from the end of the pipe to the groove, to provide a leak tight seat for the gasket. All loose paint, scale, dirt, chips, grease and rust must be removed. It is the recommendations of Victaulic that the pipe be square cut. Beveled pipe may be used provided the wall thickness is standard wall (ANSI B36.10) or less and the bevel meets ANSI B16.25.

- .3 Bottom of the groove must be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly.
- .4 Groove dimensions shall conform to standard roll groove specifications as published by Victaulic.
- .5 Pipe shall be grooved using Victaulic roll grooving system with track enhanced grooving rolls.

### **3.3 "ZERO-FLEX" COUPLING INSTALLATION**

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 Align and bring two pipe ends together and slide gasket into position centered between the grooves on each pipe. No portion of the gasket shall extend into the groove on either pipe.
- .5 Loosely assemble all segments leaving one nut and bolt off to allow for "swing-over" feature.
- .6 With one nut and one bolt removed, use "swing-over" feature to position housings over gasket and into position into the grooves on both pipes.
- .7 Remaining bolt shall be inserted. Bolt track head must engage into housing recess.
- .8 Nuts shall be tightened alternately and equally and must maintain metal-to-metal contact at the angle bolt-pads. Tighten securely to assure a rigid joint. Torque to manufacturer's recommendation.

### **3.4 "REDUCING" COUPLING INSTALLATION**

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Place large opening of the gasket over the larger pipe ends until the Assembly Washer touches the pipe end.
- .4 Align the pipe centerlines and insert the smaller pipe end in the gasket. Assembly washer provided by Victaulic shall be used.
- .5 Coupling housings shall be positioned over the gasket into the groove on each pipe.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equal until housing bolt pads are firmly together – metal-to-metal.

### **3.5 "OUTLET" COUPLING INSTALLATION**

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Gasket shall be placed on one pipe end so the lips on one side cover the area between the pipe end and the groove. The gasket must not overlap the groove. The pipe ends shall be d to touch the reinforcement ribs inside the gasket.
- .4 Bring mating pipe or fitting into position and insert into gasket. The gasket shall not overlap the groove, but fully cover the pipe end.
- .5 Housings shall be placed over the gasket and the housing keys must engage into the grooves. Ample lubricant shall be applied to the gasket outlet neck and the upper housing interior.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally until housing bolt pads are firmly together – metal-to-metal.

### **3.6 VICTAULIC "FLANGE ADAPTOR" INSTALLATION**

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 Victaulic Flange adaptor shall be opened fully and hinged flange shall be placed around the grooved pipe end with the circular key section locating into the groove.
- .4 Standard bolt shall inserted through the mating holes of the Vic-Flange adaptor to secure firmly in the groove.
- .5 Gasket shall be fully lubricated and pressed into the cavity between the pipe O.D. and flange recess.
- .6 Standard flange bolt shall be place in the hinge hole (opposite the lock bolt) and the bolt assembly shall be directed to mate with the adjoining flange. Remaining flange bolts shall be added and tightened evenly until faces contact firmly.
- .7 Where Vic-Flange adaptors do not mate to a hard smooth surface, Victaulic Flange Washers must be used.

### **3.7 MECHANICAL-T OUTLET INSTALLATION**

- .1 Holes must be drilled.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 In preparation for assembly, one nut and bolt shall be removed from the housing. The other nut and bolt shall be loosened until it is flush with the nut and bolt. Remove the tape and lift the gasket from the mechanical-T outlet.
- .4 Victaulic lubricant shall be applied to all surfaces of the gasket and the gasket shall be properly repositioned into the housing using alignment tabs.



- .5 When assembling the coupling, the lower housing shall be rotated 90 degrees away from the upper housing. Place the upper, or outlet section on to the face of the pipe in line with the outlet hole. The lower section shall then be rotated around the pipe to close the two halves. The locating collar must be in the outlet hole.
- .6 Insert bolt and apply nut. Oval neck must engage in recess of the housing.
- .7 Nuts shall be tightened alternately and equally until the housing is in complete surface contact in the gasket pocket area and the assembly is rigid. **Nuts must be tightened to 30 ft. (S/921) and 50 ft. (S/920 and 929)** with even gaps between the bolt pads.
- .8 Where mechanical-T are used as transition pieces between two runs, they must be assembled onto the runs before the branch connections are made.

### 3.8 VIC-LET STRAPLESS OUTLET & VIC-O-WELL STRAPLESS THERMOMETER & PRESSURE GAUGE INSTALLATION

- .1 Holes must be drilled.
- .2 Do not use for branch piping connections where size may not be available. Use first available size and reducer.
- .3 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Victaulic lubricant shall be applied to exposed gasket sealing lip.
- .4 Vic-Let outlet toe shall align with pipe. Tilt toe into the hole and drop into the pipe. The Vic-Let outlet must be positioned with the heel inside the pipe.
- .5 Collar shall be held in position while nut is being hand tightened. Nut shall then be wrench tightened until collar deforms to contact pipe all around. Maintain collar/gasket alignment to prevent gasket pinching. Do not exceed 200 ft.lbs. Vic-Let outlet shall not be reused after initial installation.

### 3.9 ROUST-A-BOUT PLAIN END PIPE COUPLING INSTALLATION

- .1 Pipe shall be marked 1" from the end.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 The pipe shall be butt and held in position while slide the gasket back into position. The gasket must be centered between the marks.
- .5 Housings shall be placed over the gasket.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally to standard torque specifications as published by Victaulic. Segments must be assembled with equal gaps between the bolt pads.

### 3.10 VALVE INSTALLATION

- .1 Install valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.

- .3 Install butterfly 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.
- .8 Provide ball valves for glycol service.

### 3.11 AIR VENTS

- .1 Install at high points of systems.
- .2 Install isolating ball valve on automatic air vent inlet.

### 3.12 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
  - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
  - .2 On return side of all water or glycol cooling coils.
  - .3 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

### 3.13 FLUSHING AND CLEANING

- .1 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.
- .2 Flush and clean new and existing piping system in presence of Consultant.
- .3 Flush after pressure test for a minimum of 4 hrs.
- .4 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.
- .5 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.
- .6 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .7 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
- .8 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

- .9 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.
- .10 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.
- .11 Repeat system drain and flush as often as necessary to have a clean system.
- .12 Disposal of cleaning solutions to be approved by authority having jurisdiction.
- .13 Isolate new piping system from existing system as required for system cleaning.

**3.14****FILLING OF SYSTEM**

- .1 Refill system with clean water adding water treatment as specified.
- .2 Refill glycol system with 40% propylene glycol as specified elsewhere.

**3.15****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.

**3.16****GLYCOL CHARGING**

- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Consultant.
- .4 Maintain glycol level in storage tank until system is fully charged and has equalized throughout the entire system. Monitor system on bi-weekly basis until system is completely filled.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes: Flexible pre-insulated distribution system that incorporates two crosslinked polyethylene (PEX) service tubing for hot and cold fluid distribution systems.

**1.2 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 General Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- .3 ASTM International
  - .1 ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - .2 ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.
  - .3 ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
  - .4 ASTM F2165 Standard Specification for Flexible Pre-Insulated Piping.

**1.3 SYSTEM DESCRIPTION**

- .1 Design Requirements: The PEX service tubing is manufactured and tested in accordance with the ASTM F876 and F877. The PEX service tubing has hydrostatic ratings in accordance with the temperatures and pressures listed in the ASTM standard. The hydrostatic ratings are:
  - .1 200 degrees F (93 degrees C) at 80 PSI (551 kPa)
  - .2 100 degrees F (38 degrees C) at 100 PSI (689 kPa)
  - .3 73.4 degrees F (23 degrees C) at 160 psi (1102 kPa)
- .2 Performance Requirements: Provide a pre-insulated distribution system that is manufactured, fabricated and installed to comply with regulatory agencies and authorities with jurisdiction, and maintain performance criteria stated by the tubing manufacturer without defects, damage or failure.
  - .1 Show compliance with ASTM F876.
  - .2 Show compliance with ASTM F877.
  - .3 Show compliance with DIN 4726 regarding oxygen diffusion.

**1.4 SUBMITTALS**

- .1 General: Submit listed submittals in accordance with Conditions of the Contract and Mechanical Division Submittal Procedures Section.
- .2 Product Data: Submit manufacturer's product submittal data and installation instructions.

- .3 Shop Drawings:
  - .1 Provide installation drawings indicating of tubing layout, tubing size dimension by installation segment, vault locations, support fixtures and schedules with all details required for installation of the system.
- .4 Quality Assurance/Control Submittals: Submit the following:
  - .1 Test Reports: Upon request, submit test reports from recognized testing laboratories.
  - .2 Submit the following documentation:
    - .1 Manufacturer's certificate indicating products comply with specified requirements
    - .2 Manufacturer's flow schedule for the distribution system
    - .3 Documentation indicating the installer is trained to install the manufacturer's products
- .5 Closeout Submittals: Submit the following:
  - .1 Warranty documents specified herein.
  - .2 Operation and maintenance data.
  - .3 Manufacturer's field reports specified herein.
  - .4 Final as-built tubing layout drawing.

## **1.5 QUALITY ASSURANCE**

- .1 Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving familiarization training by the tubing manufacturer.
- .2 Regulatory Requirements and Approvals: Ensure the pre-insulated PEX distribution system complies with all applicable codes and regulations.
- .3 Certifications: Provide letters of certification as follows:
  - .1 Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades person.
- .4 Pre-installation Meetings:
  - .1 Verify project requirements, excavation conditions, system performance requirements, manufacturer's installation instructions and warranty requirements.
  - .2 Review project construction timeline to ensure compliance or discuss modifications as required.
  - .3 Interface with other trade representatives to verify areas of responsibility.
  - .4 Establish the frequency and construction phase the project engineer intends for site visits and inspections by the tubing manufacturer's representative.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 General: Comply with Division 1 Product Requirement Section.
- .2 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- .3 Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .4 Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
  - .1 Store pre-insulated tubing coils under cover to prevent dirt or foreign material from entering the service tubing.
  - .2 Do not expose the PEX service tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing that is exposed to direct sunlight.

**1.7 WARRANTY**

- .1 Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- .2 Manufacturer's Warranty: Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under contract documents.
  - .1 Warranty covers the repair or replacement of any tubing or fittings proven defective.
  - .2 Warranty may transfer to subsequent owners.
  - .3 The most recent limited warranty published by the tubing manufacturer takes precedence at time of installation.

**1.8 SYSTEM START-UP**

- .1 Instruct Owner's personnel about operation and maintenance of installed system. Provide manufacturer's installation, operation and maintenance instructions for installed components within the system.

**Part 2 Products**

**2.1 PRE-INSULATED PEX DISTRIBUTION SYSTEM**

- .1 Manufacturer:
  - .1 Uponor, Inc.  
Contact: 5925 148th Street West, Apple Valley, MN 55124; Telephone: (800) 321-4739, (952) 891-2000; Fax: (952) 891-1409;  
Website: [www.uponor-usa.com](http://www.uponor-usa.com)
  - .2 Rehau
  - .3 Ipec

## 2.2 PRE-INSULATED PEX DISTRIBUTION SYSTEM MATERIALS

- .1 Service Tubing:
  - .1 Material: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engle method
  - .2 Material Standard: Manufactured in accordance with ASTM F876, F877
  - .3 Pressure Ratings: Hydrostatic design and pressure ratings in accordance with the ASTM standard
  - .4 The two PEX service tubing in the Ecoflex Thermal Twin pipe have an oxygen diffusion barrier that does not exceed an oxygen diffusion rate of 0.10 grams per cubic meter per day at 104 degrees F (40 degrees C) water temperature in accordance with German DIN 4726.
  - .5 Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated.
    - .1 1 inch [25.4mm]
    - .2 1¼ inch [31.75mm]
    - .3 1½ inch [38.1mm]
    - .4 2 inch [50.8mm]
- .2 Outer Jacket
  - .1 Material: Corrugated seamless high-density polyethylene (HDPE)
  - .2 The HDPE jacket completely encompasses and protects the insulation from moisture and damage.
  - .3 The outer jacket shall be extruded directly over the insulation.
  - .4 Minimum Bend Radius:
    - .1 1 inch pre-insulated tubing with 5.5 inch [139.7mm] jacket has a bend radius of 10 inches [254mm].
    - .2 1¼ inch pre-insulated tubing with 5.5 inch [139.7mm] jacket has a bend radius of 12 inches [304.8mm].
    - .3 1½ inch pre-insulated tubing with 6.9 inch [175.3mm] jacket has a bend radius of 14 inches [355.6mm].
    - .4 2 inch pre-insulated tubing with 6.9 inch [175.3mm] jacket has a bend radius of 18 inches [457.2].
  - .5 The outer jacket shall contain 2 percent carbon black, finely divided and thoroughly dispersed to provide protection from UV degradation.
- .3 Insulation
  - .1 The insulation shall be expanded cross-linked polyethylene closed cell foam.
  - .2 All seams of the insulation shall be sealed.
  - .3 Insulation shall not be bonded to the service tubing.

- .4 End Seals
  - .1 The tubing manufacturer will supply all EPDM rubber end caps.
  - .2 EPDM rubber end caps are to be installed on each end prior to connecting the service pipes and insulating the field joints.
  - .3 The EPDM end caps will heat shrink onto the tubing outer jacket forming a watertight seal.

### **2.3 COLD EXPANSION FITTINGS FOR PEX SERVICE TUBING**

- .1 For system compatibility, use fittings offered by the tubing manufacturer.
- .2 Fittings must comply with the performance requirements of ASTM F877.
- .3 Fittings are to be manufactured in accordance with ASTM F1960.
- .4 The fitting assembly consists of a barbed adapter and an applicable sized PEX ring.
- .5 All buried fittings will be installed, insulated, and sealed in accordance with the instructions of the tubing manufacturer.

### **2.4 COMPRESSION FITTINGS FOR PEX SERVICE TUBING**

- .1 For system compatibility, use fittings offered by the tubing manufacturer.
- .2 Fittings are to be manufactured from dezincification resistant brass.
- .3 The fitting assembly must comply with performance requirements of ASTM F877.
- .4 Fittings will consist of a compression fitting with a coupling sleeve, a fitting body insert with O-ring(s) and a bolt and nut.
- .5 All buried fittings will be installed, insulated, and sealed in accordance with the tubing manufacturer's instructions.
- .6 Male NPT thread for each compression fitting is shown below.
- .7 1 inch PEX compression fitting has 1 inch male NPT thread.
  - .1 1¼ inch PEX compression fitting has 1¼ inch male NPT thread.
  - .2 1½ inch PEX compression fitting has 1½ inch male NPT thread.
  - .3 2 inch PEX compression fitting has 2 inch male NPT thread.
  - .4 All transition fittings connecting to the compression fittings shall be manufactured of dezincification resistant brass.

### **2.5 ACCESSORIES**

- .1 Use accessories associated with the installation of the pre-insulated PEX distribution system as recommended by or available from the tubing manufacturer.
- .2 Insulation Kits
  - .1 Insulation kits will be manufactured of ABS shells with PEX-foam insulation on inside, bolts, nuts, plastic rivets and are sealed up using a sealant compound.



- .3 Connection Vaults
  - .1 The tubing manufacturer will provide the connection vaults when required by the project construction.
  - .2 Connection vaults shall be constructed of rotationally molded composite polyethylene and PE foam, providing a structurally sound and thermally insulated chamber.
  - .3 Heat shrink seals as provided by the tubing manufacturer shall be installed to prevent introduction of water into the vault.
- .4 Anchors
  - .1 The project engineer will determine the use of anchors, if required, within the distribution system.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:
  - .1 Uponor Pre-insulated Pipe Systems Design and Installation Manual, current edition

**3.2 EXAMINATION**

- .1 Site Verification of Conditions
  - .1 Verify that site conditions are acceptable for installation of the pre-insulated PEX distribution system.
  - .2 Do not proceed with installation of the pre-insulated PEX distribution system until unacceptable conditions are corrected.

**3.3 INSTALLATION**

- .1 Below-grade Installation
  - .1 Pre-insulated piping shall be installed in accordance with manufacturer's recommendations and the details as shown on the contract drawings.
  - .2 The system will be installed with the fewest number of underground joints as possible.
  - .3 The system does not require expansion loops, expansion joints or compensators of any type.
  - .4 An EPDM rubber end cap shall be applied at all terminations of the pre-insulated piping system, including all fitting locations to form a watertight seal.
  - .5 All buried fittings will be installed, insulated and sealed in accordance with the tubing manufacturer's instructions.
  - .6 Connection Vaults or Insulation Kits are required for all below-grade installations.

.2 Backfill

- .1 The pre-insulated tubing will be backfilled with clean sand material.
  - .1 Minimum vertical distance from the bottom of the tubing to the trench floor is 4 inches [102mm].
  - .2 Minimum lateral distance from the side of the tubing to the trench wall is 6 inches [152mm].
  - .3 Install a minimum of 12 inches [305mm] of clean fill over the top of the pre-insulated tubing.
- .2 The balance of the trench can be backfilled with native soil void of stone greater than 2 inches [51mm] in diameter.

**3.4 FIELD QUALITY CONTROL**

.1 Site Tests

- .1 To ensure system integrity, pressure-test the system before and during backfilling the tubing, or when other trades are working near the tubing.
- .2 The service tubing will be air tested at 1½times the operating pressure for a minimum of 1 hour prior to system burial.

**3.5 ADJUSTING**

- .1 Make any adjustments require to the system for a neat installation.

**3.6 CLEANING AND PROTECTION**

- .1 Remove temporary coverings and protection of adjacent work areas.
- .2 Repair or replace damaged installed products.
- .3 Clean the installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- .4 Remove construction debris from project site and legally dispose of debris.

**3.7 DEMONSTRATION**

- .1 Demonstrate operation of pre-insulated PEX distribution system to Owner's personnel.

**3.8 PROTECTION**

- .1 Protect installed work from damage caused by subsequent construction activity on the site.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 SMACNA HVAC Duct Leakage Test Manual.
- .4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section general requirements.
- .2 Indicate following:
  - .1 Sealants
  - .2 Tape
  - .3 Proprietary Joints
  - .4 Fittings

**1.3                CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1                DUCTWORK**

- .1 Galvanized Steel:
  - .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	Class A Gauge	Class B Gauge	Class C Gauge
<b>Square and Rectangular</b>			
Up to 600 mm (24")	22	24	24
625 mm to 1000 mm (25" to 40")	20	22	24
1025 mm to 1800 mm (41" to 72")	18	20	22
1825 mm to 2400 mm (73" to 96")	16	18	20
2450 mm and over (97")	16	16	16
<b>Round and Oval</b>			
Up to 300 mm (12")	24	24	24
325 mm to 600 mm (13" to 24")	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37" to 48")	18	20	22
1225 mm (49") and over	18	18	20

.3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

.2 Stainless Steel

- .1 To ASTM A480/A480M, Type 304.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA or as indicated.
- .3 Joints: to ASHRAE and SMACNA.
  - .1 Acceptable material:  
Ductmate Canada Ltd.

.3 Aluminum

- .1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA or as indicated.
- .3 Joints: to ASHRAE and SMACNA.
  - .1 Acceptable material:  
.1 Ductmate Canada Ltd.
- .4 Foil tape all transverse and longitudinal joints.

.4 Black Steel

- .1 To ASTM A6653/A653M.
- .2 Thickness: 1.2 mm (18 gauge)
- .3 Fabrication: ducts and fittings to ASHRAE and SMACNA.
- .4 Reinforcement: as indicated.
- .5 Joints: continuous weld.

## 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 "J" Type connection). Weld all corners.
  - .1 Acceptable materials:
    - .1 Ductmate Canada Ltd.
    - .2 Nexus, Exanno Corp.
    - .3 WDCII.

## 2.3 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius and or short radius with single thickness turning vanes  
Centreline radius: 1.5 times width of duct.
  - .2 Round:
    - .1 In exposed areas one-piece smooth radius, 1.5 times diameter.
    - .2 In concealed areas 3-piece adjustable, 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm (16"): with double thickness turning vanes.
  - .2 Over 400 mm (16"): with double thickness turning vanes.

- .4 Branches:
  - .1 Rectangular main and branch: with 45° entry on branch.
  - .2 Round main and branch: enter main duct at 45° 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 90° round spin in collars with balancing damper and locking quadrant.
- .6 Transitions:
  - .1 Diverging: 20° maximum included angle.
  - .2 Converging: 30° maximum included angle.
- .7 Offsets:
  - .1 Full short radiused elbows.
- .8 Obstruction deflectors: maintain full cross-sectional area.

**2.4 SEAL CLASSIFICATION**

- .1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class	Acceptable Leakage Classification (Rectangular)	Acceptable Leakage Classification (Round)
2500 (10")	A	4	2
1500 (6")	A	4	2
1000 (4")	A	4	2
750 (3")	A	8	4
500 (2")	B	16	8
250 (1")	B	16	8
125 (0.5")	C	16	8

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
  - .3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

**2.5 SEALANT**

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).
  - .1 Acceptable materials:
    - .1 Duro Dyne S-2
    - .2 Foster

## 2.6 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.
  - .1 Acceptable material:
    - .1 Duro Dyne FT-2

## 2.7 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

## 2.8 FIRESTOPPING

- .1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 All ductwork passing through partition walls shall be firestopped.

## 2.9 WATERTIGHT DUCT

- .1 Provide watertight duct for:
  - .1 Ductwork on roof
- .2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

## 2.10 HANGERS AND SUPPORTS

- .1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 DUCTMATE "Clutcher" cable hanging system may be utilized on round ductwork up to 450mm (18 inch) diameter in areas of exposed ceilings where lateral movement/loads on ductwork is not present (such as those caused by attached linear diffusers).
- .3 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.
- .4 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8)
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

- .5 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
    - .1 Acceptable material:
      - .1 Myatt fig. 485

- .2 For steel joist: manufactured joist clamp or steel plate washer.
  - .1 Acceptable material:
    - .1 Grinnell fig. 61 or 60
- .3 For steel beams: manufactured beam clamps:
  - .1 Acceptable material:
    - .1 Grinnell Fig. 60

**Part 3 Execution**

**3.1 GENERAL**

- .1 The following systems shall conform to these requirements:

System	Class	Material
HVAC Supply and Return	B	Galvanized steel
General Exhaust	B	Galvanized steel
Ventilation Plenum	B	Galvanized steel
Exhaust Plenum	B	Galvanized steel
Individual Exhaust	C	Galvanized steel

- .2 Do work in accordance with ASHRAE and SMACNA.
- .3 Do not break continuity of insulation vapour barrier with hangers or rods.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on each side of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

**3.2 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE, SMACNA and as follows:

Duct Size	Spacing
mm (")	mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

- .4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

**3.3 CLUTCHER CABLE HANGER**

- .1 Do not install in corrosive environments such as pools, aquariums or spas.
- .2 Utilize the standard loop hanging style. (limited to 450mm (18") diameter)



- .3 Contractor is responsible to calculate required clutcher and cable weight rating based on manufacturer selection guidelines. Minimum weight rating of system components shall be 250 lbs.
- .4 Maximum Hanger Spacing: 3000 mm (120")
- .5 Provide additional rigid supports as required if lateral movement in the ductwork occurs.

### **3.4 WATERTIGHT DUCT**

- .1 Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.
- .2 Fit base of riser with 150 mm (6") deep drain sump and 25 mm (1") drain connected, with deep seal trap and valve and discharging to open funnel drain.

### **3.5 SEALING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### **3.6 LEAKAGE TESTS**

- .1 Co-ordinate leakage testing with TAB contractor and commissioning agent. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Leakage tests to be done in sections.
- .4 Trial leakage tests to be performed as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section to be minimum of 15 m (50'-0") long with not less then 3 branch takeoffs and two 90° elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.
- .7 Complete test before insulation or concealment.
- .8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.
- .9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

### **3.7 CLEANING**

- .1 Keep ducts clear from dust and debris
- .2 Keep duct liner clean from dust, debris, and moisture.
- .3 At completion of project vacuum ducts if dirt or dust is present.

- .4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection. The extent of the cleaning shall be limited to the area immediately surrounding the new connection point.
- .5 Ensure all systems are clean prior to start up.

### **3.8 ROOF MOUNTED DUCT SUPPORT**

- .1 Provide zero penetration duct support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable materials:
  - .1 Portable pipe hanger
  - .2 Bigfoot systems
  - .3 Trikon Systems

### **3.9 INSTALLATION REQUIREMENTS**

- .1 All ductwork is to be protected from the weather and precipitation. The top and sides of all ductwork are to be completely covered with 6mil poly to the satisfaction of the consultant. Maintain protection of the ductwork until the building is made watertight and hollow cores drained. Tape all joints.

### **3.10 PAINTING**

- .1 All exposed ductwork, grilles, hangers, supports, etc shall be painted to match the color and finish of area/room where it is installed. Refer to architectural drawings and specification for any additional color and finish requirements.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Flexible connections.
  - .2 Duct access doors.
  - .3 Turning vanes.
  - .4 Instrument test ports.

**1.3                CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1                GENERAL**

- .1 Manufacture in accordance with CSA B228.1.

**2.2                FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

### **2.3 ACCESS DOORS IN DUCTS**

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.
- .3 Gaskets: neoprene
- .4 Hardware:
  - .1 Up to 300 mm (12"): 2 sash locks
  - .2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.
  - .3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.
  - .4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.
  - .5 Hold open devices.
- .5 Acceptable materials:
  - Nailor
  - E. H. Price
  - Titus

### **2.4 TURNING VANES**

- .1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.
- .2 Acceptable materials:
  - Duro Dyne
  - Ductmate

### **2.5 INSTRUMENT TEST PORTS**

- .1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material:
  - Duro Dyne IP1 or IP2
  - Duct mate

**2.6 PREFABRICATED ROOF CURB**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: 1.3 mm (18 gauge) galvanized steel with raised cant and wood nailer.
- .3 25 mm (1") insulation 3 lb density.
- .4 Acceptable materials:  
Greenheck GPR – 600 mm (24") high  
Penn

**2.7 SPIN-IN COLLAR**

- .1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.
- .2 Provide balancing damper where indicated.
- .3 Acceptable materials:
  - .1 Ecco Manufacturing
  - .2 Flex Master

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Flexible connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans. (Unless internally isolated)
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: 100 mm (4").
  - .3 Minimum distance between metal parts when system in operation: 75 mm (3").
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on each side of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
  - .1 Size:
    - .1 600 mm x 600 mm (24" x 24") for person size entry.
    - .2 600 mm x 1000 mm (24" x 40") for servicing entry.
    - .3 300 mm x 300 mm (12" x 12") for viewing.
    - .4 As indicated.

- .2 Location:
  - .1 At fire and smoke dampers.
  - .2 At control dampers.
  - .3 At devices requiring maintenance.
  - .4 At locations required by code.
  - .5 At inlet and outlet of reheat coils.
  - .6 Elsewhere as indicated.
  - .7 Inlet and outlet of duct mounted coils.
- .3 Instrument test ports.
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments
  - .3 Install insulation port extensions as required.
  - .4 Locations.
    - .1 For traverse readings:
      - .1 At ducted inlets to roof and wall exhausters.
      - .2 At inlets and outlets of other fan systems.
      - .3 At main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.
      - .2 In mixed air applications in locations as approved by Consultant.
      - .3 At inlet and outlet of coils.
      - .4 Downstream of junctions of two converging air streams of different temperatures.
      - .5 And as indicated.
- .4 Turning vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.
  - .2 Install on supply ducts only.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following: performance data.

**Part 2            Products**

**2.1                GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2                SPLITTER DAMPERS**

- .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

**2.3                SINGLE BLADE DAMPERS**

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 Shaft extension to accommodate insulation thickness and locking quadrant.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

**2.4                MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

- .3 Maximum blade height:
  - .1 50 mm (2") up to 375 mm (15") high duct.
  - .2 100 mm (4") max 400 mm (16") high duct and over.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Shaft extension to accommodate insulation thickness and locking quadrants.
- .8 Acceptable materials:
  - .1 Duro Dyne
  - .2 E.H. Price
  - .3 Nailor
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Ruskin
  - .7 Ventex/Alumavent
  - .8 United Enertech

## 2.5 LOCKING QUADRANTS

- .1 6 mm (1/4") dial regulator with square bearing shaft.
  - .1 18 gauge oval frame, cadmium plated, clearly shows damper position.
  - .2 18 gauge formed handle for easy adjustment.
  - .3 Bolt and wing nut lock damper securely.
  - .4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.
- .2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.
  - .1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
  - .2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
  - .3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
  - .4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
  - .5 Screw holes for mechanically fastening to ductwork.
- .3 High pressure system locking quadrant:
  - .1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
  - .2 Handle design for easy recognition of damper position.



- .3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
- .4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.
- .5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.
- .4 Acceptable manufacturers:
  - Duro Dyne
  - Ductmate
  - Pottorff

### **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.

**END OF SECTION**

**Part 1            General**

**1.1                CODES AND STANDARDS**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.
- .4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .5 ULC-S505, Fusible Links for Fire Protection Service.
- .6 CAN/ULC-S524, Installation of Fire Alarm Systems
- .7 CAN/ULC-S1001.11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements indicating the following:
  - .1 Damper type
  - .2 Operators
  - .3 Fusible links
  - .4 Smoke detectors
  - .5 Power requirements
  - .6 Size, orientation, construction

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.4                MAINTENANCE MATERIALS**

- .1 Provide following:
  - .1 Six (6) fusible links of each type.

**1.5                CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**Part 2 Products**

**2.1 COMBINATION FIRE AND SMOKE DAMPERS**

- .1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sampling tube, sleeve and all other components necessary for a complete and operable system. The assembly shall be factory assembled as a single unit. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.
- .2 Damper
  - .1 Damper shall be ULC listed and labelled
  - .2 Both damper and damper actuator to be ULC listed and labelled.
  - .3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.
  - .4 Damper shall have Class I leakage rating.
  - .5 Suitable for horizontal or vertical installations.
  - .6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.
- .3 Actuator/Link
  - .1 Actuator shall be ULC listed and labelled
  - .2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.
  - .3 Exterior visualization of damper position.
  - .4 Damper actuator end switches for monitoring damper position by the BAS.
  - .5 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.
  - .6 Fusible link, or electric re-settable link (ERL).
  - .7 Electric fire sensor capable of remote openable control is to be provided in place of fusible link where specifically indicated in project documents.
  - .8 Where ERL or electric fire sensor is used in place of fusible link, this device shall fail closed upon power failure.
  - .9 Actuator may be mounted in duct in areas of renovation work when ductwork is over 450mm (18") wide.
  - .10 Provide modulating actuator where damper is operating as part of a VVT system.
  - .11 Where the FSD is mounted immediately behind a sidewall grille the actuator shall be mounted inside the ductwork to avoid an additional access door beside the grille.

- .4 Factory sleeve.
  - .1 Type and style: matching application.
- .5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.
- .6 Smoke Detector:
  - .1 ULC approved photoelectric duct smoke detector;
  - .2 Operates from 300 to 3000 ft/min air velocity (fan systems), -4 to 158°F temperature, and 0 to 95% non-condensing humidity;
  - .3 Operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature and 0 – 95% non-condensing humidity (transfer ducts)
  - .4 Test/reset button with LED display;
  - .5 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing
  - .6 The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.
  - .7 Sensor may be mounted in duct in areas of renovation work when ductwork is over 450mm (18”) wide.
  - .8 Where the FSD is mounted immediately behind a sidewall grille the smoke detector shall be mounted inside the ductwork to avoid an additional access door beside the grille.
- .7 Damper assembly to operate at 120V with single point power connection.
- .8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer’s installation guidelines.
- .9 Fire rating to match wall assembly i.e. 1 hour/1 ½ hour/2 hour/ 3 hour.
- .10 Size: as indicated on drawings.
- .11 Acceptable materials:
  - E H Price
  - NCA Ltd.
  - Nailor Industries Inc.
  - Ruskin
  - Alumavent
  - United Enertech
  - Pottorff
  - Safeair-Dowco (stainless steel)
  - Pottorff

## **2.2 NUMBER OF AIR TYPE SMOKE DETECTORS**

- .1 Where air velocities are greater than 1.5 m/s (300 feet per second), one air duct type detector shall be installed for every 1.5 meters square (16 square feet) of cross-sectional duct area.
- .2 Where air velocities are less than 1.5 m/s (300 feet per second), one duct type smoke detector shall be installed for every 0.5 meters square (5.3 square feet) or cross-sectional duct area.

## **2.3 PRESSURE RELIEF DOORS**

- .1 Frames shall be Z-shape, 12 gage (2.8) galvanized steel.
- .2 Door shall be 12 gage (2.8) galvanized steel, hinged on one side.
- .3 Seal shall be around the door perimeter allowing no more than 7 cfm/ft<sup>2</sup> at 1.0 inch w.g..
- .4 Door shall include stainless steel springs to close door upon pressure relief and system shutdown.
- .5 All release mechanisms, springs and parts shall be completely out of airstream.
- .6 Pressure relief settings available from 2" (0.5 kPa) to 10" (2.49 kPa) increments of 1" w.g. (0.25 kPa). Supplier shall examine plans to provide appropriate pressure relief based on associated air handling system.
- .7 Pressure relief mechanism shall be factory calibrated in an AMCA Registered Laboratory.
- .8 Pressure Relief Doors shall be provided as indicated in the execution section.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Provide smoke dampers where indicated and at all duct penetrations through smoke barrier partitions indicated on architectural drawings.
- .2 Provide combination fire and smoke dampers where indicated and at all duct penetrations through fire rated smoke barrier partitions indicated on architectural drawings. To provide separated fire dampers and smoke dampers, obtain approval from the consultant for the alternate arrangement.
- .3 Provide pressure relief doors (both positive and negative as applicable) as follows:
  - .1 For all systems with a combination fire smoke or smoke damper in the duct main of the system when:
    - .1 The system operates at static pressure of 1.0 inches w.g. or higher; and
    - .2 More than 50% of the system airflow passes through the combination fire/smoke or smoke damper.
  - .2 Where/as indicated on the plans.
- .4 Install in accordance with ANSI/NFPA 90A, in accordance with conditions of ULC listing and manufacturer's recommendation.
- .5 Maintain integrity of smoke separation and fire rating.

- .6 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .7 Install access door adjacent to each damper and smoke detector.
- .8 Front grille access for through wall dampers that terminate in a grille is acceptable.
- .9 Provide proper firestopping and duct seal to fire barrier wall.
- .10 Confirm proper operation and test sheets.
- .11 Should contractor provide separated devices mount smoke detector downstream of damper and within 1.5 m (5 ft) of damper.
- .12 Ensure access doors/panels, fusible links, damper actuators and sensors are easily observed and accessible.

### **3.2 WIRING**

- .1 This contractor is responsible for obtaining 120V to control all smoke and/or fire/smoke dampers from the local electrical panel and all wiring from electrical panel to smoke detector to damper actuator to the standards of the electrical authority. Obtain hydro permit for this work.
- .2 All fire alarm wiring shall be 1 hour rated and in conduit or as per electrical fire alarm wiring requirement.
- .3 When the building has a BAS contractor, the BAS contractor can be used to provide the 120V power wiring.

### **3.3 DAMPER POSITION MONITORING**

- .1 In all cases the BAS contractor shall monitor the damper actuator end switches i.e. "closed position and open position".

### **3.4 CLEANING**

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

### **3.5 INTEGRATED LIFE SAFETY SYSTEMS TESTING**

- .1 Prior to the building Integrated Life Safety Systems Testing the mechanical contractor shall commission/verify the operation of all installed smoke dampers.
- .2 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all operating smoke dampers and associated Life Safety Systems (i.e. fire alarm).
- .3 This contractor shall work with the Integrated Life Safety Contractor and reset all systems back into proper operation.
- .4 Include all costs associated with participation Integrated Life Safety System Testing in the tender value.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .4 ASTM C916 Standard Specification for Adhesive for Duct Thermal Insulation.
- .5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .6 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.

**Part 2            Products**

**2.1                DUCT LINER**

- .1 General:
  - .1 Acoustical duct liner to be fibreglass duct liner meeting or exceeding requirements of ASTM C1071, Type I, Flexible or Type II, Rigid, and NFPA 90A/90B.
  - .2 Bonded with formaldehyde free bio-based binder
  - .3 Mat faced airstream surface
  - .4 Factory applied edge coating
  - .5 Shall not contain formaldehyde, PBDE's, asbestos, mercury, mercury compounds, lead, contain 50% or greater recycled glass content.
  - .6 Thermal conductivity, ASTM C177/C518/C1114 .24BTU (sf•hr•°F) @ 75°F mean temp).
  - .7 Noise Reduction Coefficient (NRC) 1.5 PCF 1" = .70, 1 ½ " = .80, 2" =.95  
ASTM C423, Type A mounting.
  - .8 Noise Reduction Coefficient (NRC) 2.0 PCF 1/2" = .50, 1" = .70, 1 ½ " = .85  
ASTM C423, Type A mounting
  - .9 Corrosiveness/corrosion, ASTM C665/C1617. Does not accelerate/pass.
  - .10 Mold and mildew growth/fungi resistance, ASTM C1338, ASTM G21/G22, UL2824. Pass/resistant to mold.
  - .11 Maximum service temperature, ASTM C411, 250°F (121°C).
  - .12 Maximum rate air velocity, ASTM C1071, 6,000 ft./min. (30.5 m/sec.)
  - .13 Water vapor sorption, ASTM C1104, less than 3%.

- .14 Surface burning characteristics, ASTM E84, UL 273, CAN/ULC S102, 20/50 flame spread/smoke development.
- .15 Acceptable material:
  - .1 Knauf Atmosphere Duct Liner
  - .2 Manson
  - .3 Johns Manville
  - .4 Owen Corning
- .2 Rigid:
  - .1 Use on flat surfaces.
  - .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
  - .3 Density: 96 kg/m<sup>3</sup> (6 lb/ft<sup>2</sup>).
- .3 Flexible:
  - .1 Use on round or oval surfaces only.
  - .2 25 mm (1") thick, to ASTM C1071, fibrous glass blanket duct liner.
  - .3 Density: 24 kg/m<sup>3</sup> (1.5 lb/ft<sup>2</sup>).

## **2.2 NON-FIBROUS FOAM DUCT LINER**

- .1 General
  - .1 Made from flexible polyimide foam coated with an acrylic polymer (0.80 lb/ft<sup>3</sup>) in sheets of rigid board.
  - .2 Does not support fungi, mold, mildew, or bacteria growth.
  - .3 Surface can be cleaned.
  - .4 Flame spread and smoke development below 25/50 thermal resistance at 3.3 hr.ft<sup>2</sup>.°F/BTU per inch thickness.
  - .5 Suitable for duct velocities up to 5000 fpm.
  - .6 Provide 'tough coat' duct liner sealant for cut edges and panel seams. This is the air-dry version of the factory applied acrylic coating.
  - .7 Liners used in medical environments shall be resistant to UV-C light to permit installation of future UV lamps in ductwork.
- .2 Acceptable manufacturer:
  - .1 Boyd (Solimide Foams) 'Solcoustic'

## **2.3 FOIL FACED POLYESTER DUCT LINER**

- .1 General
  - .1 Made from polyester, webbed into a blanket, and bonded with a FSK facing.
  - .2 Does not promote or support mold or mildew growth.



- .3 Density of 1.5 – 1.9 lb/ft<sup>3</sup>.
- .4 Flame spread and smoke development below 25/50 thermal resistance at R-4.2 per inch thickness. Suitable for air velocities to 4000 fpm.
- .2 Acceptable manufacturer:
  - .1 Ductmate 'PolyArmor'

## 2.4 ADHESIVE

- .1 Meet requirements of ASTM C916.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).
- .3 Acceptable material:
  - .1 Duro Dyne 1A-22
  - .2 Ductmate

## 2.5 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

## 2.6 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.
- .2 Acceptable materials:
  - .1 Duro Dyne FT2
  - .2 Ductmate

## 2.7 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 (-90°F) to 93°C (200°F).
- .3 Acceptable materials:
  - .1 Duro Dyne 1A-94
  - .2 Ductmate

**Part 3 Execution**

**3.1 GENERAL**

- .1 Do work in accordance with recommendations of MAIMA Fibrous Glass Duct Liner Standards (FGDLS) or SMACNA duct liner standards.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

**3.2 DUCT LINER**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.
- .2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.
- .3 Store foam liners away from sunlight.

**3.3 JOINTS**

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Consultant.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 AMCA 99, Standards Handbook.
- .3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Product data to include fan curves and sound rating data.

**1.3                OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

**1.4                CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

**Part 2            Products**

**2.1                FANS GENERAL**

- .1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Provide vibration isolation hangers/pads for all fans.
- .7 Acceptable materials:
  - .1 Greenheck
  - .2 Penn-Barry
  - .3 Cook
  - .4 Jenco (S & P)/Jenn
  - .5 Carnes
  - .6 Acme
  - .7 Zonex
  - .8 Nutone (Range hood)
  - .9 Broan (Range hood)
  - .10 Twin-City
  - .11 Reversomatic
  - .12 Fantech
  - .13 Aerovent
- .8 Provide factory mounted speed control for all direct drive motors.

## **2.2 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 gasketed 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 CEILING DISCHARGE FANS**

- .1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.
- .2 Sizes and capacity: as indicated.

- .3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.
- .4 Side duct outlet with integral backdraft damper, size as indicated.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Silver anodized aluminum grille paint finish.

**2.4 RANGE HOOD EXHAUST FANS**

- .1 Centrifugal direct drive 750 mm (30") wide, suitable for under cabinet installation, enamel steel metal housing complete with halogen lights, colour selected by consultant.
- .2 Sizes and capacity: as indicated.
- .3 Internal Toggle switch operated fan and light.
- .4 Top or rear side 80 mm x 250 mm (3" x 10") rectangular duct outlet with integral backdraft damper.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Aluminum mesh cleanable grease filter.

**2.5 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide flexible duct connection for all fans.
- .3 Provide backdraft damper at building exterior penetration.
- .4 Provide and install vibration isolation.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1        Submit product data in accordance with general requirements.
- .2        Indicate the following:
  - .1        Capacity.
  - .2        Throw and terminal velocity.
  - .3        Noise criteria.
  - .4        Pressure drop.
  - .5        Neck velocity.

**1.2                MAINTENANCE MATERIALS**

- .1        Include:
  - .1        Keys for volume control adjustment.
  - .2        Keys for air flow pattern adjustment.

**1.3                MANUFACTURED ITEMS**

- .1        Grilles, registers and diffusers of same generic type to be product of one manufacturer.

**1.4                CERTIFICATION OF RATINGS**

- .1        Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by them from independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1                GENERAL**

- .1        To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2        Frames:
  - .1        Full perimeter gaskets.
  - .2        Plaster frames where set into plaster or gypsum board and as specified.
  - .3        Concealed fasteners.
- .3        Concealed operators.
- .4        Colour and Finish: standard as directed by Consultant.

- .5 Acceptable materials:
  - .1 E.H. Price
  - .2 Nailor
  - .3 Krueger
  - .4 Titus
  - .5 Carnes
  - .6 Tuttle and Bailey

## **2.2 SUPPLY GRILLES AND REGISTERS**

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.3 RETURN AND EXHAUST GRILLES**

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.4 DIFFUSERS**

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.5 OPEN MESH SCREEN**

- .1 15 mm x 15 mm (½" x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.
- .2 On all open ends of ductwork and where indicated.
- .3 Size: To match ductwork size.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place.

- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.
- .5 Clean grilles upon completion.
- .6 Paint ductwork beyond grilles, matte black where visible.
- .7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1      All codes, standards, etc. as referenced shall be the latest edition.
- .2      ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

**1.2                PRODUCT DATA**

- .1      Submit product data in accordance with general requirements.
- .2      Indicate the following:
  - .1      Pressure drop.
  - .2      Face area.
  - .3      Free area.
  - .4      Colour and finish.

**1.3                CERTIFICATION OF RATINGS**

- .1      Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**1.4                TEST REPORTS**

- .1      Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**Part 2            Products**

**2.1                BRICK VENTS**

- .1      Construction: welded with exposed joints ground flush and smooth.
- .2      Material: extruded aluminum alloy 6063-T5.
- .3      Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").
- .4      Frame, head, sill and jamb: 100 mm (4") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.
- .5      Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .6      Screen: 15 mm (1/2") exhaust 20 mm (3/4") exhaust mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.7 Finish:  
Powder Coated  
Colour: to Consultant's approval.

.8 Acceptable materials:  
.1 Greenheck Model BVF  
.2 Construction Specialties  
.3 Airolite Co.  
.4 Krueger  
.5 Ruskin  
.6 Ventmaster  
.7 Ventex  
.8 Nailor

## 2.2 BRICK VENTS (FLANGE FRAME)

.1 Construction: welded with exposed joints ground flush and smooth.  
.2 Material: extruded aluminum alloy 6063-T5.  
.3 Blade: stormproof pattern.  
.4 Perimeter flange frame, head, sill and jamb: 40 mm (1½") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.  
.5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.  
.6 Screen: 15 mm (1/2") exhaust 20 mm (3/4") exhaust mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.  
.7 Finish:  
Powder Coated  
Colour: to Consultant's approval.  
.8 Options:  
.1 Straight duct extension.  
.2 Perimeter flange frame.  
.9 Acceptable materials:  
.1 Greenheck Model BVF  
.2 Construction Specialties  
.3 E.H. Price  
.4 Krueger  
.5 Ruskin  
.6 Ventmaster  
.7 Ventex  
.8 Nailor

**2.3 WALL BOXES**

- .1 0.3 mm (16 gauge) aluminum wall sleeve sized as noted on plans.
- .2 Extruded aluminum grille, 25 mm (1") perimeter flange with 4-hole screw fasten.
- .3 Bottom outlet with removable 15 mm x 15 mm (1/2") x (1/2") aluminum screen.
- .4 Neoprene backdraft damper with aluminum crimp on bottom edge.
- .5 Acceptable materials:
  - .1 Reversomatic
  - .2 Broan
  - .3 Ventex
  - .4 Shop fabricated (submit sample for approval).

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3 Anchor securely into opening.
- .4 Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1            General****1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ARI 210/240, Unitary Air-Conditioning, and Air-Source Heat Pump Equipment.
- .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.
- .6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 ANSI/UL 1995, Central Cooling Air Conditioning.
- .8 AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
- .9 AMCA 99 – Standards Handbook
- .10 AMCA 500 – Test Methods for Louver, Dampers, and Shutters.
- .11 AHRI 340/360 – Unitary Large Equipment.
- .12 NEMA MG1 – Motors and Generators.
- .13 National Electrical Code.
- .14 NFPA 70 – National Fire Protection Agency.
- .15 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.
- .16 UL 900 – Test Performance of Air Filter Units.

**1.2                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.

### **1.3 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.

### **1.4 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 MANUFACTURERS**

- .1 Trane
- .2 Lennox
- .3 Johnson/York
- .4 Daikin

### **2.2 GENERAL DESCRIPTION**

- .1 Furnish as shown on plans, Single zone Air Source Heat Pump Heating and Cooling Unit(s). Unit performance and electrical characteristics shall be per the job schedule
- .2 Configuration: Fabricate as detailed on prints and drawings:
  - .1 Return plenum/economizer section complete with power exhaust
  - .2 Filter section
  - .3 Cooling coil section

- .4 Supply fan section
- .5 Condensing unit section
- .3 The complete unit shall be cETLus listed.
- .4 The unit shall be ASHRAE 90.1-2016 compliant and labeled.
- .5 Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.
- .6 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
- .7 All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up report forms shall be supplied with each unit.
- .8 Efficiency:
  - .1 Units under 5 tons of cooling meet a SEER rating of 14.0.
  - .2 Units 6 tons of cooling and larger meeting an EER rating of 12.0 (9.6 for 12 ½ ton unit).
  - .3 Electronic controls with data link and diagnostic operation.
  - .4 Energy Star rated.

### **2.3 CABINET, CASING, AND FRAME**

- .1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 2" thick with an R-value of 13.0 and shall be 2-part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
- .2 Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat.
- .3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless-steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.
- .4 The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

## **2.4 OUTDOOR/RETURN AIR SECTION**

- .1 Unit shall be provided with an outdoor air economizer section. The economizer section shall be fully modulating integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in accordance with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.
- .2 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.
- .3 Unit shall be provided with a 100% outdoor air hood. The 100% outdoor air hood shall allow outdoor air to enter from the back of the unit, at the draw-through filter section. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

## **2.5 FILTERS**

- .1 Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" MERV 13. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with construction filters and 2 additional sets of final 2" MERV 13 filter. The contractor shall at building occupancy, the final set of filters per the contract documents.
- .2 Provide two (2) sets of final MERV 13 filters.

## **2.6 COOLING COIL**

- .1 The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.
- .2 The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

- .3 The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.
- .4 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.
- .5 The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

## **2.7 SUPPLY FAN**

- .1 Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a variable speed direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.
- .2 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.
- .3 Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.
- .4 The motor shall be T frame and open drip proof. Overload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
- .5 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

## **2.8 HEATING SECTION**

- .1 Gas Heat
  - .1 The rooftop unit shall include a back-up natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.
  - .2 Each module shall have modulating heating controls.
  - .3 The heat exchanger tubes shall be constructed of stainless steel.
  - .4 The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.



- .5 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber. Heater shall use a direct spark ignition system.
- .6 The factory installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

## **2.9 HEAT PUMP HEATING**

- .1 The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.
- .2 The refrigerant system shall have a pump-down cycle.
- .3 The unit shall have a natural gas furnace for hybrid heating. When the heat pump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.
- .4 Factory installed low ambient kit to extend operating range down to 0 °F.

## **2.10 CONDENSING SECTION**

- .1 Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.
- .2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of (0,25)-120°F. Mechanical cooling shall be provided to (0, 25) °F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
- .3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.
- .4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.

- .5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.
- .6 Each circuit shall be dehydrated, and factory charged with R-410A Refrigerant and oil.

## **2.11 ELECTRICAL**

- .1 Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color- coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 120- volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

## **2.12 UNIT CONTROLS**

- .1 Units shall be provided with factory mounted controls, wired and piped, to provide a fully automated start-up and accurately modulated discharge air temperature.
- .2 Burner on/off, modulation or staging control, and all safeties as required, shall be by a unit-mounted micro-processor controller
- .3 O.E.M. furnished controller, on units equal to or exceeding 5 tons nominal cooling capacity and/or equal to or exceeding 400 MBH nominal heating capacity, must use the following inputs for control:
  1. 0 Vdc to 10 Vdc (or 4 mA to 20 mA) analogue signal from Building Automation System for Discharge Air Temperature set-point.
  2. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
  3. Binary input from Building Automation System to command / enable / disable Heating
  4. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
  5. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
- .4 O.E.M. furnished controller, on units less than 5 tons nominal cooling capacity and/or less than 400 MBH nominal heating capacity, must use the following inputs for control:
  1. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
  2. Binary input from Building Automation System to command / enable / disable Heating

3. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
4. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
- .5 In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring.
- .6 Unit Control will be by the Building Automation contractor in accordance with Section 23 09 93.

## 2.13

### CONTROLS

- .1 Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.
- .2 The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in non-volatile memory. No settings shall be lost, even during extended power shutdowns.
- .3 The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/ disable, heat indication, cool indication, and fan operation.
- .4 All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.
- .5 The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in non-volatile memory to ensure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

- .6 The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:
- .1 Return air temperature.
  - .2 Discharge air temperature.
  - .3 Outdoor air temperature.
  - .4 Space air temperature.
  - .5 Outdoor enthalpy, high/low.
  - .6 Compressor suction temperature and pressure.
  - .7 Compressor head pressure and temperature.
  - .8 Expansion valve position.
  - .9 Condenser fan speed.
  - .10 Inverter compressor speed.
  - .11 Dirty filter indication.
  - .12 Airflow verification.
  - .13 Cooling status.
  - .14 Control temperature (changeover).
  - .15 Cooling status/capacity.
  - .16 Unit status.
  - .17 All time schedules.
  - .18 Active alarms with time and date.
  - .19 Previous alarms with time and date.
  - .20 Optimal start.
  - .21 Supply fan and exhaust fan speed.
  - .22 System operating hours.
    - .1 Fan
    - .2 Exhaust fan
    - .3 Cooling
    - .4 Individual compressor
    - .5 Heating
    - .6 Economizer
    - .7 Tenant override

- .7 The user interaction with the keypad shall provide the following:
  - .1 Controls mode
    - .1 Off manual
    - .2 Auto
    - .3 Heat/Cool
    - .4 Cool only
    - .5 Heat only
    - .6 Fan only
  - .2 Occupancy mode
    - .1 Auto
    - .2 Occupied
    - .3 Unoccupied
    - .4 Tenant override
  - .3 Unit operation changeover control
    - .1 Return air temperature
    - .2 Space temperature
    - .3 Network signal
  - .4 Cooling and heating change-over temperature with deadband
  - .5 Cooling discharge air temperature (DAT)
  - .6 Supply reset options
    - .1 Return air temperature
    - .2 Outdoor air temperature
    - .3 Space temperature
    - .4 Airflow (VAV)
    - .5 Network signal
    - .6 External (0-10 vdc)
    - .7 External (0-20 mA)
  - .7 Temperature alarm limits
    - .1 High supply air temperature
    - .2 Low supply air temperature
    - .3 High return air temperature
  - .8 Lockout control for compressors.
  - .9 Compressor interstage timers
  - .10 Night setback and setup space temperature.
  - .11 Building static pressure.
  - .12 Economizer changeover
    - .1 Enthalpy
    - .2 Drybulb temperature

- .13 Currently time and date
- .14 Tenant override time
- .15 Occupied/unoccupied time schedule
- .16 One event schedule
- .17 Holiday dates and duration
- .18 Adjustable set points
- .19 Service mode
  - .1 Timers normal (all time delays normal)
  - .2 Timers fast (all time delays 20 sec)
- .8 If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
  - .1 Zone sensor with tenant override switch
  - .2 Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)
- .9 To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
  - .1 Airflow
  - .2 Outside air temperature
  - .3 Space temperature
  - .4 Return air temperature
  - .5 External signal of 1-5 vdc
  - .6 External signal of 0-20 mA
  - .7 Network signal

#### **2.14 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.

#### **2.15 CAPACITY**

- .1 As indicated.

#### **2.16 ACCESSORIES**

- .1 600 mm (24") high roof curb.
- .2 Vibration isolation rail.
- .3 Opposed blade economizer dampers.
- .4 Condenser coil hail guard.
- .5 Power exhaust.

- .6 Stainless steel vertical extension on flue gas discharge.
- .7 Stainless steel heat exchanger.

## **2.17 ELECTRICAL REQUIREMENTS**

- .1 As indicated.
- .2 Field installed devices.
  - .1 Provide all field installed wiring required for all units that are equipped with power exhaust. Provide transformers as required.
- .3 Mount all accessories shipped loose onto the units.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated. Provide all necessary continuous wolmanized 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 manufacturer 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 stainless steel heat exchanger.

**END OF SECTION**

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HDSB Division 25

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Section 25 09 23

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Direct Digital Control System for HVAC

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## 1. General

### 1.1 Summary

1. The approved Building Automations System Contractor per 2.1, referred to herein as the Contractor, shall provide a complete Direct-Digital Control System as indicated on the project documents in accordance with the drawings and as described in these specifications.
2. Where existing legacy controls exist, the Contractor shall be responsible for the removal and preservation of existing controls and accessories, and to engineer, permit, provide and install a fully functioning Building Automation System which meets the requirements detailed herein.
3. Where an Owner or Owner's representative provided points / object and equipment list is not provided as part of the bid package, the Contractor shall be responsible to verify existing site conditions and/or review all available drawings so to ensure all existing and/or currently proposed equipment at the facility is identified in accordance with 1.3.2, and is made part of the complete Direct-Digital Control System.
4. The work administered by this Section of the technical specifications shall include all engineering, programming, labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required for a complete and fully functional Controls Systems.

### 1.2 Related Sections:

- A. General and Supplementary Conditions
- B. Division 01 General Requirements
- C. Division 20, 22, 23 and 25 Mechanical Requirements
- D. Division 26 Electrical Requirements

### 1.3 Design Instructions

1. Design shall meet the functional intent of an "open", and interoperable Building Automation System, comprised of a network of stand-alone digital controllers. incorporating the Niagara 4 Framework®.
2. The Building Automation System is to include, but not limited to, the monitoring and/or control of ALL of following equipment instances at each specified site:
  1. HVAC Equipment
  2. Exhaust fans
  3. Heaters
  4. Exterior Lighting
3. The system shall be modular in nature and designed for future flexibility so to accommodate the addition of functionality, control points or expansion of facility.
4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications

shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the B-BC shall have no effect on the field controllers, including those involved with global strategies

5. Coordinate the specifications and equipment schedules in related sections for manufacturer furnished DDC systems to ensure the minimal hardwired points and sequences can be met in accordance with Section 23 09 93. OEM DDC Systems, that meet the minimum hardwired points are preferred and approved for use with the following equipment ONLY; boilers, main air handling equipment and, chillers. The supplier of the equipment is responsible for the configuration, programming, start-up, and testing of that product to meet the sequence of operation and specifications. The supplier shall also provide any licensing, hardware, and software required for interface to the DDC system.

#### **1.4 Definitions**

BAS	Building Automation System
B-BC	BACnet Building Controller
B-AAC	BACnet Advanced Application Controller
B-ASC	BACnet Application Specific Controller
BACnet / BACnet Standard	Building Automation and Controls Network - ANSI/ASHRAE Standard 135-2012
BACnet/IP	BACnet Annex J – describes how BACnet devices can make use of IP directly for communicating across IP-based terminals
BBMD	BACnet Broadcast Management Device, see BACnet Annex J
BIBB	BACnet Interoperability Building Blocks: A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task
BTL	BACnet Testing Laboratory: A recognized, independent third party laboratory certified to test product for compliance to BACnet standards. BTL Certified products are indicated by a registered seal affixed to the product.
B/I	Binary Input
B/O	Binary Output
COV	Change of Value
cUL	Underwriters Laboratory Canada
DDC	Direct Digital Control
D/I	Digital Input
D/O	Digital Output
Embedded Control	Some OEM's (Original Equipment Manufacturer) equipment have a factory installed controller. These controllers must follow these standards. Examples can be found in chillers, boilers, variable frequency drives, etc. Proprietary communication protocols will not be allowed.
Gateway	A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them (ASHRAE/ANSI 135-2004). Gateways are NOT to be included unless approved by the Owner.
GUI	Graphical User Interface
HVAC	Heating, Ventilation and Air-Conditioning
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
LAN	Local Area Network (an individual school or site)
MS/TP	Master Slave Token Passing: Data link protocol as defined by the BACnet Standard. Operates over a serial field bus network (RS485)
NEMA	National Electrical Manufacturers Association
PICS	Protocol Implementation Conformance Statement: All devices conforming to the BACnet protocol shall have a documented statement that identifies all portions of BACnet that are implemented in the device.
P.I.D.	Proportional Integral Derivative
Shall	indicate a requirement that, in the view of the Board, must be complied with
UPS	Uninterruptible Power Supply Unit
VFD	Variable Frequency Drive
VLAN	Virtual Local Area Network: Dedicated for Facilities Services equipment

WAN	Wide Area Network (board wide)
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1. Definitions of terms used in this section may differ from those given in general and supplementary
2. conditions and take precedence over them.

**1.5 Reference Standards**

1. Where edition date is not specified, consider that references to the manufacturer’s data, and published codes, standards and specifications are made to the latest edition or revision, approved by the issuing organization.
2. Reference Standards and specifications are quoted to establish minimum standards. Work in which quality exceeds the specified minimum will be considered to conform.
3. The requirements of the Contract Documents govern over the requirements of reference standards and specifications.
4. Standards, specifications, associations, and regulatory agencies are generally referred to throughout the Contract Documents by their abbreviated designations, as listed below:
  1. AMCA American Movement and Air Control Association
  2. ANSI American National Standards Institute
  3. ARI Air Conditioning and Refrigeration Institute
  4. ASME American Society of Mechanical Engineering
  5. ASTM American Society for Testing and Materials
  6. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
  7. CGA Canadian Gas Association
  8. CGSB Canadian General Standards Board
  9. CSA Canadian Standards Association
  10. NFPA National Fire Protection Association
  11. SMACNA Sheet Metal and Air Conditioning Contractors’ National Association
  12. ULC Underwriters’ Laboratories of Canada

**1.6 System Architecture and Description**

1. The Building Automation System as detailed in this Section shall be based on a hierarchical architecture incorporating the Niagara 4 Framework® through Tier 1 and 2 inclusive. Systems not developed on the Niagara 4 Framework® platform are unacceptable.
2. All Niagara 4 Framework® components shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification.
3. All devices supplied under this specification, excluding sensors, shall be connected to the site LAN and shall communicate natively using the following BACnet/IP, BACnet MS/TP, Peer to Peer, or Ethernet (ISO 8802-3), as defined in the ANSI/ASHRAE Standard 135, latest or Peer-to-Peer using Niagara’s Fox Protocol or SNMP.
4. Program databases, data acquisition and all control sequence logic shall reside in the respective B-BC, B-AAC and B-ASC controller. Each device shall, to the greatest extent possible, perform

its programmed sequence. Operation of each device shall not be dependent on a connection to a server or master controller.

5. The B-BC and any B-AAC or B-ASC shall be capable of updating firmware without the replacement of any hardware, microprocessors, or chips.
6. Each school / site shall be furnished with a single B-BC, which is responsible for and capable of providing fully distributed control including user access control and all necessary site computations at the site, independent of or under the Enterprise Management System and it must be stand-alone, multi-tasking, multi-user with a real-time digital processor. All controlled objects, sequences and associated operational parameters shall be both operator definable and modifiable through the embedded User Interface.
7. The B-BC shall provide a web-based graphical user interface for programming, monitoring, and control, independent of any Enterprise Management System, be accessible remotely from a central site(s) and locally. The web-enabled user interface shall operate on an industry standard web-browser without the requirement of additional plugins.
8. Each Mechanical or Electrical System and/or major piece of mechanical or electrical equipment shall have 1 dedicated B-AAC controller with sufficient I/O capacity such that it shall be connected to ALL field devices and points associated with that system, space and/or piece of equipment. B-ASC use shall be limited to VAV box applications provided the full functional intent can be met within the singular device.
9. Mechanical and Electrical Systems i.e., VFD's, chillers, boilers, unitary equipment, etc. units that are equipped with manufacturers furnished controls shall be BTL certified. Gateways are not to be used unless prior written approval has been acquired. A single B-AAC can be used in combination with the manufacturer supplied controls, only where the manufacturer's controls are unable to meet the functional intent, it shall be implemented in accordance with Section 23 09 93.
10. The use of multiple application controllers used to control a single piece of equipment is strictly prohibited, except those specifically noted in 1.6.9.
11. The system shall include real time monitoring of the following utilities; electricity (main feed), natural gas (main), and water (main). Meters supplied under this division shall communicate BACnet Natively. For existing meters, utility owned, coordinate integration requirements with the respective utility provider.
12. The B-BC shall be connected to the HDSB Facilities VLAN, in accordance with Section 25 00 00, to be supplied by the Owner at the Owners expense.
13. Site workstations, otherwise referred to as Caretaker PC, will be provided by the Board.

### **1.7 Hardware and Software Licensing**

1. The Owner shall be named license holder of all controllers and components, software and firmware supplied under this specification. The Owner shall receive ownership of all project specific configuration documentation, data files, and application-level software developed for the site.
2. The Owner shall have unrestricted access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the building automation system
3. All software provided shall be full featured and not limited or trial version.

**1.8 User Control Over Configuration**

1. The intent of this specification is to provide a system which shall allow the Board to independently do its own modifications to all objects, operational parameters, and sequences.

**1.9 Intellectual Property and Proprietary Material**

1. The Board shall sign a software and hardware licensing agreement, upon review and agreement of terms and conditions, as a condition of contract. Such license will grant use of all programs and application software to the Board and its representatives, as defined by the agreement, and shall protect the manufacturer’s rights to disclosure of intellectual property contained within such software.

**1.10 System performance**

1. The System shall conform to the following minimum:
  1. The system shall report values with minimum end-to-end accuracy listed in Table 1.

Table 1 - Reporting Accuracy	
Measured Variable	Reported Accuracy
Space Temperature	1% of range
Ducted Air Temperature	1% of range
Outside Air Temperature	±1°C (±2°F)
Water Temperature	1% of range
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see note 2)
Carbon Dioxide (CO <sup>2</sup> )	±50 ppm
Electrical (kW, kVA, kWh, A, V, pF)	±1% of reading (see note 3)

Note 1: 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

2. Control Stability and Accuracy shall maintain measured variable at set-point within tolerances listed in Table 2.

Table 2 – Control Stability and Accuracy		
Controlled Variable	Control Accuracy	Range of Medium Accuracy
Air Pressure	±50 Pa (±0.2 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
	±3 Pa (±0.01 in. w.g.)	
Airflow	±10% of full scale	
Space Temperature	±1°C (±2°F)	
Duct Temperature	±1.5°C (±3°F)	
Fluid Pressure	±10 kPa (±1.5 psi)	MPa (1-150 psi) 0-12.5 kPa (0-5- in. w.g.) differential
	±250 Pa (±1 in. w.g.)	

### **1.11 Work covered by the contract documents**

1. The Scope of Work for the Building Automation Systems Contractor shall include, but is not limited to the following:
  1. Demolition: all existing Building Automation Control(s) and accessories being replaced shall be removed from site and disposed of in accordance with local regulations. Prior to disposal, provide a list of controllers and accessories to Owner, which will be salvaged and remitted to the Owner for the explicit use of maintaining existing legacy systems at other sites.
  2. Furnish and install all necessary controllers, control and/or ancillary devices, sensors, wiring, pneumatic peripherals and tubing, software, licenses, and programming to deliver a complete and functional building automation system, which meets the functional intent of the systems design.
  3. The naming and addressing of all objects and devices to be in accordance with the specifications.
  4. Configure the web-based user interface embedded in the B-BC in accordance with the specifications.
  5. Coordinate equipment specifications for related sections necessary to meet the functional intent including: variable frequency drives, dampers, valves, actuators, and peripheral devices considered to have wet surfaces such as pressure taps, thermal wells, flow switches, flow meters, etc., preference is given to these devices being furnished by the Original Equipment Manufacturer, where applicable.
  6. Review and coordinate with other related sections so to ensure all mechanical and electrical systems and components to be integrated have the necessary hardware and software to meet the points and sequences specified.
  7. Coordinate with the Owner, the setup and communication of the B-BC on the Owners supplied VLAN, in accordance with the specifications.
  8. Coordinate with the Owner and the respective utility provider, the installation and setup of utility metering equipment or the integration of any existing meters, in accordance with the specifications.
  9. Identify and label all controllers and associated devices including but not limited to connected I/O points, address', network id, etc.
  10. Verification of existing equipment operation, and notifying Owner of any deficiencies
  11. Attain, where required, all necessary permits and inspections
  12. Commissioning of new BAS
  13. Submit the required documentation as described herein, including, but not limited to submittals, project record, start-up, commissioning, testing, acceptance documentation and system warranty
  14. Operator Training

### **1.12 Products Furnished but not Installed by the Building Automation Contractor**

1. Hydronic Piping:
  1. Control Valves
  2. Temperature Sensor Wells and Sockets

- 2. Refrigerant Piping:
  - 1. Pressure Transducers
- 3. Ductwork Accessories:
  - 1. Automatic Dampers
  - 2. Air Flow Switches

**1.13 Products not Furnished or Installed but Integrated by the Building Automation Contractor**

- 1. Fire Alarm Systems
  - 2. Unitary and Packaged Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)
- Responsibility Matrix by Division Contractor

Work / Item / System	Furnish	Install	Control Wiring	Power
Control System Communication Wiring	23 09 23	23 09 23	23 09 23	n/a
Controls Equipment, panels, enclosures, and accessories	23 09 23	23 09 23	23 09 23	23 09 23
Interface to OEM furnished controllers supplied under Division 23	23 09 23	23 09 23	23 09 23	23 09 23
HVAC Manufacturer furnished space mounted controls (i.e., thermostat)	n/a	n/a	n/a	n/a
Starters, operator switches			23 09 23	26
Automatic Damper (not OEM installed)			23 09 23	
Automatic Damper Actuators	23 09 23	23 09 23	23 09 23	
Fire Alarm control monitoring relay	28	28	23 09 23	26

**1.14 Quality assurance**

- 1. The Controls Contractor shall be responsible for inspection and quality assurance for all materials and workmanship provided
- 2. The Controls Contractor shall have an established working relationship with the proposed BAS manufacturer of not less than 3 years.
- 3. The Controls Contractor shall have successfully completed all control system training and certification as required by the manufacturer.

**1.15 Permits, Inspections and Testing**

- 1. Contractor will arrange for submission to the Electrical Safety Authority (ESA) for review of this project and pay all associated fees. Provide Certificate(s) of Acceptance from ESA and other Authorities having jurisdiction upon completion of the Work.



2. Where modification to mechanical or electrical equipment control wiring is necessary to meet the requirements of the specifications, the contractor is responsible for arranging any testing required by the Authority Having Jurisdiction to maintain the required certification and ensure the safe operation of the equipment modified.

#### **1.16 Performance Verification of Installed Equipment**

1. Installed equipment may be subject to performance verification as specified herein if required by Owner or Owner's Representative(s).
2. When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.
3. If requested, Contractor shall arrange for services of independent testing agency.
4. Maintain building comfort condition when equipment removed from service or testing purposes.
5. Promptly provide Owner, or Owner's Representative(s) with test reports.
6. Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay costs resulting from performance verification procedure.
7. Should test results reveal equipment does not meet specified performance, equipment will be rejected and the following shall apply:
  1. Remove rejected equipment. Replace with equipment that meets requirements of Contract Documents, including specified performance requirements.
  2. Replacement equipment may be subject to performance verification as well; use same testing procedures as performed on originally installed equipment.
  3. Contractor shall pay costs resulting from performance verification procedure.

#### **1.17 Submittals**

1. All submittals and documentation including complete BAS System Engineering Design Submittal & Drawings, Project Record Documents, Application Engineering Documents and Owner's & Maintenance Manuals shall be submitted electronically in the form of an Adobe Portable Document Format (.pdf). All Control Schematics, Wiring Diagrams, Riser Diagrams, &c. shall be formatted for A3 11" x 17". Floor Plans shall be submitted in CAD format (.dwg). All other documentation may be formatted for 8.5" x 11".
2. Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents.
3. Complete BAS Engineering Design Submittal & Drawings shall be prepared in accordance with Section 1.20 using the following guidelines:
  1. Submittal documentation and drawings shall consistently use the same abbreviations, symbols, nomenclature, and identifiers. Each control system element shall be assigned a unique identifier pursuant with the Contract Documents

Submit the following:

2. A complete bill of materials of all equipment, controllers, devices, sensors, actuators, valves, etc., necessary to meet the requirements detailed herein is to be provided, indicating unique equipment identifier/tag, unique device/controller identifier/tag, manufacturer, and model number.

3. Riser diagram of Local Area Network (LAN) shall outline execution and details of all network cabling, BAS & Network Hardware including the following:
  - a. All BAS/DDC Hardware with controller number, MAC Addresses where required, unique identifier/tag, location, equipment, and service
  - b. All Network Hardware with unique identifier, location, and service
  - c. Network cabling configuration and execution specification
  - d. Location of all cabling termination points and End of Line (EOL) terminators
  - e. Location of all network interface jacks
  - f. A separate riser diagram shall be provided for each network segment
4. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include for every BAS component including but not limited to the following:
  - a. Gateways or BBMD associated networking peripherals
  - b. Control Valves
  - c. Dampers
  - d. Actuators
  - e. Variable Frequency Drives

#### **1.18 Substantial Completion Requirements.**

1. Contractor shall provide checklist for completion before Substantial Completion Field Review. Provide written declaration that work is complete. The following items shall be complete before Substantial Completion Field Review:
  1. Mechanical and Electrical systems capable of operation with Building Automation System, in operation with alarms functional.
  2. Tests on systems and equipment completed and certificates of approval obtained from regulating Authorities.
  3. Fire stopping completed, if required.
  4. Valve tagging completed and equipment, ductwork and piping identified.
  5. Escutcheons installed.
  6. Extended warranty form mailed to manufacturer and copy provided to Owner.
  7. Ensure access doors suitable located and equipment accessible.
  8. Ensure electrical connections to mechanical equipment are complete and motor rotation correct.
  9. Equipment cleaned inside and out, lubricated and paint touched-up
  10. Commissioning, Testing, Demonstration and Acceptance
  11. Complete program back-up and system files provided and verified for functionality

### 1.19 Project Record

1. Upon completion of installation and systems commissioning, submit record documents for review. "As-Built" Project Record Documents should include:
  1. Project Record Application Engineering Drawings shall include all BAS System Engineering Design Submittal with Drawings updated to reflect actual field conditions, architecture, and execution
  2. Electronic Operating & Maintenance (O&M) Manual including:
    - a. Operator's Manual with Manufacturers' complete operating instructions.
    - b. Documentation of all project specific Application and DDC programs
    - c. All necessary system Administrator-Level passwords and/or required access credentials
    - d. Information required for programming BAS
    - e. Complete Final Point Schedule including all hardware and software data points and documentation of calibration and configuration values for all Inputs, Outputs, Variables and PID Loops at the conclusion of systems commissioning and functional testing.
    - f. Routine preventative maintenance procedures, corrective diagnostic troubleshooting procedures and calibration processes
    - g. Final Bill of Material with all installed parts, manufacturers, manufacturers' part numbers and ordering information
  3. Sequence of Operation shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. No operational deviation from specified Sequences of Operation as outlined in Contract Documents shall be permitted without prior written approval. Sequences of Operation shall include and conform to the following:
    - a. Refer to equipment and control devices by their specific unique identifiers/tags pursuant with the Contract Documents and BAS Submittal package.
    - b. Clearly represent actual Application Programming methodology and functional control operation. Do not merely provide a copy of Contract Document specified Sequence of Control.
    - c. Include description of functional system operation under normal and failure conditions.
  4. BAS Control Schematics and Wiring Diagrams shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. BAS Control Schematics and Wiring Diagrams shall include and conform to the following:
    - a. Floor plan showing exact location, MAC addresses where required, including unique identifiers of all hardware supplied under this section.
    - b. Control Schematic flow diagram of each system (air, water, gas, & etc.) being controlled showing actual physical configuration and control device/sensor location of all fans, coils, dampers, valves, pumps, heat exchangers, control devices, &c. including each hardware point type, controller and associated ancillary devices.

- c. Controller termination details showing every controller point termination.
- d. Wiring Diagrams of all packaged equipment, motor starters, relay wiring, equipment interlock, safety circuits, & etc. clearly indicating all interconnecting wiring and termination of all conductors and cables including labels of all cables and points.
- e. Control Enclosure details for every enclosure including panel identifier, location, physical lay-out, dimensions, instrumentation, labels, & etc. Also include detail wiring (I/O, network, and power) and power source for each panel, transformer and controller.

**2. Products**

**2.1 Approved Manufacturers**

- 1. The following controls hardware and software, in no particular order of preference, are approved for use:

<b>Manufacturer</b>	<b>Tier 2 Product Line</b>	<b>Manufacturer Assigned Vendor</b>
Alerton	AIE Niagara 4	HTS Engineering Ltd (115 Norfinch Drive, North York, ON)
Distech Controls	EC-BOS Niagara 4	Energy Controls & Mechanical Services Inc. (Kitchener)

**2.2 Sole Vendor Site Designation**

- 1. A site or school with an existing B-BC meeting the specifications detailed in 2.3 shall determine the Approved Manufacturer for the respective site.
- 2. Any minor site additions or upgrades, requiring manufacturer specific products as detailed herein will be that of the Approved Manufacturer for the site, per 2.3.
- 3. The Board reserves the right to change the status of an Approved Manufacturer at any time should they not meet the performance or requirements detailed herein.

**2.3 Building Controller (B-BC)**

- 1. The B-BC shall be BTL certified, communicate BACnet Natively and incorporate the Niagara 4 Framework®.
- 2. The B-BC shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of “\*”, it shall be understood to mean that parameter is open to all possible values. Note that this will result in the following entries in the license.dat file:

Specific Feature	license.dat file entry value
Owner	"HDSB"
Project	"HDSB"
BrandId	"*" preferred, "Distech" or "Alerton" acceptable
accept.station.in	"*"
accept.station.out	"*"
accept.wb.in	"*"
accept.wb.out	"*"
<b>Expiration</b>	
All expiration instances	"never"
<b>Limit</b>	
<sup>1</sup> All .limit instances	"none"
<b>Export</b>	
BACnet	"true"
obix	"true"
<b>Import</b>	
rdbSqlServer	"true"
<b>web</b>	
ui	"true"
ui.wb	"true"
ui.wb.admin	"true"

<sup>1</sup> With the exception of limitations defined by hardware configuration

3. The B-BC shall function in a real-time, multi-tasking networked operating environment. It must complete all necessary site computations based on information from any object in the internetwork and locally execute global strategies and supervisory control for all field devices supplied under this specification, without additional hardware or software and independent of or under a B-AWS. It shall be capable of executing application control programs to provide the following:
  1. Calendar Functions
  2. Scheduling
  3. Trending and Data Management
  4. Alarm Monitoring and Routing
  5. Real-Time Clock and Network Time Synchronization
  6. Network and User Management functions for all devices on the LAN
4. The B-BC shall be equal to a JACE 8000 and be supplied with the following hardware features as a minimum
  1. two (2) Ethernet ports
  2. one (2) RS-485 BACnet MS/TP port
  3. one (1) USB port
  4. Wi-Fi connectivity
  5. expansion capability

6. a battery backup and/or non-volatile memory. If battery backup or non-volatile memory is not available an Uninterruptable Power Supply must be provided to maintain program file and data base for a minimum 24 hours.
5. The B-BC shall contain sufficient memory to support its own operating system, User Interface, all specified control strategies and objects, energy management applications, data storage and trending, alarm annunciation, and network management.
6. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.
7. The B-BC must enable access to the complete BAS system installed under this section, via web-browser. Access includes but is not limited to comprehensive programming capabilities for all controllers and real-time operational values via an embedded web-browser Graphical User Interface (GUI). The GUI shall support the latest version of standard web-browsers, without the requirement of additional plugins or software, and must be configured in accordance with these specifications.
8. The B-BC shall provide alarm management to monitor, buffer, and direct alarms and messages to operator devices and memory files, to be assigned in accordance with these specifications. Each B-BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.
9. The B-BC shall have the ability to collect and archive any data, for any property of any object on the LAN, in accordance with these specifications. The embedded UI shall be capable of configuring the collection of data. The data shall be accessible in either the following formats, XML or CSV from the WAN Server Supervisory Software or through a standard web-browser.
10. The B-BC shall be capable of maintaining an Audit log that tracks and archives all activities performed.
11. The B-BC shall provide, a minimum of four (5) levels of local access privileges. The highest level, Administrator Level, shall allow the BAS administrator to perform application, database, and user management functions. Each login credentials shall be assigned to a pre-defined level of access.
12. The B-BC shall provide WAN access privileges, including a comprehensive list of accessibility/functionality items, to be enabled or disabled for each user according to the level of access granted. Operators shall be able to perform only those commands available for the access level assigned to their login credentials. Login credentials are to be looked up using the Lightweight Directory Access (LDAP) through the BAS server.

#### **2.4 Advanced Application Controllers (B-AAC)**

1. B-AAC's shall be BTL Certified.
2. B-AAC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.
3. Each B-AAC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

4. The B-AAC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. The B-AAC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.
7. Each B-AAC shall be supplied with a minimum 3 spare Universal I/O's.

### **2.5 Application Specific Controllers (B-ASC)**

1. B-ASC use is limited to VAV box and will not be accepted for use in any other application.
2. B-ASC's shall be BTL Certified.
3. B-ASC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.
4. Each B-ASC shall contain sufficient memory to support its own operating system, data storage and programming requirements.
5. The B-ASC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
6. Controllers that perform scheduling shall have a real-time clock.
7. The B-ASC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.
8. Each B-ASC shall be supplied with a minimum 3 spare Universal I/O's.

### **2.6 Room and Space Control Devices**

1. Room sensors, associated with each "Room Controller" detailed in Section 23 09 93, are to be communicating type complete with integral override button, configurable set-point / offset adjustment and without a display. Only the following room sensors, associated with occupant comfort, are approved for use:

DisTech Controls - Allure EC-Smart-Comfort-SO  
Alerton - Microtouch Wall Sensor

## **3. Part 3 – Execution**

### **3.1 Installation**

1. The BAS contractor is responsible to verify that equipment can be installed in accordance with the manufacturer's instructions and as detailed within these specifications, as such the contractor shall inspect the site and report any discrepancies, conflicts or omissions to the Owner or it's representative, for resolution prior to the commencement of work.
2. Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

### **3.2 Object and Point Naming**

1. Where the first four segments of the object / point name are configured by virtue of the Niagara Network Device Addressing, only the 5<sup>th</sup> segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.
2. All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:
  1. First five characters = School's unique identifier
  2. Sixth character = Network number
  3. Seventh and eighth characters = Device number
  4. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier
  5. Last segment = Point name abbreviationExample: S1156\_2\_15\_HP10\_RmTemp (S1156 = Forest Trail, 2 = Network 2, 15 = 15<sup>th</sup> device on network, HP10 = heat-pump 10, RmTemp = Room Temperature)
3. Object name segment shall be delimited by ( \_ ) character, however, must be consistent by Vendor across all Board sites
4. Where a BACnet object or point name is not explicitly detailed in Schedule A of these Specifications, the Owner shall supply the required information including, but not limited to, device name, instance number, point name, units, meta tag, etc.,

### 3.3 Controller and Device Addressing

1. Where the first four segments of the Controller and Device Addressing are configured by virtue of the Niagara Network Device Addressing, only the 4<sup>th</sup> segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.
2. Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

#### Device Instance

1. First five characters = School's unique identifier
2. Sixth character = Network number
3. Seventh and Eighth character = Device number
4. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

Example: S1156\_2\_15\_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15<sup>th</sup> device on network, HP10)

#### BACnet Network Number

1. First five characters = School's unique identifier



2. Sixth character = Network number

3. Seventh = Network and Type

Example: S1156\_2\_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1<sup>st</sup> MS/TP network)

#### MAC Addresses

0. B-BC

1. Maintenance Connection

2. Reserved

3. – 127. Master Range

128. – 254. Slave Range

255. Broadcast

2. Object name segment shall be delimited by ( ) character, however, must be consistent by Vendor across all Board sites

### 3.4 Controller / Device Naming

1. Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

#### Device Instance

1. First five characters = School's unique identifier

2. Sixth character = Network number

3. Seventh and Eighth character = Device number

4. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

Example: S1156\_2\_15\_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15<sup>th</sup> device on network, HP10)

#### BACnet Network Number

4. First five characters = School's unique identifier

5. Sixth character = Network number

6. Seventh = Network and Type

Example: S1156\_2\_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1<sup>st</sup> MS/TP network)

#### MAC Addresses

4. B-BC

5. Maintenance Connection

6. Reserved

7. – 127. Master Range

129. – 254. Slave Range

255. Broadcast

2. Object name segment shall be delimited by ( ) character, however, must be consistent by Vendor across all Board sites

### 3.5 School's Unique Identifier

1. The School's Unique Identifier will be provided by Owner and must be used in the first segment, for all device, network, object, and point names.

### **3.6 Controller / Equipment Identifier**

1. The Controller / Equipment Identifiers are restricted to dedicated B-AAC and B-ASC controllers. Identifiers are limited those listed below. Where an identifier is not listed below the Owner shall supply the required information.

1. AC# = Air Conditioning Unit
2. AHU# = Air Handling Unit
3. Blr# = Boiler
4. BPB# = By-Pass Box (constant volume)
5. Chiller# = Chiller
6. CU# = Condensing Unit
7. HVAC# = HVAC Unit
8. HVAC#VAV# = HVAC Unit (associated with) Variable Air Volume Box
9. HP# = Heat pump
10. HWLoop# = Heating Water Loop
11. HpLoop# = Heat-pump Loop
12. HX# = Heat Exchanger
13. MAU# = Make-up Air Unit
14. Tower# = Cooling Tower
15. UV# = Unit Ventilator
16. VRF# = Variable Refrigerant Flow Condensing Unit
17. VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit
18. VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit

2. Where a dedicated B-AAC or B-ASC is not configured specific to a system or unit, controller identifier is to be approved by Owner.

### **3.7 Point Name Abbreviation**

1. The Object / Point Name convention must be followed for the objects / points as listed in Schedule A of this Section, note abbreviations are case sensitive.
2. Where an identifier is not listed below the Owner shall supply the required information.

### **3.8 Programming**

1. Sequences of Operation are to be programmed in accordance with Section 23 09 93
2. Programs for like equipment i.e, heat-pump, unit heater, etc. shall be consistent by controls vendor across the facility and all Board sites.

### **3.9 History and Trending**

1. A minimum of 7 days history shall be maintained within the B-BC for the points identified in Schedule A of this Section.
2. Data stored in the B-BC shall be uploaded to the B-AWS in accordance with Section 25 00 00.

3. Default Graphical trends, Navigation button per 3.9, shall be pre-configured.

### **3.10 Scheduling**

1. Scheduling feature shall include seven-day schedule, plus holiday or event schedule, each with start time and stop time. Schedules shall be individually editable for each day and holiday.
2. The scheduling feature shall allow for each individual equipment to be assigned to one of the Schedule Groups which includes, but is not limited to:
  1. Administration
  2. Gymnasium
  3. First Floor Classrooms
  4. Second Floor Classrooms
  5. Kindergarten
  6. Library
  7. Daycare
  8. Theatre
  9. Cafeteria
  10. Refuge
3. The Areas, associated schedule, and equipment grouping will be provided by Owner.
4. Timed override feature shall allow a temporary change of the scheduled equipment. An override command shall be selectable by an individual unit, all units assigned to a given schedule group, or to all units in a building. Timed override shall terminate at the end of the event. Timed override feature shall be allowed by a password level.

### **3.11 Demand Limiting**

1. Programming or schedules shall incorporate a delay such that there is a delay between the start-up of each Schedule Group.
2. Equipment within the Schedule Group shall incorporate a delay such that there is a delay between the start-up of individual equipment within the Schedule Group.

### **3.12 Alarms**

1. Logical and consistent alarm strategy must be used as defined within these specifications. The alarm strategy detailed herein applies to those objects identified in Schedule A of this section. It is expected that additional alarms be added when applicable, Owner to determine class.
2. Alarms, not classified as Emergency or Communication / Network, shall have the following values adjustable: threshold, limit and time delay.
3. Alarm actions, defined by Alarm Class, shall be annunciated as follows:
  1. Emergency (E): email, header button red, graphic with flashing alarm object, Alarm Portal B-BC record
  2. High Priority (H): graphic with flashing alarm object, header button red, Alarm Portal B-BC record
  3. General (G): Alarm Portal B-BC Record
4. The complete object / point name shall be included in every alarm message, refer to "Object and Point Naming" within this specification section.

5. The minimum shall be recorded by the B-BC for each alarm:

1. Time and Date
2. Complete object / point name
3. Acknowledge time, date, and user who issued acknowledgement

### 3.13 User Access

1. Set up the following 5 password levels to include the specified capabilities.
  1. Level 1: (The Board's BAS Administrator)  
Level 2 capabilities.  
All administrative rights  
View, add, change and delete usernames, passwords, password levels.  
All unrestricted system capabilities including all network management functions.
  2. Level 2: (TBD)  
Level 3 capabilities.  
Configure system software.  
Modify control unit programs.  
Modify graphic software.  
Unrestricted except for viewing or modifying usernames, passwords, password levels.
  3. Level 3: (Approved Facilities Staff and Board's HVAC Maintenance Technicians)  
Level 4 capabilities.  
Temporary override of designated objects and/or points.  
Temporary set-point value change.  
Change selected equipment schedules.
  4. Level 4: (Approved Facilities Staff)  
Level 5 capabilities.  
Acknowledge alarms.  
Change selected equipment schedules.
  5. Level 5: (Read Only)  
Display all graphic data.  
Trend point data.
2. Level 1 and 5 will be accounts which reside locally within the B-BC.
3. Level 2 through 4 will be will use LDAP for login credential authentication.

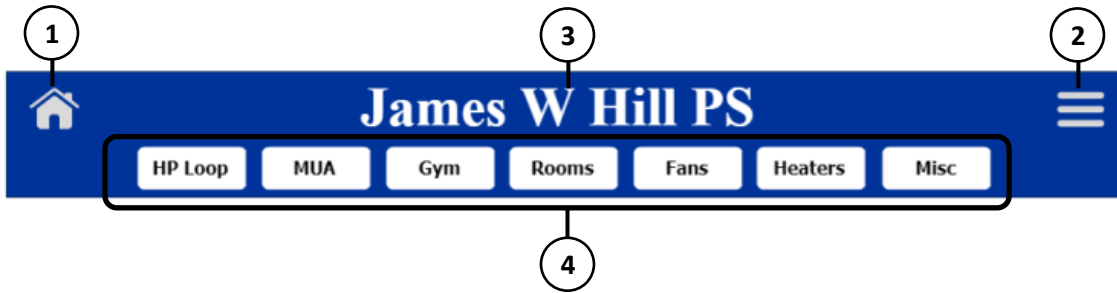
### 3.14 Graphical User Interface

1. Provide a colour graphic home screen, floor plans, system flow diagrams for each system and summary screens, designed and sized for iPad, with all points indicated on the points list in Schedule A of this Section, and in accordance with these specifications.
2. All graphics shall be rendered as N4 HTML 5 views. Any graphic page that depends on JAVA based animated widgets, or in any way depends on any browser-side-applet shall not be acceptable.
3. The Graphical User Interface shall not use Red as graphical representation for any of the following: stop, alarm, or fault. Red is used explicitly for graphical representation of heat command and/or enable, with the only exception in text format in charts, the word "fault" can be coloured red.

- 4. Graphics not explicitly detailed within this section shall be reviewed and approved by Owner.
- 5. Common for all Graphics:

- 1. Header

The Header is one PX file for the entire project. All links, labels, etc. shall be edited from only one instance of the Header. The following aspects of the Header should appear exactly the same across all Board Facilities: Dimensions, Font Size, Colour(s), Equipment Navigation Buttons' Size, Font, and Colour(s). The following shall be exactly the same 1 - Home Button, 2 - Three Line Menu Navicon. The following aspects are dynamic: 3 - Page title, and 4 - Equipment Navigation Buttons (function and name)



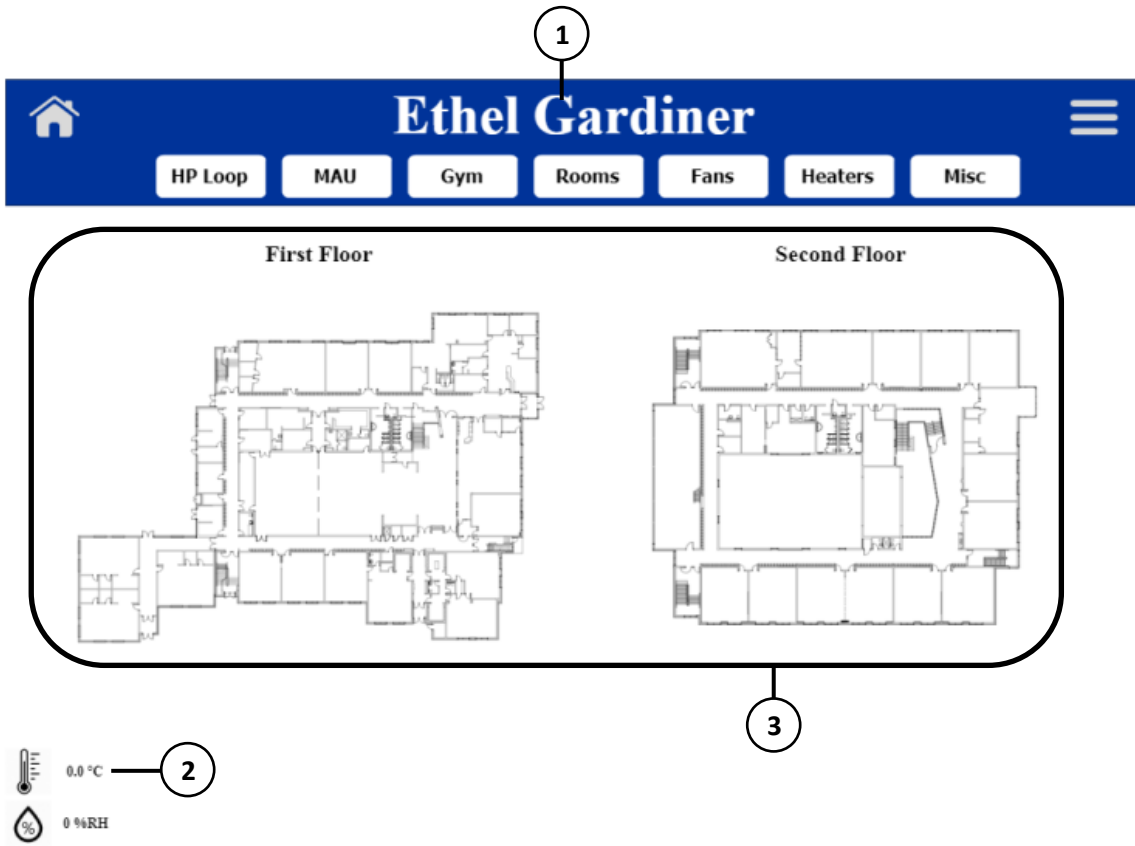
- 2. Flashing Alarm graphic (a standard Niagara graphic white triangle with red boarder and black exclamation mark) shall be consistent for all alarm annunciations, across all Board facilities, regardless of vendor.



- 3. Page Title shall be representative of the Navigation name used to link to the page and is to include information identifying area or equipment

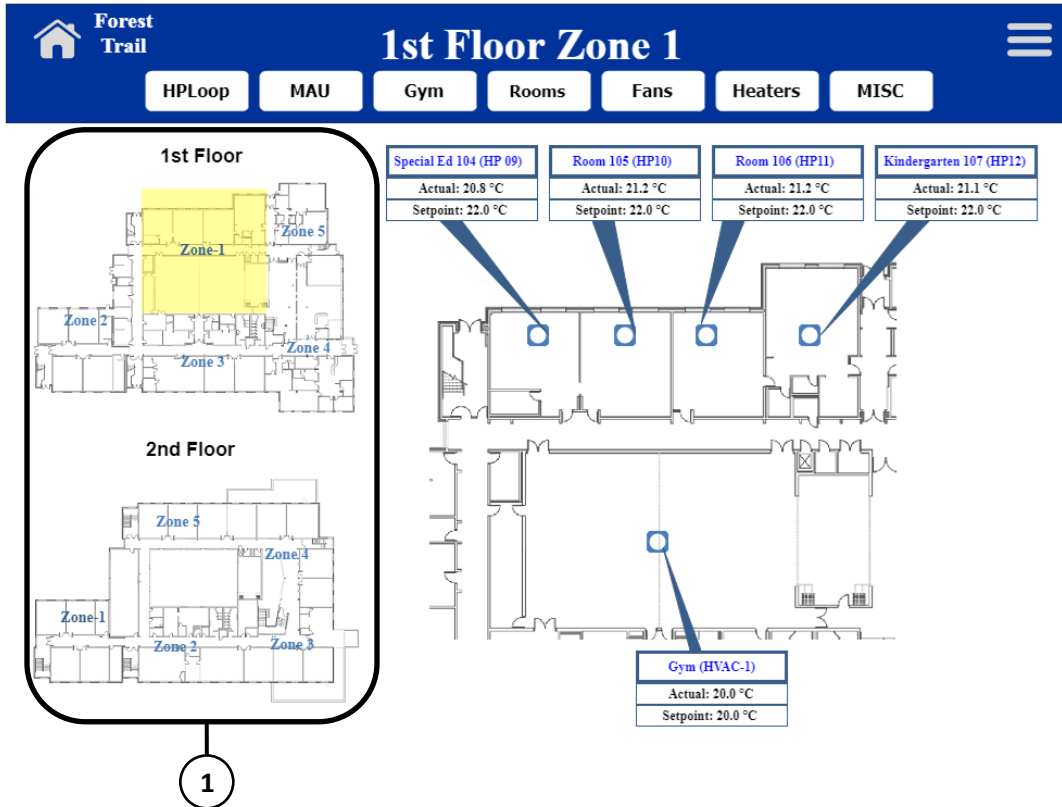
- 6. Home Page

The Home Page shall be comprised of the following: 1 – School / Facility name as page title, 2 - Outdoor Air Temperature, 3 - Complete Facility Floor Map (individual floors labelled accordingly).



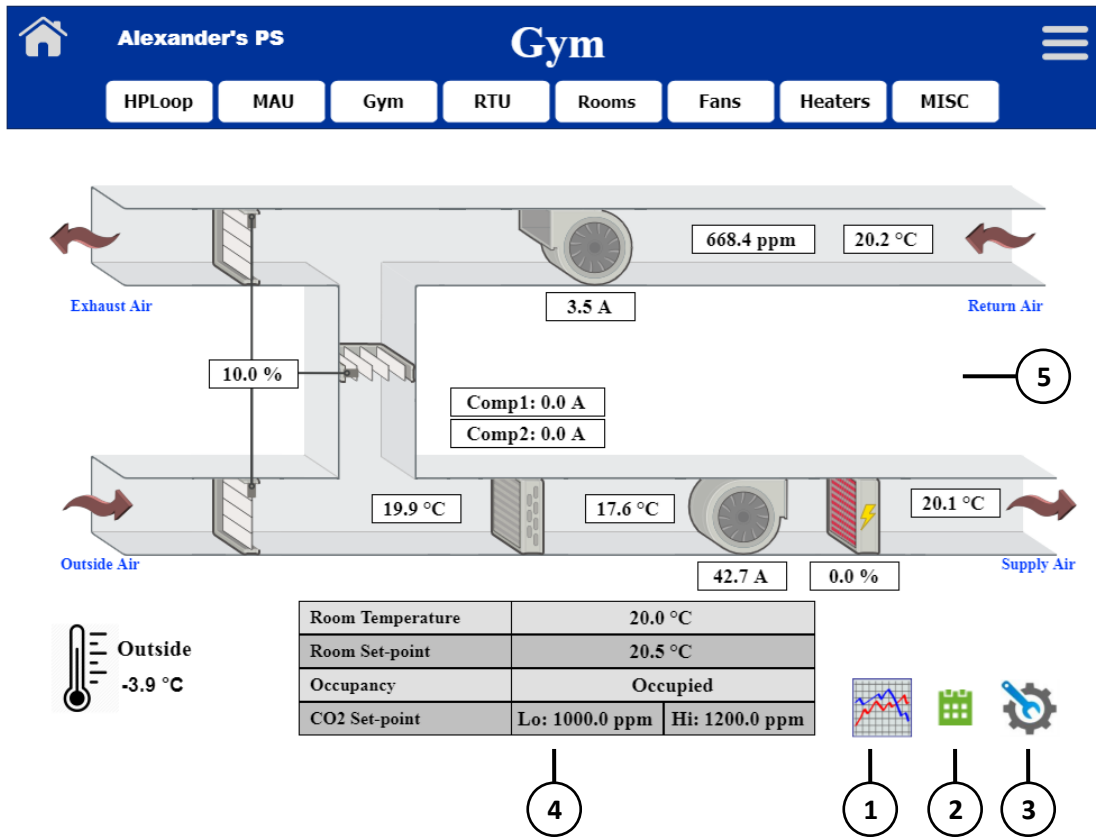
7. Zone Page(s)

The Zone Page(s) which are scaled portions of the floor plan shall be comprised of 1 – Keyplan indicating respective zone, individual space temperatures and set-points, navigation button to respective equipment



8. Gym Page

The Gym page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status, Where more than one piece of equipment conditions a single gymnasium, the Room Temperature, Room Set-point and Occupancy shall be a single object and programmed as such. Where more than one gymnasium exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



9. HVAC Page

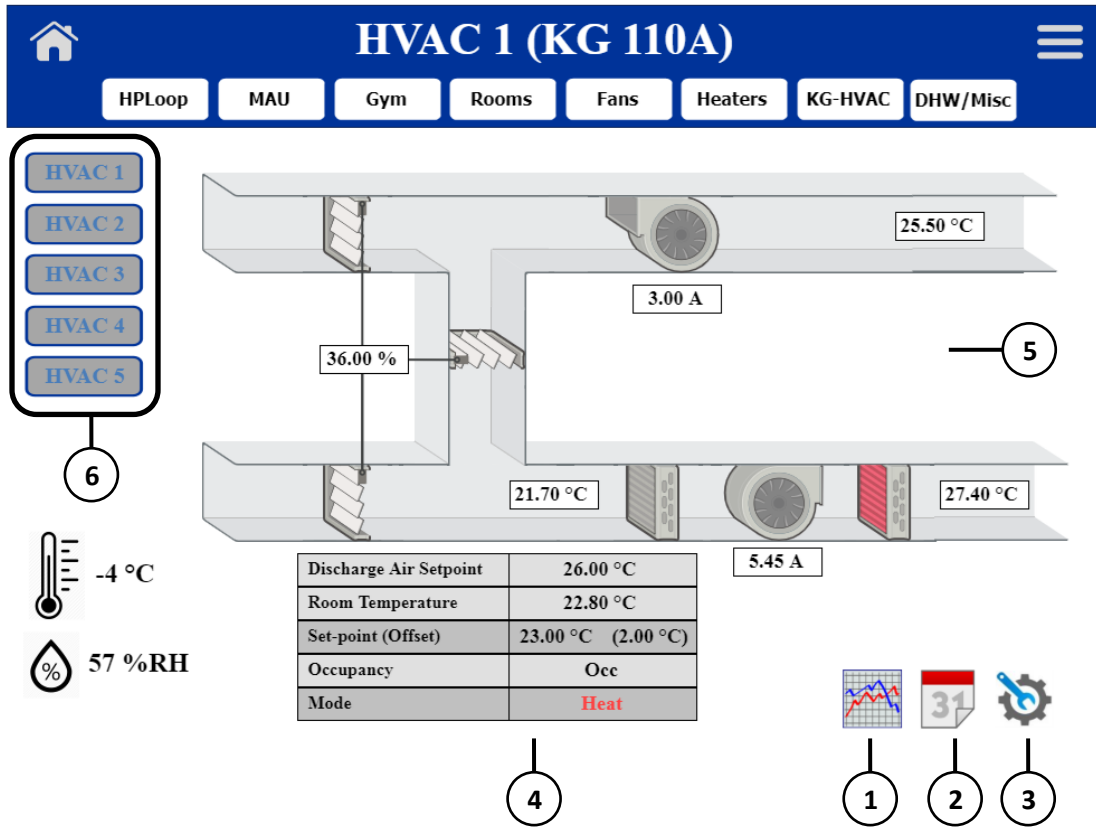
Where an HVAC Unit serves a classroom or office (which can include 1 by-pass box), an HVAC Header navigation button is not required, and the unit operational information can be presented on the Rooms Page. The individual unit, navigation from chart, is to be configured per below.

Where is more than one HVAC Unit serving multiple common spaces, i.e., Library, Shop, etc., there is to be a HVAC Header navigation button used.

The HVAC page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status,

Where more than one HVAC Unit exists in a facility, 6 - navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.





### 3.15 Low-Voltage Electrical and Control Wiring

1. It shall be the System Contractor's responsibility to complete and/or coordinate all wiring, less than 600 V, in accordance with 1.15, required for a complete Control System, including but not limited to:
  1. All raceways, boxes, cables, circuit breakers, grounding, relays, motors, starters and wirings from existing panel boards or switchgear through splitters, starters and field disconnect switches to complete power supply required for equipment supplied under this Contract not indicated on the electrical plans and specifications.
  2. Power to all actuators and sensors.
  3. Provide all wiring and cabling for network communications except for owner provided LAN(s)/WAN(s).
  4. All sensor and control device input and output wiring.
  5. All interconnecting cabling between and amongst network devices
  6. Interlock wiring between devices, and between motor starters.
  7. All other necessary wiring for fully complete and functional system as specified.
  8. Install piping, wiring/cabling routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.
2. Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with National Electric Code (NFPA 70), CSA C22.2

and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

3. All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.
4. The following cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.
  1. Network / Communication
  2. Signal (input / output control wiring)
5. Maximum allowable voltage for control wiring shall be 120-volts.
  1. 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.
  2. 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.
6. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site. This Section includes wiring, circuit breakers and accessories rated 600 V and less.
8. 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.

### **3.16 Power Wiring and Cabling**

1. Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications.
2. The B-BC panel shall be served from isolated ground receptacle via UPS by dedicated branch circuits.
3. Power shall NOT be obtained by tapping into miscellaneous circuit that could inadvertently be switched off.
4. Transformers and power supplies for controllers and field devices shall be supplied in accordance with manufacturers recommendations and shall be located within the designated control enclosure.
5. Power for controls equipment shall be from a dedicated circuit. Where a controller is dedicated to controlling a single piece of equipment, power may be obtained directly from that equipment.
6. All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.

### **3.17 Network and Communication Cabling**

1. Network installation shall strictly adhere to the manufacturer's network installation instructions and procedures.
2. All data cabling shall use stranded conductors. Solid core conductors shall not be accepted.

3. Data cabling shall be run separately from power and signal wiring
4. All communications wire shall be externally identified as "Building Automation System Network" in accordance with the HDSB's Building Automation Systems Standards and Design, latest revision.
5. Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135, latest will be followed. Those include but are not limited to:
  1. Only one path can exist from any BACnet device to another
  2. The maximum length and cabling type of an MS/TP segment shall be in accordance with manufacturers specifications and shall comply with EIA-485.
  3. Each internetwork LAN must have a unique Network Number (1 - 65,545).
  4. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.
  5. Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot and preferred 20 AWG or lower. A shield wire shall be included for ground connection.
6. Primary LAN Network wire and cable shall be run separately from all other wiring.
7. Other LAN Network wire and cabling shall be installed separate from any wiring over thirty (30) volts.
8. All communications shielding shall be grounded as per Networked System manufacturer's recommendations.

### **3.18 BACnet Ethernet Communication Cabling**

1. Data cable shall Category 5 or better Ethernet cable.
2. Data cable shall be four twisted pair 24 AWG solid copper, Plenum Rated FT-6 / CMP or Riser Rated FT-4 / CMR (as required by local codes) unshielded twisted cable meeting EIA / TIA 568B.1 Category 5e classification.
3. The maximum cable length for each run shall be limited to 90 meters.
4. All cables must be Power Sum accepted and recognized by the manufacturer.
5. Cable Skew must be specified as 20Ns or less per 100 meters.
6. Cables must display the manufacturer's stamp stating that the cable is included in the latest UL verified publication for respective Category standards.

### **3.19 Signal (Input/output control) Wiring**

1. Minimum #20 AWG stranded copper conductors (larger gauge wire/cable shall be provided where required by BAS equipment and where applications warrant (e.g., rated load, long runs, etc.).
2. All BMS input/output point wire/cable and communication cable shall be shielded.
  1. Non-shielded cables may be approved for BAS input and output field point wiring following certification from the BAS manufacturer that non-shielded cables will function satisfactorily for the life of the building and that the use of non-shielded cables will not negatively affect other building systems/cabling.

2. The manufacturer's certification shall guarantee to the Board that should it be determined that BAS system performance is negatively affected, or another building system or equipment is negatively affected due to the non-shielded cable, the BAS manufacturer shall replace the cable at no cost to the Board.
3. All cabling shall be installed in a neat and workman like manner. Follow manufacturer's installation recommendations for all communication cabling.
4. Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.
5. Wiring located in combustibles rated buildings above T-bar ceiling shall be run in free air using fire rated cable with a minimum rating of FT-6.
6. Note: all free air cabling used in combustibles rated buildings to interface to security or fire alarm systems shall be FT-6 rated.
7. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
8. Cables shall follow building lines and be installed in bundles resting in a cabling support system (J-hooks).
9. Cable supports shall be attached to the wall or ceiling of the area they are running through. Cable supports shall not be attached to:
  1. Electrical raceways,
  2. Duct work,
  3. Ceiling suspension systems,
  4. Piping,
  5. Wilson joists.
  6. All wire/cable terminations shall be made at screw type terminal strips. Wire nut terminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.
10. All BAS equipment and components shall be grounded to building ground facilities.
11. BAS shall only be capable of controlling electric motors when the associated hand/off/auto (HOA) motor control switches are in the "auto" position. BAS control shall be wired into the auto circuit of the hand/off/auto motor control circuit only. Where hand/off/auto switches do not exist, they shall be provided by the Controls Contractor.
12. Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.
13. Existing interlocks and override control should typically not be removed or overridden by the application of new BAS control without the specific instruction and/or approval of the Owner.

### **3.20 Commissioning, Testing, Demonstration, and Acceptance**

1. The system shall be commissioned in its entirety. All commissioning and tested shall be documented and submitted prior to Demonstration and Acceptance testing. Commissioning and Testing shall include, but not limited to the following:
  1. Verify all programming, naming, identification, and conforms to the HDSB's Building Automation Systems Standards and Design, latest revision.
  2. A point-to-point check of the location, installation, and labeling

3. Calibrate all analogue inputs and devices using actual versus the embedded UI
  4. Control loops are to be fully set-up and tuned
  5. Each control program and sequence shall be fully commissioned and confirmed by an end-to-end test, for the complete design intent compliance and functionality.
  6. Verify failsafe conditions
2. The naming and identification of all points, networking instances, objects, meta tags, etc. is to be extracted from the site controls electronically and sent to the Owner or its Authorized representative in one of the following formats .csv, .xls or xlsx, for review and acceptance. The values are not to be edited or formatted prior to sending.
  3. Pursuant to 3.8.1, assist and cooperate with the Owner approved third party commissioning provider in the following manner: using a skilled technician who is familiar with the building, assist in the functional performance testing of the control system as per test requirements developed in the commissioning check sheets (prepared by the commissioning provider).
  4. When Commissioning, Testing, Demonstration and Acceptance process has been completed and approved and/or verified by the Owner, and within ten (10) days, the contractor will be provided with a signed letter from the owner indicating acceptance.

### **3.21 Training**

1. Subsequent to the acceptance, per 3.9., and part of this contract, 1 day of training is to be provided to a maximum 6 individuals responsible for the operation of the site at the sole discretion of the Owner. The training shall provide instruction and demonstration on the operation, adjustment, and maintenance of the BAS inclusive of all hardware and software supplied under this and other related specifications necessary to meet the functional intent. The training is to include, but not limited to, the following:
  1. Location of all controllers, devices, sensors, peripherals, etc.
  2. Equipment layout and dependencies
  3. Sequence of operation
  4. Preventative maintenance

### **3.22 Warranty, Maintenance, and Service**

1. Provide warranty under provisions of these specifications.
2. At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:
  1. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within eight (8) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected through telephone support to the Owner, or its representatives, the next step is to attempt to correct the issue through remote site access. In the event the problem persists, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within forty-eight (48) hours of the Owner's initial request for service, as specified.

2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within two (2) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected immediately through telephone support or remote site access, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight (8) hours of the Owner's initial telephone request for service, as specified.
3. Owners Request for Service: Contractor shall specify three telephone numbers and email addresses, including order of contact and procedure in the event a contact fails to respond, for the Owner to use in the event of a need for service.
3. Provide all labour, associated travel and expenses, materials, and equipment necessary for the successful operation of this system for a period of 12 months from the date of final acceptance, per 3.9. In addition, provide three (3) visits for testing and evaluating the performance of the hardware and software installed per this specification, to be coordinated with the HDSB's Building Automation Manager. One visit shall be during the cooling season, one visit shall be during the heating season, and one visit shall be during a shoulder season, either spring or fall. Provide a written report after each visit is complete. This service visit shall include, but not be limited to, the following:
  1. Check calibration and re-calibrate if needed instrumentation sensors for air flow, liquid flow, pressure, humidity, temperature, and transducers. Written records shall be kept indicating the performance of such calibrations along with pertinent data.
  2. Check the operation of dampers and damper actuators to assure no lock up has occurred and stroke is proper. Written records shall be kept indicating the performance of such calibrations along with pertinent data.
  3. Check the overall system field operations by performing a review of all points. Verify that all monitoring and command points are valid and active. Written records shall be kept indicating the performance of such exercises.
4. If a problem develops at any time during the warranty/service period, the affected BAS point/object shall be monitored and logged for the remainder of the warranty/service period. "A problem" in the above statement will refer to an incident in which any of the following occur:
  1. An alarm occurs due to a defective control system component(s), improper installation, or programming.
  2. Overall performance of the system is compromised due to a defective control component(s), improper installation, or programming.
  3. Major recalibration (by greater than 5 times the catalogued accuracy) is required for a sensor during one of the service visits.
5. Pursuant to 3.3, changes required to meet design, compliance, and functionality, that were not part of the Demonstration and Acceptance process, will be made at no cost to the Owner.
6. Any changes to programming, inclusive of but not limited to set-points, schedules, sequences, alarms, history, network addressing, object naming, etc. are to be performed in accordance with the Change Management Procedures outlined in the HDSB's Building Automation Systems Standards and Design, latest revision.

### 3.23 Schedule A

1. Objects / Points identified in Schedule A as Mandatory ('Y' in Mandatory column) must be included in program of the respective system or equipment. Where an Object or Point is not listed as Mandatory, inclusion within Schedule A does not dictate the requirement for use within a program and are listed for information purposes only where equipment differs from standard and program variations must be made to meet the sequences per 23 09 93.
2. Objects / Points identified as Mandatory must be adjustable, in accordance with 3.12 of this Section
3. Where a 'G' and/or 'V' is indicated in the User Interface column, the Object or Point shall be represented on the respective graphic page, in accordance with 3.9 of this Section. Mandatory points without a 'G' and/or 'V' indicated in the User Interface column shall be presented in the settings page.
4. Where an Object or Point is identified as a software point with a 'B' in the Software Point column of the table, BACnet value will be an accepted means of data source provided change of value requirements are met. BACnet shall not be used as a writeable point or as a data source for Alarms classified as Emergency.

23 09 90 Schedule A

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Type	Alarm
						Graphic or Value	History		Alarm Parameters
Outdoor Air Temperature	OAT		Y	x		V	x	E	5% from average
<b>Boiler</b>									
Supply or Return Water Temperature Reset Set-point	Blr#ResetTempSpt		Y		x	V	x		
Supply or Return Water Temperature Reset Signal	Blr#ResetSignal		Y	x		V	x		
Boiler Command (Enable / Disable)	Blr#Cmd		Y	x		G	x		
Boiler Lead / Lag Status**	Blr#Lead (Lag)		Y		x				
Supply Water Temperature	Blr#SWT		Y	x	B	V	x		
Return Water Temperature	Blr#RWT			x	B		x		
Boiler Status	Blr#Status			x	B	G	x		
Boiler Alarm	Blr#Alarm		Y	x		G	x	L	Binary
Boiler Output	Blr#Output				B				
Boiler Pump Command (Enable / Disable)**	Blr#PumpCmd		Y	x		G	x		
Boiler Pump Status	Blr#PumpAmp		Y	x	B	V	x		
Boiler Pump Alarm	Blr#PumpAlarm				x	G			
<b>Heating Loop</b>									
Heating Loop Supply Water Temperature Reset Set-point	HWLoop#ResetTempSpt		Y		x	V	x		
Supply Water Temperature	HWLoop#SWT		Y	x		V	x		
Return Water Temperature	HWLoop#RWT		Y	x		V	x	H	≤ 27°C when heat plant enable <sup>1</sup>
Water Temperature Alarm	HWLoopTempAlarm		Y		x	G			
Supply Water Pressure	HWLoopSWPress		Y	x		V	x		
Return Water Pressure	HWLoopRWPress		Y	x		V	x		
Pressure Differential Supply vs Return	HWLoop#PD		Y		x	G	x		
Flow Status (when Pressure Differential not available)**	HWLoop#Flow		Y	x		G	x	E	Binary or 30% from set-point
Flow Alarm	HWLoop#FlowAlarm		Y		x	G			
Zone Temperature**	HWLoop#Zone#Temp		Y	x		V	x		
Zone Temperature Alarm**	HWLoop#Zone#TempAlarm		Y		x	G			
Circulating Pump Command (Enable / Disable)	HWLoop#Pump#Cmd		Y	x		G	x	L	
Circulating Pump Status	HWLoop#Pump#Amp		Y	x		V	x		
Circulating Pump Speed**	HWLoop#Pump#Spd		Y	x		V	x		
Pump Lead / Lag Status**	HWLoop#Pump#Lead(Lag)		Y		x	V			
<b>Chiller</b>									
Occupancy Schedule	OccSched		Y		x	V			
Chilled Water Loop Supply Water Temperature Set-point	LoopSpt		Y		x	V	x		
Chiller Command (Enable / Disable)	Cmd		Y	x		G	x		
Chiller Leaving Water Temperature	LWT		Y	x	B	V	x		
Chiller Entering Water Temperature	EWT		Y	x	B	V	x		
Condenser Leaving Water Temperature	CndLWT		Y	x	B	V	x		
Condenser Entering Water Temperature	CndEWT		Y	x	B	V	x		
Alarm	Alarm		Y	x		G		L	On failure
Condenser Flow	CondFlow				B	V			
Condenser Pump Command (Enable / Disable)	CndPumpCmd				B	V			
Condenser Pump Status	CndPumpAmp				B	V	x		
Refrigerant Saturated Condensing Temperature	SCT				B	V	x		
Refrigerant Discharge Pressure	Discharge				B	V	x		
Refrigerant Discharge Line Temperature	DischargeLineTemp				B	V	x		
Refrigerant Saturated Suction Temperature	SST				B	V	x		
Refrigerant Suction Pressure	Suction				B	V	x		
Refrigerant Suction Line Temperature	SuctionLineTemp				B	V	x		
Refrigerant Liquid Pressure	Liquid				B	V	x		
Refrigerant Liquid Line Temperature	LiquidLineTemp				B	V	x		
Refrigerant Superheat	SH				B	V	x		
Refrigerant Sub-cooling	SC				B	V	x		
Compressor Command (Enable / Disable)	CompCmd				B	V	x		
Compressor Speed	CompSpd				B	V	x		
Compressor Status L1	CompAmpL1		Y		B	V	x		
Compressor Status L2	CompAmpL2		Y		B	V	x		
Compressor Status L3	CompAmpL3		Y		B	V	x		
Compressor Voltage L1	CompVoltL1		Y		B	V	x		
Compressor Voltage L2	CompVoltL2		Y		B	V	x		
Compressor Voltage L3	CompVoltL3		Y		B	V	x		
Compressor Run-time	CompRunTime		Y		B	V	x		
Evaporator Flow	EvapFlow				B	V			
Refrigerant Monitor	RefMonitor		Y	x		G		E	On failure



Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Cooling Tower</b>									
Cooling Tower Command (Enable / Disable)**	TowerCmd			x		V	x		
Cooling Tower Leaving Water Temperature	TowerLWT	Y		x		V	x		
Cooling Tower Return Water Temperature**	TowerRWT	Y		x		V	x		
Sump Temperature	TowerSumpTemp	Y		x		V	x	H	≤ 4°C
Sump Heater Status	TowerSumpHeaterAmp	Y		x		V	x		
Sump Heater Command (Enable / Disable)**	TowerSumpHeaterCmd			x		V	x		
Dampers Open	TowerDOpen	Y		x		V	x		
Spray Pump Command (Enable / Disable)	TowerSprayCmd	Y		x		G	x	L	
Spray Pump Status	TowerSprayAmp	Y		x		V	x		
Cooling Tower Fan Command (Enable / Disable)	TowerFanCmd	Y		x		G	x	L	
Cooling Tower Low Speed Fan Command (Enable / Disable)**	TowerLowSpdFanCmd	Y		x		V	x		
Cooling Tower High Speed Fan Command (Enable / Disable)**	TowerHighSpdFanCmd	Y		x		V	x		
Cooling Tower Fan Speed**	TowerFanSpd	Y		x		V	x		
Cooling Tower Fan Status	TowerFanAmp	Y		x		V	x		
<b>Heat-pump Loop</b>									
Heat-pump Loop Mode	HpLoopMode	Y			x	V	x	H	In Emergency Mode
Heat-pump Loop Cooling Supply Water Temperature Set-point	HpLoopClgSWTSpt	Y			x	V	x		
Heat-pump Loop Heating Supply Water Temperature Set-point	HpLoopHtgSWTSpt	Y			x	V	x		
Supply Water Temperature	HpLoopSWT	Y		x		V	x		
Return Water Temperature	HpLoopRWT	Y		x		V	x		
Heat-pumps Cooling	HpLoopHPClg	Y			x		x		
Heat-pumps Heating	HpLoopHPHtg	Y							
Supply Water Pressure	HpLoopSWPress	Y		x		V	x		
Return Water Pressure	HpLoopRWPress	Y		x		V	x		
Pressure Differential Supply vs Return	HpLoopPD	Y		x		G	x		
Flow Status (when Pressure Differential not available)**	HPLoopFlow	Y		x		G	x	E	Binary or 30% from set-point
Main Circulating Pump #1 Command (Enable / Disable)	HpLoopP1Cmd	Y		x		G	x	L	
Main Circulating Pump #1 Status	HpLoopP1Amp	Y		x	B	V	x		
Main Circulating Pump #1 Speed**	HpLoopP1Spd	Y		x		V	x		
Main Circulating Pump #2 Command (Enable / Disable)**	HpLoopP2Cmd	Y		x		G	x	L	
Main Circulating Pump #2 Status**	HpLoopP2Amp	Y		x	B	V	x		
Main Circulating Pump #2 Speed**	HpLoopP2Spd	Y		x		V	x		
Pump Lead / Lag Status**	HpLoopLead (Lag)	Y			x	V			
<b>Heat-Exchanger</b>									
Primary Entering Water Temperature**	HtExchanger#EWT	Y		x		V	x		
Primary Leaving Water Temperature	HtExchanger#LWT	Y		x		V	x		
Supply Water Temperature	HtExchanger#SWT	Y		x		V	x		
Return Water Temperature**	HtExchanger#RWT	Y		x		V	x		
Valve Signal	HtExchanger#Valve%	Y		x		V	x		
Supply or Return Water Reset Set-point	HtExchanger#Spt	Y			x	V	x		
<b>Domestic Hot Water</b>									
Occupancy Schedule	DHWOccSched	Y			x	V			
Supply Water Temperature	DHW#SWT	Y		x		V	x		
Supply Water Temperature Set-point**	DHW#Spt			x		V	x		
DHW Circulating Pump Command (Enable / Disable)	DHW#PumpCmd	Y		x		V			
DHW Circulating Pump Status	DHW#PumpAmp	Y		x		V	x		

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Make-up Air Unit</b>									
Occupancy Schedule	OccSched		Y		x	V			
MAU Unit Command (Enable / Disable)	Cmd		Y	x		V	x		
MAU Unit Alarm	Alarm		Y	x		G		H	On failure
Fire Interlock Command (Enable / Disable)	FireCmd			x		V			
Supply Air Fan Command (Enable / Disable)	SAFanCmd		Y	x		G	x	L	
Supply Air Fan Speed Schedule**	SAFanSpdSched				x	V			
Supply Air Fan Speed Set-point**	SAFanSpd		Y	x		V	x		
Supply Air Fan Status	SAFanAmp		Y	x		V	x		
Outdoor Air Damper Schedule	OADOccSched				x	V			
Outdoor Air Damper Status	OADPosition			x	B	G/V			
Outdoor Air Damper Signal**	OAD%		Y	x		G/V	x		
Exhaust Air Fan Command (Enable / Disable)	EAFanCmd			x	B	G		L	
Exhaust Air Fan Speed Schedule	EAFanSpdSched				x	V			
Exhaust Air Fan Speed Set-point	EAFanSpd			x	B	V			
Exhaust Air Fan Status	EAFanAmp		Y	x	B	V	x		
Exhaust Air Damper Status	EADPosition			x	B	G/V			
Exhaust Air Damper Signal**	EAD%		Y	x		G/V			
Cooling Command (Enable / Disable)	ClgCmd		Y	x		G	x		
Cooling Stage**	ClgStg#Cmd		Y	x	B	V			
Cooling Output Signal**	Clg%		Y	x	B	G/V			
Compressor Status **	Comp#Amp		Y	x	B	V	x		
Heat Command (Enable / Disable)	HtgCmd		Y	x		G	x		
Heat Output Signal**	Htg%		Y	x	B	G/V			
Heat Status	HtgStatus			x	B	V			
Discharge Air Temperature	DATemp		Y	x		V	x		
Discharge Air Temperature Reset Set-point	DATSpt		Y		x	V	x		
Discharge Air Temperature Reset Signal	DATSptSignal		Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm		Y	x		V	x	H	>20°C more than 20 min
Return Air Temperature	RATemp		Y	x	B	V	x		
Downstream H/ERV Temperature	ERVOutTemp		Y	x	B	V	x		
H/ERV Command (Enable / Disable)	ERVCmd			x		G			
Mixed Air Temperature	MATemp		Y	x	B	V	x		
Exhaust Fan Interlock**	EF#Interlock			x		V			
Freeze Stat (when unit contains hydronic heating coil)	FreezeStat		Y	x		G	x	H	On failure
Fresh Air Filter / Supply Fan Belt Status	SAService				x				
Exhaust Air Filter / Belt Status	EAService				x				

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>HVAC Unit</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature**	RmTemp		Y	x		V	x	L	≤ 17°C during Occupied
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point**	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset**	RmTempOffset		Y		x	V	x		
Actual Room Temperature Set-point**	ActRmSpt		Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
<b>Room Temperature Alarm**</b>	<b>RmTempAlarm</b>		<b>Y</b>	<b>x</b>	<b>x</b>	<b>G</b>			
HVAC Unit Command (Enable / Disable)	Cmd		Y	x			x		
HVAC Unit Alarm	Alarm		Y	x		G		H	On failure
Fire Interlock Command (Enable / Disable)	FireCmd			x		V			
Supply Air Fan Command (Enable / Disable)	SAFanCmd		Y	x		G	x		
Supply Air Fan Speed Set-point**	SAFanSpd		Y	x		V	x		
Supply Air Fan Status	SAFanAmp		Y	x		V	x		
Return Air Fan Command (Enable / Disable)	RAFanCmd		Y	x		G	x		
Return Air Fan Speed Set-point**	RAFanSpd		Y	x		V	x		
Return Air Fan Status	RAFanAmp		Y	x		V	x		
Exhaust Air Fan Command (Enable / Disable)**	EAFanCmd		Y	x		G	x		
Exhaust Air Fan Speed Set-point**	EAFanSpd		Y	x		V	x		
Exhaust Air Fan Status**	EAFanAmp		Y	x		V	x		
Outdoor Air Damper Schedule	OADOccSched		Y	x		G/V			
Outdoor Air Damper Status	OADPosition		Y		x	G/V	x		
Outdoor Air Damper Signal	OAD%		Y	x		V	x		
Return Air Damper Status**	RADPosition		Y		x	V	x		
Return Air Damper Signal**	RAD%		Y	x		G/V	x		
Exhaust Air Damper Status**	EADPosition		Y		x	G/V	x		
Exhaust Air Damper Signal**	EAD%		Y	x		G/V	x		
Cooling Command (Enable / Disable)	ClgCmd		Y	x		G	x		
Cooling Stage	ClgStg#Cmd			x	B	G/V			
Cooling Output	Clg%			x	B	G/V			
Compressor Status **	Comp#Amp		Y	x		V	x		
Heat Command (Enable / Disable)	HtgCmd		Y	x		G	x		
Heat Output	Htg%			x	B	G/V			
Heat Status	HtgStatus			x	B	G/V			
Discharge Air Temperature	DATemp		Y	x		V	x		
Discharge Air Temperature Reset Set-point**	DATSpt		Y		x	V	x		
Discharge Air Temperature Reset Signal**	DATSptSignal		Y	x		V	x		
Discharge Air Temperature Alarm**	DATempAlarm		Y	x		V	x		
Return Air Temperature	RATemp		Y	x		V	x		
Downstream H/ERV Temperature	ERVOutTemp		Y	x	B	V	x		
H/ERV Command (Enable / Disable)	ERVCmd			x		G			
Mixed Air Temperature	MATemp		Y	x		V	x		
Return Air CO2	RACO2		Y	x		V	x		
Return Air CO2 Set-point	RACO2Spt				x	V			
Freeze Stat (when unit contains hydronic heating coil)	FreezeStat		Y	x		G/V	x	H	On failure
Occupancy Override Push-button**	OccPB		Y	x			x		
Occupancy Override Time**	OccTimer		Y		x				
Supply Air Service	SAService				x	G			
Return Air Service	RAService				x	G			

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Room Controller Heat-pump</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y		x	V	x		
Actual Room Temperature Set-point	ActRmSpt		Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Room Temperature Alarm	RmTempAlarm		Y		x	G		L	≤ 17°C
Loop Valve Open / Close**	LVlv		Y	x		V			
Fan Command (Enable / Disable)	Fan		Y	x		G	x		
Fan and Compressor Status (total unit CT)	Amp		Y	x		V	x		
Low Amperage	LowAmp		Y		x	G			
Heating Command (Enable / Disable)	HtgCmd		Y	x		G	x		
Cooling Command (Enable / Disable)	ClgCmd		Y	x		G	x		
Heating Minimum Run-time	HtgMinRun		Y		x				
Cooling Minimum Run-time	ClgMinRun		Y		x				
Heating Call Delay	HtgDmdDelay				x				
Cooling Call Delay	ClgDmdDelay				x				
Heating Cooling Switch-over Delay	HtgClgDelay		Y		x				
Discharge Air Temperature	DATemp		Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm				x				
Heat-pump Alarm	Alarm		Y	x		G	x	L	On failure
Occupancy Override Push-button	OccPB		Y	x			x		
Occupancy Override Time	OccTimer		Y		x				
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd		Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%		Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd		Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%		Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp		Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp		Y	x		V	x		
Window Interlock Status <sup>1</sup>	Window			x		V	x		
<b>Room Controller By-Pass Box (Dump)</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt		Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Room Temperature Alarm	RmTempAlarm		Y		x	G			
Damper Position	Damper%		Y		x	V	x		
Discharge Air Temperature	DATemp		Y	x		V	x		
Discharge Air Temperature Alarm**	DATempAlarm				x				
Re-Heat Command (Enable / Disable)**	ReHtCmd		Y	x		G	x		
Re-Heat Control Signal (where modulating)**	ReHt%		Y	x		V	x		
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd		Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%		Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd		Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%		Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp		Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp		Y	x		V	x		

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Room Controller V.V.T.</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt		Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Room Temperature Alarm	RmTempAlarm		Y		x	G		L	≤ 17°C
Damper Position	Damper%		Y		x	V	x		
Discharge Air Temperature	DATemp		Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm				x				
Re-Heat Command (Enable / Disable)**	ReHtCmd		Y	x		G	x		
Re-Heat Control Signal (where modulating)**	ReHt%		Y	x		V	x		
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd		Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%		Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd		Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%		Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp		Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp		Y	x		V	x		
<b>Room Controller Electric or Hydronic Heat</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y	x			x		
Actual Room Temperature Set-point	ActRmSpt		Y		x		x		
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Room Temperature Alarm	RmTempAlarm		Y		x	G		L	≤ 17°C
Comfort Heat Enable / Disable	Cmd		Y	x		G	x		
Comfort Heat Status**	Temp		Y	x		V	x	H	≤ 5°C
Comfort Heat Status**	Amp		Y	x		V	x		
Heat Output (where modulating)**	Htg%		Y	x		V	x		
Occupancy Override Push-button	OccPB		Y	x			x		
Occupancy Override Time	OccTimer		Y		x				
Discharge Air Temperature (where applicable)**	DATemp		Y	x		V	x		
Discharge Air Temperature Alarm (where applicable)**	DATempAlarm		Y	x		G	x		

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Room Controller Unit Ventilator</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt		Y		x	V			
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Heating Discharge Air Temperature Maximum	HtgDATMax		Y						
Heating Discharge Air Temperature Minimum	HtgDATMin		Y						
Cooling Discharge Air Temperature Maximum	ClgDATMax		Y						
Cooling Discharge Air Temperature Minimum	ClgDATMin		Y						
Room Temperature Alarm	RmTempAlarm		Y	x		G		L	≤ 17°C
Loop Valve Open / Close**	LVlv		Y	x		G	x		
Fan Command (Enable / Disable)	Fan		Y	x		G	x		
Fan and Compressor Status (total unit CT)	Amp		Y	x		V	x		
Low Amperage	LowAmp		Y		x	G			
Outdoor Air Damper	OADCmd		Y	x		G	x		
Outdoor Air Damper Position	OAD%		Y	x		V	x		
Outdoor Air Damper Minimum Position	OADMIN%		Y						
Heating Command (Enable / Disable)	HtgCmd		Y	x		G	x		
Free Cooling Command (Enable / Disable)	FreeClgCmd			x			x		
Free Cooling Enable Temp	FreeClgTemp		Y						
Cooling Command (Enable / Disable)	ClgCmd		Y	x		G	x		
Heating Minimum Run-time	HtgMinRun				x				
Cooling Minimum Run-time	ClgMinRun		Y		x				
Heating Call Delay	HtgDmdDelay				x				
Cooling Call Delay	ClgDmdDelay				x				
Heating Cooling Switch-over Delay	HtgClgDelay		Y		x				
Discharge Air Temperature	DATemp		Y	x		V	x		
Heating Discharge Air Temperature Setpoint	HtgDATSpt		Y						
Cooling Discharge Air Temperature Setpoint	ClgDATSpt		Y						
Discharge Air Temperature Alarm	DATempAlarm				x				
Unit Ventilator Alarm	Alarm		Y	x		G	x	L	On failure
Occupancy Override Push-button	OccPB		Y	x			x		
Occupancy Override Time	OccTimer		Y		x				
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd		Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%		Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd		Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%		Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp		Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp		Y	x		V	x		
Window Interlock Status †	Window			x		V	x		
<b>Room Controller Air Conditioning, Heat-pump, Ductless Split, or V.R.F. - Indoor Air Handling (Cassette / Fan Coil) Unit Only</b>									
Occupancy Schedule	OccSched		Y		x	V			
Room Temperature	RmTemp		Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt		Y		x				
Occupied Heating Set-point	OccHtgSpt		Y		x				
Network Set-point	NtwkSpt		Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset		Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt		Y		x	V			
Unoccupied Cooling Set-point	UnOccClgSpt		Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt		Y		x				
Room Temperature Alarm	RmTempAlarm		Y	x		G		L	≤ 17°C
Fan Command (Enable / Disable)	Fan		Y	x		G	x		
Fan Status	FanAmp				x	V	x		
Low Amperage	LowAmp				x	G			
Heating Command (Enable / Disable)	HtgCmd		Y	x		G	x		
Heat Control (where modulating)	Htg%			x		V	x		
Heat Status (Hydronic)	HH#Temp			x		V	x		
Heat Status (Electric)	EH#Amp			x		V	x		
Cooling Command (Enable / Disable)	ClgCmd		Y	x		G	x		
Heating Call Delay	HtgDmdDelay				x				
Cooling Call Delay	ClgDmdDelay				x				
Heating Cooling Switch-over Delay	HtgClgDelay		Y		x				
Discharge Air Temperature	DATemp			x		V	x		
Discharge Air Temperature Alarm	DATempAlarm				x				
Unit Alarm	Alarm		Y	x		G		L	On failure
Occupancy Override Push-button	OccPB		Y	x			x		
Occupancy Override Time	OccTimer		Y		x				
Window Interlock Status †	Window			x		V	x		
<b>Remote Condensing Unit - excluding V.R.F.</b>									
Condensing Unit Command (Enable / Disable)	CU#Cmd		Y	x		V			
Fan and Compressor Status (total unit CT)	CU#Amp		Y	x		V	x		

Point Description	Object / Point Abbreviation	Name	Mandatory	Hardware Point	Software Point	User Interface		Alarm	
						Graphic or Value	History	Type	Alarm Parameters
<b>Supply Air Fan</b>									
Supply Fan Schedule	SAFan#OccSched		Y		x	V			
Supply Fan Command (Enable / Disable)	SAFan#Cmd		Y	x		G	x		
Supply Fan Status	SAFan#Amp		Y	x		V	x		
<b>Return Air Fan</b>									
Return Fan Schedule	RAFan#OccSched		Y		x	V			
Return Fan Command (Enable / Disable)	RAFan#Cmd		Y	x		G	x		
Return Fan Status	RAFan#Amp		Y	x		V	x		
<b>Exhaust Fan</b>									
Exhaust Fan Schedule	EFOccSched		Y		x	V			
Exhaust Fan Command (Enable / Disable)	EF#Cmd		Y	x		V			
Exhaust Fan Status	EF#Amp		Y	x		V	x		
MAU Interlock (where applicable)	EF#MAU#Interlock		Y		x	V			
<b>Ancillary Heat - electric or hydronic</b>									
Ancillary Heat OAT Disable	AncillaryHeatOATCmd		Y		x	V			
Ancillary Heat Schedule	AncillaryHeatOccSched		Y		x	V			
Ancillary Heat Command (Enable / Disable)	AncillaryHeatCmd								
Ancillary Heat Status	HH#Temp		Y	x		V	x	E	≤ 5°C
Ancillary Heat Status	EH#Amp		Y	x		V	x		
Space Temperature**	EH#RmTemp		Y	x		V	x	H	≤ 5°C
Space Temperature**	HH#RmTemp		Y	x		V	x	H	≤ 5°C
Space Temperature Set-point**	EH#Spt		Y		x	V			
Space Temperature Set-point**	HH#Spt		Y		x	V			
<b>Lighting</b>									
Exterior Light Astronomical Clock	ExtLtgClock		Y		x	V			
Exterior Wall Packs Schedule	ExtLtgWP#Schedule		Y		x	V			
Exterior Wall Packs Command (Enable / Disable)	ExtLtgWP#Cmd		Y	x		V			
Exterior Wall Pack Status	ExtLtgWP#ON (OFF)		Y	x		V			
Parking Lot Schedule	ExtLtgPL#Schedule		Y		x	V			
Parking Lot Command (Enable / Disable)	ExtLtgPL#Cmd		Y	x		V			
Parking Lot Lighting Status	ExtLtgPL#ON (OFF)		Y	x		V			
<b>Misc</b>									
Trap Seal Primer Command (Enable / Disable) **	Trap#Cmd		Y	x		V			
Trap Seal Primer Schedule**	Trap#Schedule		Y		x	V			
Urinal Flush Valve Command (Enable / Disable) **	Urinal#Cmd		Y	x		V			
Urinal Flush Valve Schedule**	Urinal#Schedule		Y		x	V			
<b>Metering</b>									
Electricity kWh	kWh		Y	x		V	x		
Electricity kW	kW		Y	x		V	x		
Natural Gas	m <sup>3</sup>		Y	x		V	x		
Water	L		Y	x		V	x	H	TBD

\*\* Indicates Object or Point may not be applicable i.e., Room Controller with no Auxillary Heat, or single Boiler subsequently no Lead / Lag requirement

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## Building Automation Systems

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### Section 25 09 93

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#### Sequences of Operation for HVAC Control

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## **1 General**

### **1.1 Summary**

A. Section Includes:

- i. Control Sequences for HVAC Systems, sub-systems, and accessories

### **1.2 General**

- A. Sequences specified herein indicate the functional intent of the systems operation and do not fully detail the programming required to obtain the indicated operation.
- B. Throttling ranges, proportional bands, and cycle differentials shall be centered on the associated set-point. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.
- C. Equipment start-up concluding a power failure shall be provisioned such that there is protection against building reduced voltage resulting from starting multiple inductive loads. Mechanical equipment shall be grouped such that the combined starting current of the defined group will not exceed the electrical distribution system rated capacity less base load. An interval of not less than 3 seconds shall be maintained between starting of the defined groups.
- D. Preference will be given to using OEM furnished controls. OEM furnished controls must have minimum hard-wired points as indicated herein.

## **2 Products**

**Section Not Used**

### 3 Execution

#### 3.1 Gymnasium Unit

**Unit OEM Controller Minimum Hard-wired points**

Outdoor Air Damper Position Signal: Analogue input (0 to 10 Vdc, or 4 to 20 mA)

Fan(s) Command and/or Enable: Binary input

Heating Command and/or Enable: Binary input

Mechanical Cooling Command and/or Enable: Binary input

A. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring and fans, heating, cooling, and mechanical energy recovery system are to be disabled and/or commanded off.

**B. Scheduled Occupancy**

**Pre-Occupancy:** The BAS shall command on and/or enable the supply and return air fans, 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.

**Occupied:** The BAS shall command on and/or enable the unit (and all associated HVAC equipment, i.e., change room exhaust fans) as per Occupancy Appendix. The outdoor air dampers are to be kept to a minimum position or to vary to maintain a return air CO<sup>2</sup> level equal to or less than 800 ppm. The unit is controlled to maintain the space temperature at 19°C.

**Un-Occupied:** The BAS shall command off and/or disable the unit as per Occupancy Appendix. All fans are to be commanded off and/or disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. Outdoor air dampers are to remain closed during un-occupied times. The space temperature shall be controlled to maintain between 16°C and 25°C.

#### 3.2 Room Control HVAC Unit (single Zone)

**HVAC Unit Controls Minimum Hard-wired points**

Outdoor Air Damper Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)

Fan(s) Enable / Disable (10 Vdc to 24Vdc)

Heating Enable (10 Vdc to 24Vdc)

Mechanical Cooling Enable (10 Vdc to 24Vdc)

A. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

B. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.

- C. The compressor will have minimum run time of 5 minutes.
- D. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring and fans, heating, cooling and mechanical energy recovery system are to shut down.
- E. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.
- F. Where the unit is equipped with a hydronic heating coil, in the event the freeze stat senses a low temperature event, the unit fans are to be disabled, outdoor air dampers close by way of mechanical spring, and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).

G. **Scheduled Occupancy**

**Pre-Occupancy:** The BAS shall enable the supply and return air fans 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.

**Occupied:** The BAS shall enable the unit as per Occupancy Appendix. The dampers are to be kept to a minimum position or to maintain the return air CO<sup>2</sup> to a level of 800 ppm. The unit is controlled to maintain the space temperature. The exhaust fan and dampers are enabled with the supply and return air fans.

**Un-Occupied:** The BAS shall disable the unit as per Occupancy Appendix. All fans are to be disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. The space temperature shall be controlled to maintain between 16°C and 25°C.

**Perimeter Heat (Auxiliary Heat)**

When a room conditioned by a HVAC unit is provisioned with auxiliary heating, the auxiliary heat shall be enabled when the heat pump has been heating for 30 minutes. For hydronic heating only, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

H. Scheduled Occupancy

**Occupied:** Occupancy is to be scheduled as per Occupancy Appendix.

**Un-Occupied:** Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band

### 3.3 Room Control Occupant Comfort Heat

Occupant comfort heat includes but is not limited to the following instances:

- Perimeter heaters, unit heaters, duct heaters, radiant panels, etc., in all classrooms, administrative areas, work rooms and resource areas.
- A. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- B. Heating is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band.
- C. The BAS shall control room temperature and indicate status with an analog current Transformer or temperature sensor in accordance with Object Table.

### 3.4 Ancillary Heat

- A. Ancillary Heat shall use a stainless-steel plate sensor include the following areas:
  - Vestibules
  - Outdoor storage areas
  - Supply storage rooms
- B. "Spare" I/O points from a typical room controller are not to be used for Ancillary Heat (i.e. points from Room Controller located within proximity to the Ancillary Heater). I/O point terminations and control points are to be detailed on the drawings.
- C. Stairwells: Ancillary heaters servicing a stairwell and vestibule are to be grouped and controlled using a sensor located within the stairwell (not the vestibule area). Status is required for individual heaters.
- D. Grouping multiple Ancillary Heaters to a single I/O control point is preferred. Status is required for individual heaters.
- E. The BAS shall indicate status using a temperature sensor located on the unit return water piping (Hydronic heater) or using an analog current transformer (Electric heater).
- F. The room temperature set-point shall use unoccupied set-point as for comfort heaters.
- G. For Hydronic heaters the heat is to be enabled and/or commanded on to maintain heater temperature at a minimum of 6°C. Will enable circulation pump where applicable.

### 3.5 Exhaust Fans

- A. The BAS shall control exhaust fans and monitor status with an analog current transformer.
- B. Fans are to be enabled in accordance with local, provincial, and federal code requirements.

**Group A** fans include but is not limited to the following instances:

- Gym washrooms / change rooms

Fans are to be enabled with the gymnasium HVAC unit occupancy schedule.

**Group B** fans include but is not limited to the following instances:

- Exterior storage areas

Fans are to be enabled to maintain room temperature below 27°C.

**Group C** fans include but is not limited to the following instances:

- Staff and Classroom washrooms
- Interior storage areas

Fans are to be enabled during hours of school occupancy and when the school is occupied by custodial or cleaning staff.

Fans are to be removed from the BAS and controlled via a switch near their relative equipment.

### 3.6 Exterior Lighting

- A. The BAS shall enable or disable exterior lighting using a combination calendar and astronomical clock. Command status shall be verified using an analog Current Transformer.
- B. The lighting is to be grouped as Wall-packs and Pole Lighting.

**Part 1            General**

**1.1                INSTRUCTIONS TO BIDDERS**

- .1    The Electrical Supplemental Tender Form must be submitted to the architect and consultant (dei@deiassociates.ca) within 2 hours of tender closing. Electrical contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.
- .2    Should the Electrical Supplemental Form not be submitted then the contractor shall use Basis of Design manufacturers as listed.
- .3    CONTRACTOR  
I/We certify that I/We have the authority to bind the company.

_____	_____
COMPANY NAME	AUTHORIZED SIGNATURE
_____	_____
ADDRESS	PRINTED SIGNATURE
_____	_____
CITY	TITLE
_____	_____
TELEPHONE NUMBER	DATE
_____	
FAX	

CONTRACTOR'S NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

.4 SUB-CONTRACTORS

The Contractor shall state below the name of the Short Circuit/Co-ordination Study/Arch Flash hazard analysis and Life Safety Systems Commissioning Agent Sub-contractor they intend to use, which shall not be changed without the consent of the Consultant.

Co-ordination Study \_\_\_\_\_

Life Safety Systems Commissioning Agent \_\_\_\_\_

.5 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Electrical Contractor shall not indicate equipment, materials or suppliers which are not listed.

.6 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.7 Submit the following list of basis of design and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	Equipment	Basis of Design	Acceptable Alternate Manufacturer	Indicate Manufacturer Or Supplier
26 51 13	LED Interior	Cooper Lithonia	Signify	
26 51 13	LED Exterior	Cooper	Signify Lithonia	
26 51 13	Exit Lighting (running man) & Combo units	Stanpro	Lumacell Aimlite	
26 51 13	Emergency Battery Units	Stanpro	Lumacell Aimlite	
26 51 13	Emergency Fixtures (remote heads)	Stanpro	Lumacell Aimlite	
26 51 16	Digital Occupancy & Daylight Control Systems	Acuity Controls	Cooper Controls Wattstopper	
28 31 25	Fire Alarm System (Addressable)	Mircom	Simplex Edwards Mircom	

CONTRACTOR'S NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

.8 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Apprentice Electrician \$ \_\_\_\_\_/hr

Journeymen Electrician \$ \_\_\_\_\_/hr

**1.2 ELECTRICAL TENDER PRICE (EXCLUDING HST)**

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: \$ \_\_\_\_\_

\_\_\_\_\_  
(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

**END OF SECTION**

CONTRACTOR'S NAME: \_\_\_\_\_ DATE: \_\_\_\_\_



**Part 1            General**

**1.1                GENERAL INSTRUCTIONS**

- .1            Comply with the General Conditions, Supplementary Conditions, and all General Requirements, Mechanical and Electrical Divisions.

**1.2                CASH ALLOWANCES (HST EXCLUDED)**

- .1            Security System Cash Allowance (HST excluded)
  - .1            This contractor shall be responsible for coordinating with the security contractor all associated work to facilitate the installation of the security system.
  - .2            The cost of the work being performed by the Security System will be paid via cash allowance in Division 1 specification.
- .2            PA System Cash Allowances (HST excluded)
  - .1            This contractor shall be responsible for coordinating with the PA system contractor all associated work to facilitate the installation of the PA system.
  - .2            The cost of the work being performed by the PA system contractor will be paid via cash allowance in Division 1 specification.
- .3            IT & Data cabling system Cash Allowance (HST Excluded)
  - .1            This contractor shall be responsible for coordinating with the IT & data contractor all associated work to facilitate the installation of the IT & data system.
  - .2            The cost of the work being performed by the IT & data system contractor will be paid via cash allowance in Division 1 specification.

**1.3                FEES**

- .1            The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.
- .2            A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be coordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action. Contractor will not be responsible for these review costs.

**1.4                EQUIPMENT ALLOWANCES**

- .1            The electrical contractor is to review all specification sections forming part of the electrical bid documents and include additional equipment or components, as well as all associated installation costs and testing costs as noted, in the electrical bid price.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL**

- .1            This Section covers items common to Electrical Divisions.**
- .2            This section supplements requirements of Division 1.
- .3            Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

**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 electrical work.
- .2            Where used, words "Section" and "Division" shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3            Where used, word "supply" shall mean furnishing to site in location required or directed complete with accessory parts.
- .4            Where used, word "install" shall mean secured in place and connected up for operation as noted or directed.
- .5            Where used, word "provide" shall mean supply and install as each is described above.

**1.3                TENDERS**

- .1            Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.
- .2            Submit Supplemental Tender Form as noted.
- .3            Submit tender based on specified described equipment or Alternates listed.
- .4            State in Tender, names of all Subcontractors proposed for work under this Division.

**1.4                LIABILITY INSURANCE**

- .1            This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the Owner, the Consultant and the Contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

**1.5                DRAWINGS**

- .1            Electrical 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 conduits and ducts to accommodate structural conditions. Location of conduits and other equipment may be altered by the Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

- .2 As work progresses and before installing fixtures and 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 fittings.
- .3 Electrical drawings are diagrammatic. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Conceal wiring, 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 Before commencing work, check and verify all sizes, locations, grades, elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .5 Locate all electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .6 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install services so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .7 Relocate equipment and/or material installed but not co-ordinated with work of other Sections as directed, without extra charge.
- .8 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

## **1.6 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 the 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 equipment room drawings clearly showing all distribution equipment.
  - .3 Detailed layout drawings clearly showing conduit/feeder runs 78mm diameter or larger, including hangers or tray.
- .6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

## **1.7 QUALITY ASSURANCE**

- .1 The installations of the division must conform to the latest edition of the Electrical Safety Code as well as its supplemental bulletins and instructions. Provide materials and labour necessary to comply with rules, regulations, and ordinances.
- .2 Complete underground systems in accordance with CSA C22.3 No. 7-94 except where specified otherwise.
- .3 Abbreviations for electrical terms: to CSA Z85-1983.
- .4 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

## **1.8 ALTERNATES AND SUBSTITUTIONS**

- .1 Throughout these sections are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment.
- .2 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacture 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" unit is proposed and does not fit space allotted nor equal specified product in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .3 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.

## **1.9 EXAMINATION**

- .1 Site Reviews
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Electrical Drawings show general arrangement of fixtures, power devices, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural, Mechanical, 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 Electrical Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

#### 1.10 SEQUENCING AND SCHEDULING

- .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 electrical items, make proper provision to avoid interferences in a manner approved by consultant. Changes required in work specified in these sections caused by neglect to do so shall be made at no cost to Owner.
- .3 Arrange fixtures, conduit, ducts, and equipment to permit ready access to junction boxes, starters, motors, control components, and to clear openings of doors and access panels.
- .4 Furnish and install inserts and supports required by these sections 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 the electrical trade.
- .5 Adjust locations of ducts, conduits, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each conduit and duct prior to installation.
  - .1 Make offsets, transitions, and changes in direction of ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
  - .2 Supply and install pull boxes, etc., as required to effect these offsets, transitions, and changes in direction.

#### 1.11 DRAW BREAKDOWN

- .1 This Contractor MUST submit a breakdown of the tender price into classifications to the satisfaction of the Consultant, with the aggregate of the breakdown totaling the total contract amount. **Each item must be broken out into material and labour costs.** Progress claims, when submitted are to be itemized against each item of the draw breakdown. This shall be done in table form showing contract amount, amount this draw, total to date, % complete and balance.

- .2 Breakdown shall be as follows:
  - .1 Permits and fees
  - .2 Mobilization (maximum 1%)
  - .3 Panelboards and miscellaneous distribution equipment
  - .4 Feeder conduits
  - .5 Branch conduits
  - .6 Branch wiring
  - .7 Lighting fixtures (interior)
  - .8 Emergency lighting
  - .9 Exterior lighting
  - .10 Fire alarm system
  - .11 Voice/Data system
  - .12 Starters, contactors and control devices
  - .13 Electric heating
  - .14 Wiring for mechanical equipment
  - .15 Wiring for owner's equipment
  - .16 Cash allowances (itemized)
  - .17 Commissioning and Integrated System Testing**
  - .18 Electrical contractor closeout requirements (minimum of 3% but not less than \$5,000.00)
- .3 The breakdown must be approved by the Consultant prior to submission of the first draw.
- .4 Breakdowns not complying to the above will not be approved.
- .5 Breakdown must indicate total contract amount.
- .6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.**

## **1.12 SHOP DRAWINGS AND PRODUCT DATA**

- .1 General
  - .1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 14 days after award of Contract.
  - .2 Upon receipt of approved shop drawing, product is to be ordered immediately.
  - .3 Provide a complete list of shop drawings to be submitted prior to first submission.
  - .4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

- .5 If material or equipment is not as specified or submittal is not complete, it will be rejected by consultant.
- .6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .7 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**
- .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 Manufacturer test data where requested.
  - .3 Manufacturer to certify as to current model production.
  - .4 Certification of compliance to applicable codes.
- .13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
- .14 **If a shop drawing is returned "reviewed as noted" this Contractor must provide written indication that the comments have been complied with.**
- .15 A partial list of shop drawings includes:
  - .1 Panelboards and disconnects
  - .2 Fire alarm system
  - .3 Luminaires and drivers
  - .4 Emergency battery units and fixtures
  - .5 Starters, contactors and control devices
  - .6 Firestopping materials
  - .7 Hand dryers
  - .8 Wiring devices
  - .9 Occupancy sensors & digital lighting controls (including completed engraving sheets)
  - .10 Co-ordination study
  - .11 Roof cone
  - .12 Integrated Life Safety System Testing Plan (ITP)

- .2 Submissions shall be submitted electronically as per the following directions:
  - .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
      - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
      - .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
      - .5 Submissions shall contain multiple files according to section names as they appear in Specification.
      - .6 File names shall include consultant project number and description of shop drawing section submitted.
      - .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
      - .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
      - .9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**
    - .2 Email submissions shall include subject line to clearly identify the consultants' project number and the description of the shop drawings submitted.
    - .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
    - .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
    - .5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.
    - .6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.



**1.13 CARE, OPERATION AND START-UP**

- .1 Instruct Consultant and operating personnel in the operation, care, and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

**1.14 VOLTAGE RATINGS**

- .1 Operating voltages: to CAN3-C235-83.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

**1.15 PERMITS, FEES, AND INSPECTION**

- .1 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be co-ordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action.
- .2 The contractor is required to include in his tender all required inspection costs by the Electrical Safety Authority. Permit application is the responsibility of the contractor.
- .3 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.
- .4 Notify Consultant of changes required by Electrical Safety Authority prior to making changes.
- .5 Furnish Certificates of Acceptance to Engineer from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.
- .6 This contractor must furnish any certificates required to indicate that the work completed conforms with laws and regulations of authorities having jurisdiction.

**1.16 MATERIALS AND EQUIPMENT**

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.

**1.17 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS**

- .1 Supplier and installer responsibility is indicated in the Equipment Wiring Schedule on electrical drawings.
- .2 Control wiring and conduit is specified in the Electrical specifications except for conduit, wiring and connections below 50 V, which are related to control systems specified in the Mechanical specifications.

**1.18 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish.
  - .2 Paint indoor switchgear and distribution enclosures light grey.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks, fastenings, and conduits etc. to prevent rusting.

**1.19 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
  - .1 Lamacoid 3 mm (1/8") thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

**NAMEPLATE SIZES**

Size 1	9 mm x 50 mm (3/8" x 2")	1 line	3 mm (1/8") high letters
Size 2	12 mm x 70 mm (1/2" x 2 1/2")	1 line	5 mm (3/16") high letters
Size 3	12 mm x 70 mm (1/2" x 2 1/2")	2 lines	3 mm (1/8") high letters
Size 4	20 mm x 90 mm (3/4" x 3 1/2")	1 line	9 mm (3/8") high letters
Size 5	20 mm x 90 mm (3/4" x 3 1/2")	2 lines	5 mm (3/16") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	12 mm (1/2") high letters
Size 7	25 mm x 100 mm (1" x 4")	2 lines	6 mm (1/4") high letters

- .3 Wording on nameplates labels to be approved by consultant prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Nameplates for disconnects, starters and contactors must indicate equipment being controlled and voltage.
- .8 Nameplates for transformers must indicate transformer label as indicated and capacity, primary, and secondary voltages.
- .9 Nameplates for equipment connected to emergency services are to be red in colour.

**1.20 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

**1.21 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes, and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (45') intervals.

**1.22 Colour bands must be 25 mm (1") wide.**

	<u>Prime</u>
up to 208 V	yellow
209 to 600 V	white
Voice/Data system	green
Security System	orange
Public Address	blue
Fire alarm	red
Emergency lighting (DC)	pink

- .1 This contractor must paint all system junction boxes and covers in conformance with the above schedule.

**1.23 PROTECTION OF OPENINGS**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**1.24 WIRING TERMINATIONS**

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

**1.25 MANUFACTURERS AND CSA LABELS**

- .1 All labels must be visible and legible after equipment is installed.

**1.26 WARNING SIGNS**

- .1 To meet requirements of Electrical Safety Authority and Consultant.
- .2 Provide porcelain enamel signs, with a minimum size of 175 mm x 250 mm (7" x 10").

**1.27 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm (6") horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m (10'), and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door or as indicated on drawings.

### 1.28 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of 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 electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1100 mm (43-1/4").
  - .2 Wall receptacles:
    - .1 General: No lower than 400 mm (15-3/4") from the finish floor to the bottom of the receptacle.
    - .2 Above top of continuous baseboard heater: 200 mm (8").
    - .3 Above top of counters or counter splash backs: 100 mm (4").
    - .4 In mechanical rooms: 1200 mm (48").
  - .3 Panelboards: as required by Code or 1400 mm (56").
  - .4 Fire alarm pull station: 1200 mm (3' - 11") max.
  - .5 Fire alarm visual and signal devices: the entire lens is not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor. Or unless noted on the drawing.
  - .6 Fire alarm horn: Not less than 2300 mm above the floor (where ceiling heights allow) measured to the centre of the device. Not less than 150 mm from the ceiling measured from the top of the assembled device. Or unless noted on the drawing.
  - .7 Television outlets: Not lower than 400 mm (15-3/4") from the finish floor to the bottom of the receptacle.
  - .8 Voice/data outlets: At height of adjacent outlet or no lower than 400 mm (15-3/4") from the finish floor to the bottom of the receptacle.
  - .9 Thermostat: 1200 mm (3'-11") max.
  - .10 Clocks: 2100 mm (84").
  - .11 Heaters: 200 mm (8" AFF) to bottom of heater.
  - .12 Emergency call switches and/or pushbuttons: 900 mm (35").
  - .13 Door operators: be mounted between 900mm (35") and 1100mm (43-1/4") from the floor.

### 1.29 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers, and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

**1.30 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 steel pipes, sized for free passage of conduit, and protruding 50 mm (2") beyond either side.
- .2 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

**1.31 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.

**1.32 GUARANTEE AND WARRANTY**

- .1 At the substantial completion stage of this project this Contractor must provide a written guarantee indicating that any defects, not due to ordinary wear and tear or improper use which occur within the first year from the date of substantial completion will be corrected at the contractor's expense.
- .2 **If the electrical sub-contractor's office is 50 kilometers (30 miles) or more from the project site, the sub-contractor is to provide a service/warranty work agreement for warranty period with a local electrical sub-contractor approved by consultant. Include copy of service/warranty agreement in warranty section of operation and maintenance manual.**
- .3 Warranty period shall start from date of substantial completion.
- .4 Refer to individual specification sections for information on any special manufacturer's equipment warranties.

**1.33 SYSTEM START UP**

- .1 Provide consultant with written notice verifying all equipment operation and installation is complete prior to scheduled start-up period.
- .2 Start up shall be in presence of the following: owner or representative, contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .3 Arrange with all parties and provide 72 hours notice for start up procedure.
- .4 Simulate system start up and shut down and verify operation of each piece of equipment.
- .5 These tests are to demonstrate that the systems and equipment installed are operational as specified.
- .6 The contractor must describe during the start up session the required maintenance for each piece of equipment according to the manufacturer.
- .7 The contractor must provide all necessary tools (including a digital multimeter) to successfully complete the start up procedure.

**1.34 OPERATION AND MAINTENANCE MANUAL**

- .1 Provide operation and maintenance data for incorporation into manual as specified in other Sections of this Division.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.
  - .1 Submit 1 copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by consultant.
    - .1 Manual(s) shall be in a three-ring binder (minimum 50 mm (2") ring) labelled:
      - .1 Operation and Maintenance Manual.
      - .2 Project Name.
      - .3 Location.
    - .2 Make changes as required and re-submit as directed by consultant.
- .3 Each manual must include (in "tabbed" sections) the following:
  - .1 Index
  - .2 List of General, Mechanical, Electrical Contractors and all associated sub-contractor names, addresses and contact numbers.
  - .3 List of suppliers and equipment wholesalers local to the project.
  - .4 Warranty letter for all parts, equipment, and workmanship.
  - .5 List of manufacturers, spare parts list, and source.
  - .6 Copy of typewritten schedules for all new panels.
  - .7 Receipt of spare lamps and fuses from owner's representative.
  - .8 Receipt of turned over keys for electrical panels.
  - .9 Copy of all substantial performance final certificates.
  - .10 Copy of electrical shop drawings which have been stamped and reviewed by consultant.
  - .11 Electrical As-built drawings including contractor company's as built stamp.
  - .12 Coordination study/Arc flash hazard study shop drawings.
  - .13 Any special warranties on equipment required (i.e. LED lighting, digital lighting control, SPDs, power generation).
  - .14 Certificate of completion from all associated sub-contractors.
  - .15 System commissioning certificate and report.
- .4 Final Submittals of as-built drawings and close-out documents:
  - .1 Upon acceptance of Operation and Maintenance Manual by the Consultant provide the following:
    - .1 One (1) USB drive with:
      - .1 Autocad Drawings – record
      - .2 PDF drawings (individual PDF drawings, not combined into one PDF) – record.
      - .3 Specification book

- .4 Addendum
- .5 Site instruction
- .6 Change orders.
- .7 Maintenance Manuals (Digital format – Individual document/Division, not combined).
- .8 Contact lists.
- .9 Approved shop drawings
- .10 Warranties
- .11 Guaranties
- .12 Operating and Maintenance Instructions
- .13 Reports (commission reports)
- .14 Certificates (ESA, fire alarm, etc.)
- .2 Submit approved completed reproducible paper as-built drawings as well as a scan PDF of each drawing file on a USB stick (Note PDF's cannot be combined).
- .3 Two (2) printed hard binders of the maintenance manuals, as well as a PDF file of the entire approved manual on a USB Stick.

### 1.35 AS-BUILT DRAWINGS

- .1 Site records:
  - .1 Contractor shall provide 2 sets of reproducible electrical 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 field and contract changes to electrical systems.
  - .2 On a weekly basis, transfer information to reproducible, revising reproducible to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Always make available for reference purposes and inspection.
- .2 As-built drawings:
  - .1 Identify each drawing in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .2 Submit hard copy to consultant for approval. When returned, make corrections (if any) as directed.
  - .3 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals. Submit approved completed reproducible paper as-built drawings as well as a scan pdf of **each** drawing file on USB stick (note pdfs cannot be combined).

**1.36 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS**

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Manufacturers or their representatives are to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, As-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

**1.37 SUBSTANTIAL PERFORMANCE**

- .1 Complete the following to the satisfaction of the consultant prior to submission of substantial performance.
  - .1 As-built Drawings.
  - .2 Maintenance Manuals.
  - .3 System Start up.
  - .4 Instructions to Owners.
  - .5 Final Certificates (Electrical Safety Authority, Fire Alarm, Security, Public Address, Telecommunications, Emergency Lighting, Integrated Life Safety Systems Commissioning, Coordination Study/Arc Flash Hazard (including photos of each breaker)).

**1.38 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.

**1.39 REVISION TO CONTRACT**

- .1 Provide the following for each item in each change notice:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/supplier's invoice if requested.

**1.40 EQUIPMENT SUPPORTS**

- .1 Equipment supports supplied by equipment manufacturer: shall be installed by the electrical contractor.
- .2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings if necessary.



- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. This installation of this pad shall be the responsibility of the electrical contractor.
- .4 This contractor shall be responsible for providing all anchor bolts and associated formed concrete bases for lighting standards as detailed.

**1.41 SLEEVES**

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete, or fire rated assemblies and as indicated.
- .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.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and conduit.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.
- .6 Through foundation walls PVC sleeves are acceptable.
- .7 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 Fill future-use sleeves with easily removable filler.

**1.42 FIRESTOPPING**

- .1 Firestopping material and installation within annular space between conduits, ducts, and adjacent fire separation.
- .2 Provide materials and systems capable of maintaining effective barrier against flame, smoke, and gases.
- .3 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .4 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.
- .5 Provide "firewrap" blanket around services penetrating firewalls. Extent of blanket must correspond to ULC recommendations. In general wrap individual conduits with approved firewrap materials on each side of firewall. Refer to architectural drawings for FT ratings. Provide 1 and/or 2 layers of firewrap with transverse and longitudinal seams overlapped and/or butted (second layer offset from first layer). Cut edges are to be sealed with aluminum foil tape. Provide 50 mm stainless steel banding at 200 mm intervals. Install firewrap to manufacturers' recommendations for proper FT rating. Acceptable manufacturers are 3M Firemaster ductwrap or approved equal.

- .6 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens, and volatile solvents.
  - .7 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
  - .8 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.
  - .9 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
  - .10 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.
  - .11 Submit product literature and installation material on firestopping in shop drawing and product data manual.**
  - .12 Acceptable manufacturers:
    - .1 Rectorseal Corporation (Metacaulk)
    - .2 Proset Systems
    - .3 3M
    - .4 Hilti
    - .5 STI Firestop
- Note: Fire stop material must conform to requirements of local authorities having jurisdiction. Contractor to confirm prior to application and ensure material used is compatible with that used by other trades on site.**
- .13 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

#### **1.43 ACCESS DOORS**

- .1 Supply access doors to concealed electrical equipment for operating, inspecting, adjusting, and servicing.
- .2 Flush mounted 600 mm x 600 mm (24" x 24") for body entry and 300 mm 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.
  - .3 Installation is specified in applicable sections.

- .5 Acceptable materials:
  - .1 Le Hage
  - .2 Zurn
  - .3 Acudor
  - .4 Nailor Industries Inc.

**1.44 DELIVERY STORAGE & HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury, but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

**1.45 REPAIR, CUTTING, CORING AND RESTORATION**

- .1 Be responsible for required digging, 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.
- .2 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.
- .3 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.
- .4 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .5 Slots, cores 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.

**1.46 CLEANING**

- .1 Clean interior and exterior of all electrical equipment provided including light fixture lenses.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

**1.47 ASBESTOS**

- .1 If asbestos is suspected or identified cease all work in the immediate area in accordance with OSHA 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.**

**1.48 DISCONNECTION AND REMOVAL**

- .1 Disconnect and/or remove equipment 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.

**1.49 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.
- .2 Design drawings are diagrammatic and do not necessarily indicate all specific final connection requirements. For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

**1.50 ENCLOSURES**

- .1 This contractor must ensure that all electrical equipment mounted in sprinklered areas is provided with an enclosure in conformance with the Electrical Safety Code.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL PROVISIONS**

- .1      Conform to the General Provisions of Division 1 and Electrical General Requirements Section.
- .2      This project is one of a retrofit nature in part, and which will require selective 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                SCOPE OF WORK**

- .1      The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, devices 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 electrical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5      All new holes and openings to facilitate electrical 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, 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, devices, cabling, services, etc. as indicated.
- .11 Remove all redundant and obsolete systems, connections, and wiring but to its source.
- .12 Provide a list of equipment to be removed to the owner, for their acceptance of same. Remove all equipment from site that 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. The floor in the demolition area shall be protected at all times.

**END OF SECTION**

**Part 1 General****1.1 INTENT**

- .1 Life safety and fire protection systems are to be installed to comply with the provisions of the current Ontario Building and Fire Codes. As a result, testing of these integrated systems must be performed as a whole to ensure the proper operation and inter-relationship between systems (functional testing).
- .2 The testing is to provide functional verification and documented confirmation that these building systems satisfy the intent of the Building Code.
- .3 These systems as applicable to any given project include but are not limited to fire alarm, sprinkler system and associated valves, ventilation systems, door hold open devices, elevator recalls, fire shutters, suppression systems, and smoke and fire dampers.

**1.2 GENERAL**

- .1 This testing process is the responsibility of the Integrated Testing Firm as a sub-contractor to the electrical trade. Electrical trade to include all costs associated with the Integrated Testing Coordinator in contract.
- .2 This process must be co-ordinated with suppliers and sub-contractors associated with these systems (mechanical and/or electrical).
- .3 This process must be co-ordinated with the project construction schedule and be completed, including all associated documentation, prior to the consultant's certification of the project for occupancy.
- .4 All applicable contractors, sub-contractors, and suppliers are to include all required costs in their respective tender costs.
- .5 All work is to be performed in accordance with CAN/ULC S1001-2011. Special consideration is to be given to the Sample Integrated Testing Plan (ITP), the review of life safety system design documents, and the provision of test plans and reports.
- .6 The work to be performed by this contractor is also described in CAN/ULC S1001-2011.
- .7 Refer to CAN/ULC S1001-11 Rev1-2019 Informative Annex (C) for Sample Integrated Testing Plan (ITP).

**1.3 QUALITY ASSURANCE**

- .1 The following criteria must be met in order to be considered an acceptable Integrated Testing Coordinator for this project:
  - .1 Manufacturers: Firms regularly engaged in functional testing and implementation of life safety and fire protection systems for not less than five years.

- .2 Qualifications: Firms with at least five years of successful experience in facility construction, inspection, acceptance testing or commissioning as it relates to fire protection and life safety and equipment similar to that required for this project.
  - .3 The Contractor shall be an established commissioning contractor that has had and currently maintains a locally run and operated business for at least five years.
  - .4 The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the systems.
- .2 For bidder information only, experienced Life Safety Systems Testing Firms include these listed below or local branches of the companies noted in the vicinity of this project:
- .1 Vintage Fire and Life Safety Ltd.  
25 Coverdale Cres.  
Kitchener, Ontario N2M 4X1
  - .2 Troy Life and Fire Safety  
805 Boxwood Dr., Unit #201  
Cambridge, Ontario N3E 1A4
  - .3 Control Tech Systems  
31 Regal Road  
Guelph, Ontario N1K 1B6
  - .4 Lonergan Engineering  
4 Industrial Parkway South  
Aurora, Ontario L4G 3W1
  - .5 Guardian Fire Consulting Group  
55-346 Northfield Dr.  
Waterloo, Ontario N2K 3T6
- NOTE: This agent must be a third-party firm NOT associated with this project in any way and be under contract with the electrical sub-contractor not the fire alarm supplier.**
- .3 Other firms to these listed above, who feel they are capable, must submit in writing, to the Consultant's office confirmation of the items listed in the criteria above, a minimum of one week prior to tender close in order to be considered as a bidder.

#### 1.4 GENERAL REQUIREMENTS

- .1 The Commissioning Process shall generally encompass and co-ordinate the following key areas:
  - .1 Integrated systems testing planning.
  - .2 Integrated systems testing implementation (functional testing).
  - .3 Integrated systems testing documentation.



**1.5 RESPONSIBILITIES****.1 General Contractor:**

- .1 The general contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation of the noted systems.
- .2 The general contractor will assure participation and co-operation of Sub-Contractors and Specialty Contractors (mechanical, electrical, building management, etc.) under the General Contractor's jurisdiction as required for the commissioning process.

**.2 Mechanical Contractor:**

- .1 Verify Functional performance of associated mechanical systems for compliance with design intent as specified in the appropriate Specification sections.
- .2 Provide the documentation with standard Functional performance reports on completion of the testing.
- .3 Verify submissions for system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.

**.3 Electrical Contractor:**

- .1 The Integrated Life Safety Systems Testing Coordinator (ITC) is being retained by the electrical contractor, however; this contractor's work to satisfy the ITC requirements shall be included in the tender price.
- .2 Verify Functional performance of electrical systems for compliance with design intent as specified in the appropriate Specification sections.
- .3 Provide the documentation with standard Functional performance reports on completion of the testing.
- .4 Verify submissions for electrical system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.
- .5 As a minimum this contractor must include for:
  - .1 Providing the ITC with documentation of design and shop drawings.
  - .2 Provide documents for sequence of operation and maintenance of system.
  - .3 Testing of all components and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.
  - .4 Testing and operation of any generator (s) as applicable to the project.
  - .5 Other items that may be requested by the ITC.
  - .6 Re-commissioning of any items that may have failed.

- .7 Re-setting of the system to proper operation after tests are completed.
  - .8 Provide documentation of compliance with OBC 3.2.7.3 'Emergency Lighting' and 3.2.7.4 'Emergency Power for lighting'.**
  - .9 Provide written confirmation that life safety systems are installed in accordance with applicable codes and standards, as well as the scope of the project engineering documents.
- .4 Equipment Manufacturers:
- .1 The equipment manufacturers shall be responsible for providing labour, material, equipment, etc., required within the scope of the respective equipment to facilitate the commissioning process.
  - .2 The equipment manufacturers will perform Pre-Functional and Functional Performance Tests required by the commissioning process.
- .5 Design Engineer:
- .1 The design engineer shall review and provide written confirmation of acceptance of the Integrated Testing Plan (ITP).
  - .2 The design engineer shall observe Functional Performance Testing, at his discretion.
  - .3 The design engineer shall provide technical capabilities for resolution of deficiencies, where required.
  - .4 The design engineer shall provide necessary information to assist Integrated Test Coordinator including written confirmation of life safety systems installation in accordance with project engineering documents and are ready for integrated testing.

## **Part 2 Commissioning Process**

### **2.1 OPERATIONS AND MAINTENANCE MANUALS**

- .1 Furnish Final, reviewed Operation and Maintenance Manuals to the Consultant fourteen (14) days prior to scheduled Functional Performance Tests.

### **2.2 FUNCTIONAL PERFORMANCE TEST**

- .1 The contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems are installed in accordance with the specifications, drawings, and manufacturers' requirements.
- .2 The contractor shall be responsible for co-ordinating schedule for Functional tests of various equipment and systems.

- .3 In the Functional Test, all noted systems and sub-systems shall be checked for the following:
- .1 Verify that each element has been properly installed, properly identified, and that all connections have been made correctly.
  - .2 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .3 Re-commission any item(s) that may have failed.
  - .4 Notify the consultant in writing, at least fourteen (14) days prior to the date of Functional Performance Testing. Schedule the Functional performance tests over a period of consecutive business days.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
- .2        CAN/CSA-C22.2 No.131-M89(R1994), Type TECK 90 Cable.

**1.2                PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1        Conductors: stranded for 10 AWG and larger.
- .2        Minimum size: 12 AWG.
- .3        Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material 90°C (194°F) rated T90 for indoor above grade installations and RW90 for below grade installations.

**2.2                TECK CABLE**

- .1        Cable: to CAN/CSA-C22.2 No.131.
- .2        Conductors:
  - .1        Grounding conductor: copper.
  - .2        Circuit conductors: copper, size as indicated.
- .3        Inner jacket: polyvinyl chloride material.
- .4        Armour: aluminum.
- .5        Overall covering: polyvinyl chloride material.
- .6        Fastenings:
  - .1        One hole steel zinc straps to secure surface cables 50 mm (2") and smaller. Two hole steel straps for cables larger than 50 mm (2").
  - .2        Channel type supports for two or more cables at 1500 mm (60") centres.
  - .3        Threaded rods: 6 mm (1/4") diameter to support suspended channels.
- .7        Connectors must be suitable for:
  - .1        Installed environment and approved for use with TECK cable.

**2.3                ARMoured CABLES**

- .1        Conductors: insulated, copper minimum size as indicated above.
- .2        Type: AC90 (minimum size 12 AWG).

- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors must be suitable for installed environment and approved for use with armoured cable.

**Part 3 Execution**

**3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring from source to load through raceways as specified.
- .2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

**3.2 INSTALLATION OF TECK CABLE 0 - 1000 V**

- .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

**3.3 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.
- .3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and "drops" to stud walls, lighting fixtures, and ceiling mounted devices.
- .4 **These "drops" shall not be permitted to exceed 2.4 m (8'-0"). To limit these "drops" to lengths noted above provide additional branch wiring in conduit.**

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Splitters must conform to CSA C22.2 No. 76 (latest edition).
- .2        Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

**2.2                SPLITTERS**

- .1        Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2        Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3        At least three spare terminals on each set of lugs in splitters less than 400 A.
- .4        Splitter length must match arrangement of equipment unless indicated otherwise.

**2.3                JUNCTION AND PULL BOXES**

- .1        Welded steel construction with screw-on flat covers for surface mounting.
- .2        Covers with 25 mm (1") minimum extension all around, for flush-mounted pull and junction boxes.

**Part 3            Execution**

**3.1                JUNCTION AND PULL BOXES INSTALLATION**

- .1        Install pull boxes in inconspicuous but accessible locations.
- .2        Install junction and pull boxes so as not to exceed 30 m (100') of conduit run between pull boxes and in conformance with the Electrical Safety Code.

**3.2                IDENTIFICATION**

- .1        Provide equipment identification in accordance with General Electrical Requirements Section.
- .2        Install size 2 identification labels indicating system name, voltage, and phase.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Outlet boxes, conduit boxes, and fittings must conform to CSA C22.2 No. 18 (latest edition).

**Part 2            Products**

**2.1                OUTLET AND CONDUIT BOXES GENERAL**

- .1        Size boxes in accordance with CSA C22.1.
- .2        102 mm (4") square or larger outlet boxes as required for special devices.
- .3        Gang boxes where wiring devices are grouped.
- .4        Blank cover plates for boxes without wiring devices.
- .5        347 V outlet boxes for 347 V switching devices.
- .6        Combination boxes with barriers where outlets for more than one system are grouped.

**2.2                SHEET STEEL OUTLET BOXES**

- .1        Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 64 mm (3" x 2" x 2½") or as indicated. 102 mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. Iberville 1104 Series.
- .2        Electro-galvanized steel utility boxes for outlets connected to surface mounted EMT conduit **in utility rooms**, minimum size 102 mm x 57 mm x 38 mm (4" x 2¼" x 1½"). Iberville 1110 Series.
- .3        102 mm (4") square or octagonal outlet boxes for lighting fixture outlets.
- .4        102 mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

**2.3                CONDUIT BOXES**

- .1        Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle **in areas (other than utility rooms) where surface conduit is used.**

**2.4                FITTINGS- GENERAL**

- .1        Bushing and connectors with nylon insulated throats.
- .2        Knock-out fillers to prevent entry of debris.
- .3        Conduit outlet bodies for conduit up to 32 mm (1- 1/4") and pull boxes for larger conduits.
- .4        Double locknuts and insulated bushings on sheet metal boxes.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm (1/4") of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Outlets if unwired are to be provided with blank cover plates to suit related sections of this specification.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1            CSA C22.2 No.65-1956(R1965) Wire Connectors.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as indicated.
- .2            Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3            Clamps or connectors for armoured cable, mineral insulated cable, and flexible conduit, as required.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Remove insulation carefully from ends of conductors and:
  - .1            Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2            Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  - .3            Install fixture type connectors and tighten. Replace insulating cap.

**END OF SECTION**

**Part 1**            **General**  
**Not Applicable.**

**Part 2**            **Products**

**2.1**                **MATERIALS**

- .1            Grounding equipment must conform to CSA C22.2 No 41 (latest edition).

**2.2**                **EQUIPMENT**

- .1            Clamps for grounding of conductor: size as required to electrically conductive underground water pipe and electrically conductive metal gas piping.
- .2            Rod electrodes: Copper clad steel 19 mm (3/4") diameter by 3 m (10') long.
- .3            Plate electrodes: Galvanized steel, surface area 0.2 m<sup>2</sup>, minimum 1.6 mm thick.
- .4            Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.
- .5            Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .6            Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1            Grounding and bonding bushings.
  - .2            Protective type clamps.
  - .3            Bolted type conductor connectors.
  - .4            Thermit welded type conductor connectors.
  - .5            Bonding jumpers, straps.
  - .6            Pressure wire connectors.

**Part 3**            **Execution**

**3.1**                **INSTALLATION GENERAL**

- .1            Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. **Where EMT is used, run ground wire in conduit.**
- .2            Install connectors in accordance with manufacturer's instructions.
- .3            Protect exposed grounding conductors from mechanical injury.
- .4            Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process inspectable wrought copper compression connectors to ANSI/IEEE 837.

- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Ground pad mounted transformers as detailed on the drawings.

### **3.2 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, and outdoor lighting.

**END OF SECTION**

**Part 1            General**

**1.1            APPLICATION**

- .1    Seismic restraint is becoming more prominent with improved soil testing equipment. Seismic requirement is not site specific by geographical area but determined by site soil conditions.
- .2    Where the structural engineer or architect documents have  $I_e * S_a(0.2) * F_a < 3.5$  seismic is not required on the electrical systems.
- .3    Where the structural engineer or architect documents have  $I_e * S_a(0.2) * F_a \geq 3.5$  seismic is required on the electrical systems.
- .4    Seismic will always be required on fire protection systems when required by NFPA codes.
- .5    Seismic will always be required on any "Disaster Relief Building." For example, hospitals, police stations, ambulance building, etc.
- .6    When it is unclear in the tender documents request information from the structural engineer or architect for clarification.

**1.2            SECTION INCLUDES**

- .1    Seismic Requirements for free standing equipment and other similar systems.
- .2    Seismic Requirements for single rod hanger support for conduit, and other similar systems.
- .3    Seismic Requirements for trapeze type supports for bus tray, conduit, and other similar systems.

**1.3            REFERENCES**

- .1    Building Officials and Code Administrators National Building Code (BOCA) (latest edition).
- .2    Ontario Building Code (OBC), (latest edition).

**1.4            QUALITY ASSURANCE**

- .1    The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of free-standing electrical equipment, conduit, cable trays and other similar suspended systems and equipment as determined by seismic restraint designer.
- .2    System Supports/Restraints: Firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.
- .3    Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

- .4 Only companies experienced in performing the work of this section shall do the installation.
- .5 All seismic restraint installations shall be independently reviewed by the Owner's representatives for compliance with project specifications.

### **1.5 SUBMITTALS**

- .1 Submit seismic force calculations according to forces chart located on structural engineer of record's drawings. Submit pre-approved restraint selections and installation details from acceptable manufacturer specified in this section or engineer approved equal.
- .2 Restraint selection and installation details shall be pre-approved by a professionally licensed engineer with at least 5 years of experience in the design of seismic restraints.
- .3 Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns.
- .4 Contractor to retain services of Professional Engineer, designated in local jurisdiction and submit stamped drawings. The same engineer shall provide periodic field review and final certification upon completion of the project.

The following companies are provided for information purposes:

- .1 Tecoustics Limited - 1-888-714-9596
- .2 Lampkin Structural Services – 613-830-6875
- .3 Vibro Acoustics – 1-800-565-8401
- .4 Tecoustics Vibration Control & Seismic Restraint – 905-681-6077
- .5 Gerrits Engineering 705-737-3303
- .5 All fees and associated costs for the engineering shall be the responsibility of this contractor.

### **1.6 SEISMIC BRACING AND SUPPORT DESIGN REQUIREMENTS**

- .1 Seismic restraint designer shall co-ordinate all attachments with the structural engineer of record.
- .2 Design analysis shall include force calculations according to forces chart listed on the structural engineer of record's drawings and capacity of materials utilized for the connection of the equipment or system to the structure.
- .3 Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
- .4 All seismic restraint devices shall be designed to accept without failure the calculated forces as per the applicable Building Code.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver strut systems, pipe hangers and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.
- .2 Store strut systems, pipe hangers and components in original cartons and in clean dry space; protect from weather and construction traffic.

**1.8 WORK FURNISHED BUT NOT INSTALLED**

- .1 The materials and systems specified in this section shall be purchased by the electrical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.
- .2 The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the electrical equipment.

**1.9 COORDINATION**

- .1 Coordinate size, shape, reinforcement, and attachment of all housekeeping pads supporting seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the consultant.
- .2 Coordinate with seismic restraint manufacturer to locate and size structural supports underneath seismically restrained equipment (e.g. switchboards, motor control centres, transformers, and other similar equipment).

**1.10 DESCRIPTON OF SYSTEM**

- .1 It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and electrical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.
- .2 The work under this section shall include furnishing all labour, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications.
- .3 All seismic snubber restraint assemblies shall meet the following minimum requirements:
  - .1 The snubber/restrained isolator for isolated equipment shall include a resilient element that will ensure that no un-cushioned shock can occur (this does not include cable restraints).
  - .2 It shall be possible to visually inspect the resilient material for damage and allow for replacement, if necessary.
  - .3 All snubbers are to include a maximum air gap of 0.25 in (6 mm).
  - .4 Seismic restraint systems shall be designed to offer seismic restraint in all directions, unless otherwise noted.
  - .5 Seismic restraint capacities to be verified by an independent test laboratory or certified by a registered Professional Engineer to ensure that the design intent of this specification is realized. Verification shall be by one of the following methods:
    - .1 An NRTL (National Recognized Testing Laboratory), or laboratory recommended by VISCMA.

- .2 Certified by a Professional Engineer with at least 5 years of experience, using industry standard methods of analysis, which employ common engineering practices. Adherence to the ratings standard within ASHRAE SPC171 and VISCMA 102-2007 is required.
- .3 By a nationally recognized agency, such as VISCMA, that has reviewed and approved the restraint.

#### **1.11 SYSTEM DESIGN**

- .1 Seismic restraint manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers/restraints to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.
- .2 The contractor shall furnish, to the seismic restraint manufacturer, a complete set of approved shop drawings of all equipment that is to be restrained, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length, and width dimensions, and installed operating weights of the equipment to be restrained.
- .3 All conduit etc. is to be restrained to meet code requirements. At a minimum, the seismic restraint manufacturer shall provide documentation on maximum restraint spacing for various restraint sizes and anchors, as well as "worst case" reaction loads for each restraint and/or anchor size.
- .4 The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly dowelled to the building structure, so as to withstand calculated seismic forces. In addition, the size or the housekeeping pad is to be coordinated with the seismic restraint manufacturer to ensure that adequate edge distances exist in order to obtain the desired equipment anchor capacities.

#### **1.12 ALTERNATE SYSTEMS**

- .1 Provisions of the General Conditions and Supplemental Conditions of the specifications shall govern the use of alternate systems to those specified.
- .2 Manufacturers not listed as approved in "Part 2 Materials" of this section must secure approval to bid a minimum of ten (10) days prior to the project bid date.
- .3 Uncertified internal equipment seismic restraint systems are disallowed for use on this project.

#### **1.13 INSTALLATION**

- .1 Installation of all seismic restraint materials specified herein shall be accomplished following the manufacturer's written instructions. Installation instructions shall be submitted to the engineer for approval prior to the beginning of the work.

**Part 2 Products**

**2.1 ACCEPTABLE MANUFACTURERS**

- .1 Cooper B-Line.
- .2 Unistrut Building Systems.
- .3 Kinetics Noise Control Inc.
- .4 Mason Industries.
- .5 Engineer approved equal.

**2.2 SEISMIC BRACING COMPONENTS**

- .1 Steel strut and bracing components shall be utilized in combinations as required to meet designed load capacities.
- .2 Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

**2.3 BUILDING CODE REQUIREMENTS**

- .1 Seismic Zone Factors and coefficients shall be according to geographical area information table located on structural engineer of record's drawings.

**2.4 SEISMIC SNUBBER TYPES**

- .1 GENERAL  
(Isolator/Snubber Types contained herein are per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Handbook, HVAC Applications, Seismic and Wind Restraint Design)
- .2 Type J, Cable Restraints for Suspended Conduit and Trapeze
  - .1 Seismic wire rope cable restraints shall consist of steel wire strand cables, sized to resist project seismic loads, arranged to offer seismic restraint capabilities for conduit, trapeze assemblies, and suspended equipment in all lateral directions.
  - .2 Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.
  - .3 Restraints shall be sized to the capacity of the cable or to the capacity of the anchorage, whichever is lesser.
  - .4 Seismic wire rope connections shall be made using overlap wire rope "U" clips or seismically rated tool-less wedge insert lock connectors.
  - .5 Vertical suspension rods shall be braced as required to avoid potential for buckling due to vertical "up" forces. Braces shall be structural steel angle uniquely selected to be of sufficient strength to prevent support rod bending. Brace shall be attached to the vertical suspension rod by a series of adjustable straps. Clips shall be capable of securely locking brace to suspension rod without the need for hand tools.



- .6 Where clevis hanger brackets are used for seismic restraint attachment, they will be fitted with clevis internal braces to prevent buckling of the hanger brackets.
- .7 Seismic cable shall be as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.
- .8 Seismic cable building and equipment attachment brackets shall be Model KSCA, KSCU, or KSCC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.
- .9 Seismic cable concrete anchor bolts shall be Model KCAB Wedge, Model KCCAB Cracked Concrete, or Model KUAB Undercut, as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.
- .10 Seismic wire rope connectors shall be (Model KWRC - 'U' clamp) / (Model KWGC - Tool-less wedge lock) as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.
- .11 Seismic vertical suspension stiffener rod clips shall be Model KHRC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.
- .12 Clevis Internal Braces shall be Model KCHB as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data.
- .2 Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.
- .3 No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system specified.
- .4 Do not install any equipment, piping, duct, or conduit that makes connections with the building unless isolation is not specified.
- .5 Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- .6 Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.
- .7 Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.
- .8 Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
- .9 Provide reinforced clevis bolts where required.

- .10 Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- .11 Do not brace a system to two independent structures such as a ceiling and wall.
- .12 Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- .13 Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.
- .14 Do not install any seismic restraint for equipment, cable trays or conduit that compromises isolation specified.
- .15 Hold down clamps must be used to attach conduits and/or cables to all trapeze members before applying restraints.
- .16 Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.
- .17 Coring is not permitted for the installation of concrete anchors. Use ground penetrating radar or equivalent method of embedment item detection to locate all embed items including reinforcing steel and electrical conduits. Concrete reinforcing steel and electrical conduits shall not be cut or damaged under any circumstances.

### **3.2 EXECUTION**

- .1 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.
- .2 If mounting hole diameter exceeds bolt diameter by more than 0.125" (3 mm), reduce clearance in hole with epoxy grout, flanged elastomeric bushings or welded washer.
- .3 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

### **3.3 INSPECTION**

- .1 The contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.
- .2 Upon completion of the installation of all seismic restraint devices herein specified, the local representative of the seismic restraint manufacturer shall, at the contractor's request, inspect the completed system and report in writing any installation errors, improperly selected snubber devices, or other fault in the system which could affect the performance of the system.

- .3 The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

### **3.4 CONDUIT**

- .1 Seismically restrain all electrical conduit. Use Type J Cable Restraints for all conduit supported by vibration isolation hanger assemblies. Brace all conduit to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) "Seismic Restraint Manual Guidelines for Mechanical Systems", Second Edition (Remaining Codes).

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.
  - .2 CSA C22.2 No.45-M1981(R1992), Rigid Metal Conduit.
  - .3 CSA C22.2 No.56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No.83-M1985(R1992), Electrical Metallic Tubing.
  - .5 CSA C22.2 No.211.2-M1984(R1992), Rigid PVC (Unplasticized) Conduit.
  - .6 CAN/CSA C22.2 No.227.3-M91, Flexible Nonmetallic Tubing.

**Part 2            Products**

**2.1                CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No.45, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT) with couplings: to CSA C22.2 No.83.
- .4 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .5 Flexible metal conduit: to CSA C22.2 No.56, aluminum, and liquid-tight flexible metal.
- .6 Flexible PVC conduit: to CAN/CSA C22.2 No.227.3, ENT.

**2.2                CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm (2") and smaller. Two-hole steel straps for conduits larger than 53 mm (2").
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m (5'0") oc.
- .4 Threaded rods, 6 mm (1/4") diameter, to support suspended channels.

**2.3                CONDUIT FITTINGS**

- .1 EMT fittings shall be set screw style (zinc alloy).
- .2 Flexible metal conduit fittings shall be screw-in type.
- .3 Liquid type flexible metal conduit fittings shall be sealed tight type.
- .4 PVC fittings shall be PVC type complete with PVC adaptors at all boxes.

- .5 Rigid conduit and mineral insulated conduit fittings shall be threaded type.
- .6 Coating: same as conduit.
- .7 Factory "ells" where 90° bends are required for 27 mm (1") and larger conduits.
- .8 Where bushings are noted to be provided, they must be "screwed" type fastened to a conduit connector. Push-fit or glued in place bushings will NOT be accepted.

## **2.4 FISH CORD**

- .1 Nylon twine.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical/ electrical service rooms and in unfinished areas.
- .3 **Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.**
- .4 Use rigid aluminum threaded conduit where specified and up to 2.1 m (7'0") above finish floor where exposed to mechanical injury.
- .5 **Minimum conduit size for branch circuits shall be 21 mm (3/4").** Single drops from ceiling mounted junction boxes down to a light switch or duplex receptacle may be reduced to 16 mm (1/2").
- .6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 27 mm (1") diameter.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m (5') clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines with minimum of 25 mm (1") at crossovers.
- .7 **Do not fasten surface conduit larger than 25 mm (1") to roof deck. Provide standoffs or supports as manufactured by Caddy or use Unistrut trapeze fastened to structure.**

**3.3 CONCEALED CONDUITS**

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

**END OF SECTION**

**Part 1            General****1.1                GENERAL REQUIREMENTS**

- .1        The studies must be submitted to the Consultant prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Consultant may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- .2        The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system. Normal system connections and those, which result in maximum fault conditions, shall be adequately covered in the study.
- .3        The firm should be currently involved in high- and low-voltage power system evaluation. The study must be performed, stamped, and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Consultant for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.
- .4        The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

**1.2                DATA COLLECTION FOR THE STUDY**

- .1        The Contractor shall provide the required data for preparation of the studies. The Consultant performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
- .2        The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.
- .3        Data collected for the study, including correspondence with local utility, shall be included with study report.

**Part 2            Products****2.1                SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY**

- .1        The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

- .2 In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- .3 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
- .4 Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.
- .5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
- .6 Include complete fault calculations as specified herein based on contract documents.
- .7 Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to consultant for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.



- .8 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.
- .9 Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.
- .10 When emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Contractor shall obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.
- .11 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
- .12 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

## **2.2 ARC FLASH HAZARD ANALYSIS**

- .1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D and CSA Z462- (latest edition).
- .2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
- .3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
- .4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.
- .5 The Arc-Flash Hazard Analysis shall include all significant locations in 240 Volt and 208 Volt systems fed from transformers equal to or greater than 125 kVA.
- .6 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- .7 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

- .8 Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
- .9 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-latest edition section B.1.2.

### **2.3 STUDY REPORT**

- .1 The results of the power system study shall be summarized in a final report. Submit report in accordance with Electrical General Requirements Section as a shop drawing.
- .2 The report shall include the following sections:
  - .1 Descriptions, purpose, basis, and scope of the study.
  - .2 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
  - .3 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
  - .4 Fault current calculations including a definition of terms and guide for interpretation of computer printout.
  - .5 Incident energy and flash protection boundary calculations
    - .1 Arcing fault magnitude
    - .2 Device clearing time.
    - .3 Duration of arc
    - .4 Arc flash boundary
    - .5 Working distance
    - .6 Incident energy
    - .7 Hazard Risk Category
    - .8 Recommendations for arc flash energy reduction
    - .9 **Recommendations for Personal Protection Equipment (PPE) level.**

## **Part 3 Execution**

### **3.1 POWER COMPANY APPROVAL**

- .1 Copies of the final report must be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Consultant.

### **3.2 FIELD SETTINGS**

- .1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.

- .2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.
- .3 At the completion of the project, configure settings and install equipment labels. On company letterhead, the contractor is to prepare a certification letter indicating at minimum:
  - .1 Project
  - .2 Date
  - .3 Device designation
  - .4 Certification of correct settings
  - .5 Certification of correct device labels
  - .6 Certification of arc flash hazard equipment labels
  - .7 Digital image of each breaker indicating final settings and placement of labels

### **3.3 ARC FLASH WARNING LABELS**

- .1 The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD", and shall include the following information:
  - .1 Location designation
  - .2 Nominal voltage
  - .3 Flash protection boundary
  - .4 Hazard risk category
  - .5 Incident energy
  - .6 Working distance
  - .7 Personal Protection Equipment (PPE) level
  - .8 Engineering report number, revision number and issue date.
- .3 Labels shall be machine printed, with no field markings.
- .4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - .1 For each 600, 480 and applicable 208 Volt panelboards, one arc flash label shall be provided.
  - .2 For medium voltage switches one arc flash label shall be provided
- .5 **Labels shall be field installed by the firm providing the Arc Flashing Hazard Analysis.**

**3.4 ACCEPTABLE TESTING FIRMS**

- .1 MVA Engineering (519) 668-4698
- .2 GT Woods (905) 272-1696
- .3 Brosz & Associates (905) 472-6660
- .4 K-Tek Electro-services Ltd. (905) 640-0660 ext. 228

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS**

- .1        Submit shop drawings for each system in Conformance with The Electrical General Requirements Section.

**1.2                PRODUCT/MAINTENANCE DATA**

- .1        Submit product/maintenance data for each system for inclusion in maintenance manual conforming to The General Electrical Requirements Section.

**1.3                SCOPE**

- .1        The scope of this Section will include the following systems.
  - .1        Security and access control rough-in.
  - .2        Telecommunication network system rough-in.
  - .3        Destratification fans and controls.
  - .4        Public address system and Lockdown system rough-in.
  - .5        Low Voltage Occupancy sensors

**Part 2            Products**

**2.1                SECURITY SYSTEM CONTROL ROUGH-IN**

- .1        Provide single gang box and multi gang boxes for devices flush mounted c/w conduit and pull string from device to cable management systems. Location, size of conduit and number of rough-ins as noted on drawings.
- .2        Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
- .3        Security systems installation shall be by Owner's approved vendor as part of cash allowance.

**2.2                TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1        Provide single gang box and multi gang boxes for devices flush mounted c/w conduit and pull string from device to cable management systems. Location, size of conduit and number of rough ins as noted on drawings.
- .2        Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
- .3        Provide a #6 insulated green ground conductor from main service ground to voice equipment backboard located on drawings.

## **2.3           DESTRATIFICATION FANS AND CONTROLS**

- .1     General purpose fans in the gym to be provided with the following features:
  - .1     Metal construction.
  - .2     Baked white enamel.
  - .3     Down-blowing single direction.
  - .4     1400 mm (56") diameter blade combination.
  - .5     Minimum 400 mm (16") suspension with ball aligner and canopy.
  - .6     Suitable for 120V/1/60Hz operation.
  - .7     Provided with wire cage when installed in general purpose rooms.
  - .8     Manufacturer:
    - .1     Banvil Cat. #60F9-10 (FG60C where noted).
- .2     Single fan variable speed controller shall be Banvil Cat. #100P c/w colour and coverplate to suit this specification.
- .3     Multiple fan variable speed controller shall be Banvil Cat. [#105F (up to 4 fans), 150F (up to 8 fans), or 200F (up to 12 fans)] c/w colour and coverplate to suit this specification.
- .4     Approved equal:
  - .1     Pleasantaire
- .5     Decorative fans as indicated are to be provided with the following features:
  - .1     Metal construction.
  - .2     Blade, downrod and motor finish as directed by Architect.
  - .3     Down-blowing single direction.
  - .4     1300 (52") diameter blade combination.
  - .5     Minimum 400 mm (16") suspension with ball aligner and canopy.
  - .6     Suitable for 120V/1/60 Hz operation.
  - .7     Manufacturer: Big Ass Fans Cat. #K3127-A2-XX-XX-XX-03-C complete with multi-button wall mounted controller.

## **2.4           PUBLIC ADDRESS AND LOCKDOWN SYSTEM ROUGH-IN**

- .1     Provide single gang box and multi gang boxes for devices flush mounted c/w conduit and pull string from device to cable management systems. Location, size of conduit and number of rough ins as noted on drawings.
- .2     Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

## **Part 3           Execution**

### **3.1           SECURITY AND ACCESS CONTROL ROUGH-IN**

- .1     Outlets are to be provided for devices with conduit as detailed on drawings.
- .2     Conduits terminated into ceiling spaces must be within 1m of cable management of tray or as indicated on drawing.

**3.2 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits (if applicable).
- .2 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or as noted on drawing.
- .3 Provide insulated bushings on all conduits terminated in ceiling space.

**3.3 DESTRATIFICATION FANS AND CONTROLS**

- .1 Ensure fans and controls are installed in conformance with manufacturer recommendations.
- .2 Where noted install wireguards to be level. Fasten wireguards to structure NOT roof deck. Provide intermediate Unistrut supports to suit.
- .3 Demonstrate fan operation at the time of final inspection.
- .4 Contractor is to remove manufacturer's label prior to installation.

**3.4 PUBLIC ADDRESS SYSTEM ROUGH-IN**

- .1 Conduits terminated into ceiling spaces must be within 1m of cable management tray or as noted on drawing.
- .2 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest cable management tray.
- .3 Provide insulated bushings on all conduits terminated in ceiling space.
- .4 Electrical contractor shall obtain speaker back boxes from School Board vendor for installation into ceiling tiles, block walls, etc.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.
- .2        Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

**Part 2            Products**

**2.1                PANELBOARDS**

- .1        Panel boards must conform to CSA C22.2 No. 29 (latest edition).
- .2        Panelboards: product of one manufacturer.
- .3        Install circuit breakers in panelboards before shipment.
- .4        In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. **Series rating is acceptable – submit information with shop drawings. Provide lamacoid label on feeder breaker. Lamacoid label to state "Series Rating Breaker." Lamacoid label to be size 2.**
- .5        Bus and breakers must be rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .6        Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .7        Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .8        Two keys for each panelboard and key panelboards alike.
- .9        Aluminum bus with neutral of same ampere rating as mains.
- .10       Mains must be suitable for bolt-on breakers. Provide main (if applicable) and branch breakers as bolt-on style.
- .11       Trim with concealed front bolts and hinges.
- .12       Trim and door finish must be baked grey enamel.
- .13       All panels regardless of voltage and amperage must be provided with a lockable door.
- .14       Branch circuit panelboards (250 AMP or smaller) must be one of the following:
  - .1        Eaton Cat # POW-R-LINE-C PRL-1 or PRL-2
  - .2        Schneider Electric Cat # NQ Series for up to 240V or NF Series for up to 600V
  - .3        Siemens Cat #Sentron P1 Series



- .15 Power distribution circuit breaker panelboards (400 AMP or larger) must be one of the following:
  - .1 Eaton CAT# POW-R-Line-C PRL-3A or PRL-4A
  - .2 Schneider Electric CAT# I-Line Series (Bolt-On)
  - .3 Siemens CAT# P2 Series (up to 600A mains and maximum 100A-3P branch breakers)
  - .4 Siemens CAT# S5 Series (up to 1200A mains with branch breakers above 100A-3P)
- .16 Panels ranging in width from 355.6 to 558 mm (14" to 22"), depth from 114.3 to 152.4 mm (4.5" to 6") and height from 533 to 1143 mm (21" to 45") are to be retrofitted. Retrofit panels must allow for the installation of new panel interior and trim to suit the existing recessed panel tub. Note: Panel manufacturers bidding this project that do not carry a panel retrofit kit must allow in their price the cost to remove the existing panel tub and replace with new including all necessary wall repairs. Retrofit panelboards shall be: Eaton Panelboard Retrofit Pow-R-Line 1R and 2R Renovation Panel or as indicated on drawing.

## **2.2 BREAKERS**

- .1 Breakers: to Moulded Case Circuit Breakers Section.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker (as specified) must be separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for fire alarm, stairway, exit and night light circuits.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Nameplate for each panelboard size 4 engraved description as indicated. In finished areas install label on inside of panel, and in service areas install label on exterior of panel.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved "name of load" as indicated.
- .4 Complete circuit directory with typewritten legend showing location of each circuit. **Include a copy of the directories in the maintenance manuals.**

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true, and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards or as indicated on drawing. Where practical, group panelboards on common backboard. Plywood shall be 21mm (3/4") fire rated or
- .3 Mount panelboards to height specified in Electrical General Requirements Section or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1            Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                BREAKERS GENERAL**

- .1            Moulded case circuit breakers must conform to CSA C22.1 No.5.1-M91 (latest edition.)
- .2            Bolt-on moulded case circuit breaker quick-make, quick-break type, for manual and automatic operation.
- .3            Common-trip breakers: with single handle for multi-pole applications.
- .4            Unless otherwise indicated moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .5            Moulded case circuit breakers 250 Amps and above are to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection (if indicated or applicable by the Electrical Safety Code versus the breaker amperage). Unless otherwise specified, complete system selective co-ordination shall be provided by the individually adjustable time/current curve shaping elements as following:
  - .1            Breakers shall have fixed rating plug determining breaker continuous current rating.
  - .2            All breakers shall have adjustable long delay pickup and time, L.
  - .3            All breakers shall have individual adjustments for short delay pickup and time, S; including I2t settings in time adjustment.
  - .4            Breakers shall have adjustable instantaneous pickup, I; that if required by co-ordination study can be turned off, (I).
  - .5            If required by Electrical Safety Code breakers shall have individually adjustable ground fault current pick-up and time, G; including I2t settings in time adjustment.
  - .6            Unless otherwise specified, for the low voltage systems provide an electronic trip unit as specified above for the following moulded case circuit breakers:
    - .1            Mains or ties in main switchboard: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at the point of installation.
    - .2            Feeders exceeding 250A trip setting: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at downstream panelboard.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install circuit breakers as indicated complete with all necessary mounting hardware and filler panels if necessary.
- .2 Provide lamacoid labels for series rating breakers. Lamacoid label to state "Series Rating Breaker." Lamacoid to be size 2.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                SWITCHES**

- .1        General purpose AC switches must conform to CSA C22.2 No. 111 (latest edition).
- .2        15 or 20 A, 120 V, single pole, three-way, four-way, keyed, or motor rated switches complete with pilot light.
- .3        Manually-operated general purpose ac switches with following features:
  - .1        Terminal holes approved for No. 10 AWG wire.
  - .2        Silver alloy contacts.
  - .3        Urea or melamine molding for parts subject to carbon tracking.
  - .4        Suitable for back and side wiring.
  - .5        Toggle style (Rocker style) (architect to select colour).
- .4        Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .5        Switches of one manufacturer throughout project.
- .6        Acceptable materials:
  - single pole:     Hubbell Cat # HBL1201 Series
  - three-way:     Hubbell Cat # HBL1203 Series
  - four-way:      Hubbell Cat # HBL1204 Series
  - Keyed:         Hubbell Cat. #HBL1221 Series complete with 2 keys per switch
  - (Keys):        Hubbell Cat. #HBL1209
  - Motor rated:   Hubbell Cat. #HBL1221PL c/w pilot light (20 A):
- .7        Acceptable alternate manufacturers include:
  - .1        Pass & Seymour
  - .2        Leviton.

**2.2 RECEPTACLES**

- .1 Receptacles, plugs, and other similar wiring devices must conform to CSA 22.2 No 42 (latest edition).
- .2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features (20A where noted):
  - .1 Urea molded housing (Colour by architect).
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials:

Standard duplex receptacle	Hubbell Cat # HBL5252CN
Ground fault protected T-slot receptacles	Hubbell Cat. # GF20L A complete with Decora style coverplate to suit specification below
T-slot receptacles	Hubbell Cat. #HBL5352
Dryer receptacle	Hubbell Cat # HBL9430A
Range receptacle	Hubbell Cat # HBL9450A
Automatically Controlled Receptacles (Green)	Hubbell Cat. #BR15C2GN(Green)
Automatically Controlled T-slot Receptacles (Green)	Hubbell Cat. #BR20C2GN(Green)
Half Automatically Controlled Receptacles (Green)	Hubbell Cat. #BR15C1GN
Half Automatically Controlled Receptacles (Green)	Hubbell Cat. #BR20C1GN
Duplex receptacle & Type A & C USB Ports	Hubbell Cat.# USBB15AC5WWR

- .6 Acceptable alternate manufacturers include:
  - .1 Pass & Seymour
  - .2 Leviton

**2.3 COVER PLATES**

- .1 Cover plates from one manufacturer throughout project.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, brushed, 1 mm (1/32") thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

- .5 Weatherproof cover plates complete with gaskets and “heavy-duty in use” covers in conformance with the Electrical Safety Authority. Provide product equal to Intermatic Cat. #WP5100C.
- .6 Where noted on plans for exterior weatherproof GFCI receptacles at grade, provide extra-duty single gang horizontal die cast receptacle covers. NEMA 3R rated complete with lockable hasp and reinforced hinge. Suitable for use with 12-gauge cord sets. Intermatic Cat. # WP1010HMXD or equal.

## **2.4 DIMMER CONTROL**

- .1 Dimmers are to be provided complete with the following features:
  - .1 Rating of 15 A 120 V.
  - .2 Wattage to suit load as indicated on drawings (minimum 1000W).
  - .3 Thin profile linear slide control only. (Rotary controls will not be accepted).
  - .4 Dimmer must provide full range of illumination from zero to full intensity.
  - .5 Integral on/off switch.
  - .6 Devices must mount in single gang box or multi-ganged where noted.
  - .7 Device and faceplate colour must match other wiring devices.
  - .8 Acceptable manufacturers:
    - .1 Leviton Renoir Series
    - .2 Lutron Lumea 2 Series
    - .3 Hubbell AS103 Series

## **2.5 OCCUPANCY SENSORS LINE VOLTAGE**

- .1 Provide system hardware that is designed, tested, manufactured, warranted by a single manufacturer.
- .2 Operational life: At least 10 years expected life while operating within the specified ambient temperature and humidity range.
- .3 Power Failure Memory: Automatically store system settings and recover from a power failure without requiring user input.
- .4 Occupancy Detection Technology Requirements:
  - .1 The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
  - .2 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies are accepted.
  - .3 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
  - .4 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors with (PIR/Ultrasonic) technologies are acceptable.

- .5 Occupancy Sensor Operation Requirements:
  - .1 Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
  - .2 Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting shall not be permitted as they greatly restrict energy savings potential.
  - .3 Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens and shall not require initial or subsequent field adjustment of detection sensitivity.
  - .4 All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind shall not be accepted.
  - .5 The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.
- .6 Line Voltage Occupancy Sensors:
  - .1 Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
  - .2 The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
  - .3 Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
  - .4 Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
  - .5 Multiple sensors controlling the same load shall be wired in parallel.
  - .6 For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
  - .7 Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
  - .8 Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz. A version capable of switching 347 VAC shall also be available. Load ratings shall be 13A each pole, ¼ HP motor load.
  - .9 Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.



- .10 Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- .11 Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
- .12 Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.
- .13 Wall mounted occupancy Sensor (line voltage) shall be the following model numbers. Device color and optional features as specified.
  - .1 Wattstopper Cat. #PW-101D-VOLT-X (colour by Architect).
  - .2 Sensor switch Cat. #WSXA-PDT-D-X (colour by architect).
  - .3 Cooper Controls (Greengate) Cat. #OSW-D-010-VOLT-X (colour by architect).
- .14 Ceiling mounted Sensors (Line Voltage) shall be the following model numbers.
  - .1 Wattstopper Cat. #DT-355 (colour by Architect). Or as noted on the drawing.
  - .2 Sensor switch Cat. #CMR-PDT-10-X and CMR-PDT-9-X (colour by architect). Or as noted on the drawing.
  - .3 Cooper Controls (Greengate) Cat. #OAC-DT-2000-MV (colour by architect). Or as noted on the drawing.
- .7 Provide other occupancy sensors to suit the detail on the drawings.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height specified in Electrical General Requirements Section or as indicated.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height specified in Electrical General Requirements Section or as indicated.
  - .3 Where split receptacle has one portion switched mount vertically and switch upper portion.

- .3 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 Dimmer:
  - .1 Mount devices at height as specified in Electrical General Requirements Section.
  - .2 Dimmer switches must be installed with the “most downward” position of slider corresponding to zero light intensity and the “highest” position of slider corresponding to full light intensity.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Standards Association (CSA)
  - .1        CSA C22.2 No.248.12/94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).
  - .2        CSA C22.2 No. 106-M92 (latest edition).

**1.2                MAINTENANCE MATERIAL**

- .1    Three spare fuses of each type and size installed.

**1.3                DELIVERY AND STORAGE**

- .1    Ship fuses in original containers.
- .2    Store fuses in original containers in moisture free location.

**Part 2            Products**

**2.1                FUSES GENERAL**

- .1    Fuses: product of one manufacturer for entire project.
- .2    Fuses specified below must conform to CSA C22.2 No. 106 (latest edition). Fuses conforming to standard C22.2 No. 106-1953 will be rejected.
- .3    Fuses must provide a fully co-ordinated system for both overload and fault conditions.

**2.2                FUSE TYPES**

- .1    Class L fuses (formerly HRC-L) for ratings 601-6000 Amp.
  - .1        Time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2        Fast acting as noted.
- .2    Class J fuses (formerly HRCI- J).
  - .1        Time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2        Fast acting as noted.
- .3    Class R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and  $I^2t$  values not to exceed limits of UL 198E-1982, table 10.2.

**2.3 ACCEPTABLE PRODUCTS**

- .1 Service Entrance:
  - 1-600 A: Mersen Type CJ
  - 601-6000 A: Mersen Type CL
- .2 Motor Protection:
  - 1-600 A: Mersen Type AJT
  - 601-2000 A: Mersen Type A4BT
- .3 Other acceptable manufacturers:
  - .1 GEC
  - .2 Little Fuse

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
  - .1 Install Class R rejection clips for HRCI-R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.

**END OF SECTION**

**Part 1            General**

**1.1            PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1            DISCONNECT SWITCHES**

- .1        Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).
- .2        Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).
- .3        Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.
- .4        Provision for padlocking in off switch position by three locks.
- .5        Mechanically interlocked door to prevent opening when handle in ON position.
- .6        Fuses: size as indicated, to Fuses - Low Voltage Section.
- .7        Fuse holders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .8        Quick-make, quick-break action.
- .9        ON-OFF switch position indication on switch enclosure cover.
- .10      Disconnects feeding elevator controllers must be equipped with two auxiliary contacts approved by the elevator supplier.
- .11      Service entrance rated with fault bracing and fusing as required.

**2.2            EQUIPMENT IDENTIFICATION**

- .1        Provide equipment identification in accordance with Electrical General Requirements Section.
- .2        Indicate name of load controlled on size 4 nameplate.

**2.3            ACCEPTABLE MANUFACTURERS**

<u>Manufacturer</u>	<u>General Purpose</u>	<u>Weatherproof</u>
Eaton	IHD Series	3HD Series
Schneider Electric	Type A Series	Type R Series
Siemens	ID Series	NFR/FR Series

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install disconnect switches complete with fuses if applicable.
- .2            Connect auxiliary contacts to elevator controller using conduit, wire and route approved by the elevator supplier.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Electrical General Requirements Section.
- .2        Indicate:
  - .1        Mounting method and dimensions.
  - .2        Starter/contactor size and type.
  - .3        Layout of identified internal and front panel components.
  - .4        Enclosure types.
  - .5        Wiring diagram for each type of starter.
  - .6        Interconnection diagrams.

**1.2                OPERATION AND MAINTENANCE DATA**

- .1        Provide operation and maintenance data for incorporation into manual specified in Electrical General Requirements Section.
- .2        Include operation and maintenance data for each type and style of starter/contactor.

**1.3                MAINTENANCE MATERIALS**

- .1        Provide maintenance materials in accordance with Electrical General Requirements Section.
- .2        Provide listed spare parts for each different size and type of starter:
  - .1        1 operating coil.
  - .2        3 fuses.
  - .3        10% indicating lamp bulbs used.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Starters: must conform to CSAC22.2 No. 14 (latest edition) and EEMAC E14-1.
- .2        Control transformers must conform to CSAC22.2 No. 66 (latest edition).
- .3        Auto-transformers must conform to CSAC22.2 No 47 (latest edition).
- .4        Contactors must conform to CSA C22.2 No. 14 (latest edition).
- .5        Half size starters will not be accepted. NEMA and IEC rated starters are acceptable.

## **2.2 MANUAL MOTOR STARTERS**

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1 Switching mechanism, quick make and break.
  - .2 One or Three overload heaters, manual reset, trip indicating handle.
  - .3 Toggle switch: standard duty labeled "on"/" off".
  - .4 Indicating light: standard duty type and red colour.
  - .5 Locking tab to permit padlocking in "ON" or "OFF" position.

## **2.3 FULL VOLTAGE MAGNETIC STARTERS**

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
  - .1 Pushbuttons Selector switches standard duty labeled as indicated.
  - .2 Indicating lights: standard duty type and color as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
  - .4 1 red pilot light for "stop" or "off" and 1 green light for "start" or "on".

## **2.4 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and secondary voltage to suit remote control device, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.



## **2.5 CONTACTORS**

- .1 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled.
- .2 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .3 Mount in CSA Enclosure 1 unless otherwise indicated.
- .4 Include following options in cover:
  - .1 Red indicating lamp.
  - .2 Hand - Off - Auto selector switch.
- .5 Control transformer: mounted in contactor enclosure.
- .6 Contactors must be definite purpose.

## **2.6 FINISHES**

- .1 Apply finishes to enclosure in accordance with Electrical General Requirements Section.

## **2.7 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Manual starter designation label: black plate, white letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label: black plate, white letters, size 2, engraved as indicated.
- .4 Contactor designation label:  
black plate, white letters, size 4, indicating name of load controlled.

## **2.8 ACCEPTABLE MANUFACTURERS**

- .1 The acceptable manufacturers are as follows:
  - .1 Allen Bradley
  - .2 Eaton
  - .3 Siemens
  - .4 Group Schneider
  - .5 Klockner Moeller

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Electrical General Requirements Section.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Install contactors and connect auxiliary control devices.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL REQUIREMENTS**

- .1        Basic Electrical Requirements, Instructions to Bidders, any Supplements and/or Addenda thereto form an integral part of this Specification and must be read in conjunction herewith.

**1.2                WORK INCLUDED**

- .1        Provide and install a complete emergency lighting system as described herein and shown on the drawings. The system shall consist of a charger, batteries, specified transfer and distribution features, Pictogram exit, and remote emergency heads as indicated on the plans.

**1.3                PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.
- .2        Data shall include system components, mounting method, source of power and special attachments.

**1.4                STANDARDS**

- .1        Unit equipment for emergency lighting shall conform to CSA C22.2 No. 141 and BMEC compliance to the O.B.C.

**1.5                OPERATION AND MAINTENANCE DATA**

- .1        Provide data for incorporation into maintenance manual as specified in the Electrical General Requirements Section
- .2        Operation and maintenance manual to include:
  - .1        Operation and maintenance instructions for complete emergency lighting system to permit effective operation and maintenance.
  - .2        Technical data – illustrated parts lists with parts catalogue numbers.
  - .3        Copy of approved shop drawings.

**1.6                MAINTENANCE MANUALS**

- .1        Provide maintenance materials.
- .2        Include:
  - .1        5-year warranty on all LED emergency heads.

**1.7 MAINTENANCE**

- .1 Provide one year's free maintenance with two inspections by manufacturer during the year. Submit inspection report to Owner.

**1.8 GUARANTEE**

- .1 Provide a written guarantee stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten (10) years, with a no-charge replacement during the first year and 9-year pro-rated charge, from the date of the Final Certificate of Completion.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Supply voltage: 120 V AC.
- .2 Output voltage: 6VDC or 12VDC emergency power output versions (as specified)
- .3 Wattage capacity from 36 to 100W as indicated on drawing.
- .4 Operating time: total load for not less than 30 minutes or as indicated on drawing.
- .5 Batteries: sealed, 10-year maintenance free, sealed lead acid.
- .6 Charger:

Charger, control, and supervisory functions shall reside on solid state circuit boards. The charger shall be a fully automatic, modular, single board, three stage, solid state type using integrated circuit control. It will include low voltage disconnect circuitry which automatically disconnects the batteries from the load when their voltage falls below 91% of nominal, to prevent battery over discharge.

The charger shall fully recharge the battery bank within a 24-hour period from full discharge. It shall maintain regulation of +/- 0.5% of voltage for a +/- 10% input voltage variation. The charger shall provide an automatic equalize cycle on both 30 day (selectable to 90 day) rotating basis and after every power failure.

The charger shall have DC and AC voltmeters, charge rate ammeter and pilot LEDs for AC Power 'ON' indication, HIGH CHARGE and FLOAT CHARGE.

The charger shall have circuitry to provide:

- 12-hour recharge
- Brownout transfer protection

- .7 Solid state transfer.
- .8 Low voltage disconnects solid state, modular, operates at 80% battery output voltage.

.9 Front panel:

The front panel will include the following:

- AC input circuit breaker
- Meters and alarms
- DC charge rate ammeter
- DC battery voltmeter
- Green "AC ON" LED
- Green float LED
- Amber equalize Led
- AC failure alarm
- High battery voltage alarm
- Charger failure alarm
- Low battery voltage alarm
- Ground leakage fault
- Circuit breaker Open/Trip alarm

.10 Automatic microprocessor-controlled diagnostics and communication capabilities.

.11 Cabinet: rugged steel cabinet with ultraguard rust-coating. Min. 18 Gauge Steel white powder coat finish standard

.12 Manufacturer:

- .1 Stanpro
- .2 Emergi-Lite
- .3 Lumacell
- .4 Aimlite

**2.2 STANDARD RUNNING MAN UNITS**

- .1 Running man units must conform to CSA CERTIFIED TO C22.2-141-15, C860 (latest edition).
- .2 Housing: extruded aluminum housing, white finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: 2W LED ultra bright light source
- .5 Operation: 25 years.
- .6 Units are to be provided with three (3) pictogram legends indicating "left from here", "straight from here", and "right from here".
- .7 Universal faces – Universal mounting: Ceiling mount, wall mount, end mount.

**2.3 REMOTE EMERGENCY LIGHTING FIXTURES**

- .1 Remote emergency lighting fixtures must conform to CSA C22.2 No141-15 (latest edition).
- .2 Fixtures shall be small "micro" size or recessed style as indicated in the Light Fixture Schedule.
- .3 Fixtures must be adjustable type heads with canopy.

- .4 Fixtures are to be provided with protective Lexan cube when specified in the Light Fixture Schedule.
- .5 Unless otherwise indicated surface mounted fixtures in washrooms, locker rooms, changerooms, and gymnasiums must be provided with wire guard.
- .6 Shall be suitable for 120V DC operation.

## **2.4 ACCEPTABLE MANUFACTURERS**

- .1 Lumacell.
- .2 Emergi-Lite.
- .3 Stanpro.
- .4 Aimlite

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install equipment for emergency lighting in accordance with CSA C22.1 Latest Edition.
- .2 Install unit equipment and remote mounted fixtures as indicated.
- .3 Identify conductors for polarity and voltage.
- .4 Direct light heads as directed by manufacturer's representative and Engineer.
- .5 Install with conductors sized to maintain current flow with maximum 5% voltage drop as per manufacturers recommendations.
- .6 Install running man exit lighting units with illuminated faces and chevrons/arrows indicating path(s) of exit as indicated. Unless otherwise noted install exit fixtures at 2400 mm (8' 0") above finished floor.
- .7 Install emergency lighting units and associated remote mounted fixtures as indicated.
- .8 Direct "heads" on units and remote mounted fixtures to illuminate path(s) of exit.
- .9 Install emergency lighting units and remote fixtures at 300mm (12") below finished ceiling, unless indicated otherwise.

### **3.2 WIRING**

- .1 Connect Battery units to lighting circuits as indicated. Provide duplex receptacle beside battery unit for 120V units (or within 1.5M of unit). Direct connection to 347V battery units.
- .2 Connect running man exit lights to running man exit lights dedicated circuits, that circuit shall be used for no other purpose.
- .3 All wiring of remote emergency fixtures shall be minimum #12 T90 for each circuit and run in conduit. Wiring must be sized in conformance with manufacturer's recommendations for distances required.

**3.3 FIELD QUALITY CONTROL**

- .1 At the completion of the project and in the presence of the consultant, test all exit and emergency fixtures. On company letterhead, the contractor is to prepare a chart indicating:
  - .1 Project
  - .2 Date
  - .3 Equipment type
  - .4 Certification of correct connection
  - .5 Certification of correct operation
  - .6 Duration of test in minutes (minimum 30)
  - .7 Actual period of testing (time of day)
- .2 **Provide “Integrated Testing” of this life safety system in conformance with the noted specification section. Include all associated costs in tender.**

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41- 1991, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM F1137- 88 (1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 United States of America, Federal Communications Commission (FCC)
  - .1 FCC (CFR47) EM and RF Interference Suppression.
- .4 IESNA LM-79-08, IES Electrical Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Electrical General Requirements Section for all light fixtures supplied under this contract.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by consultant.
- .3 Photometric data to include: VCP Table spacing criterion.

**1.3                SCOPE**

- .1 This contractor is responsible to supply and install all lighting fixtures as scheduled and/or indicated including lamp and those accessories required for a complete lighting system. This contractor must coordinate lighting installations with all other Divisions of this project.
- .2 All fixtures must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

**1.4                GUARANTEE**

- .1 Guarantees for materials replacement shall be as follows from date of substantial completion.
  - .1 LED fixtures, and driver: 5 years.
- .2 The labour required to replace LED fixtures must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.



## **1.5 EXISTING FIXTURE BALLAST REMOVAL AND DESTRUCTION**

- .1 Scope
  - .1 This Contractor is responsible for contracting with an approved company for the dismantling, disposal and removal of all existing fluorescent ballasts and lamps from this project. This process must include but is not limited to the following:
    - .1 Removal of existing ballasts from fixtures by this contractor.
    - .2 This contractor is to compare the ballast number to the PCB ballast identification booklet provided by the disposal company.
    - .3 If the ballast is not contaminated it is to be disposed of by normal means.
    - .4 If the ballast is contaminated provide:
      - .1 Approved confine on site storage area.
      - .2 Approved confine on site storage containers.
      - .3 All necessary on-site inspections.
      - .4 All necessary approval certificates (include copies in maintenance manuals).
      - .5 Full dismantling, complete destruction, and disposal of all ballast's components.
  - .2 Approved Disposal Companies
    - .1 PCB Containment Technology Inc.  
75 Wanless Court  
Ayr, Ontario  
NOB 1E0  
Phone: (519) 740-1333  
Fax: (519) 740-2320
  - .3 Payment Procedures
    - .1 Cost of complete services of this sub-contractor shall be paid for by this Section. Refer to Allowances and Fees Section for allowance to be carried for this work.

## **Part 2 Products**

### **2.1 FIXTURE CONSTRUCTION**

- .1 Fixtures must be constructed of 20-gauge (minimum) cold rolled steel. All metal edges require smooth finish.
- .2 Light leaks must be prevented by providing gasketing, stops, and barriers.
- .3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

## **2.2 FIXTURE LENS**

- .1 Unless otherwise noted fixture lenses shall be as follows:
  - .1 Lens thickness: 3.2 mm (1/8")
  - .2 Material: injection moulded clear prismatic virgin acrylic
  - .3 Frame: hinged, latched, steel.

## **2.3 LED FIXTURES**

- .1 Fixture LED's must be tested in conformance with IESNA LM80 standard.
- .2 LED's must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2-step MacAdam ellipse.
- .3 Luminaires must be tested to IESNA LM79 by an independent approved laboratory.
- .4 Luminaires must be tested prior to shipping.
- .5 Luminaires must be ULC certified and approved for use in Canada.
- .6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test results upon request.
- .7 Lumen values indicated for fixtures in the project documents are to be considered as "absolute" or "delivered" values.
- .8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.
- .9 Fixtures must be energy star or DLC rated.

## **2.4 ACCEPTABLE LIGHTING MANUFACTURERS**

- .1 Refer to the "light fixture schedule" as indicated on drawings.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional Unistrut support channel and/or support from structure. Co-ordinate with consultant on site.
- .2 Ball align hangers must be provided for rod suspended fixtures.
- .3 Fixtures surface mounted to suspended ceilings must be secured through ceiling assembly to cross member supports. These supports are to be steel channels or angles independently secured **to structure** using # 12 "jack" chain. Each chain must be secured so no fixture weight is added to the ceiling assembly.
- .4 Plaster frames/flange kits must be provided by this Division for fixtures recessed in plaster and/or drywall ceilings.

- .5 Where specified, fixtures to be chain hung shall be hung using “jack” chain with a capacity to suit the fixture weight. Branch circuit wiring feeding these fixtures shall be AC90 cable “ty-wrapped” at 900mm (36”) intervals along length of drop. Final appearance must be neat and professional.
- .6 **Special installation: Secure fixtures to structure to conform to the Electrical Safety Code using “jack chain” NOT ceiling suspension wire. Where coreslab is used, suspension point must be independent of the one used for suspension of the ceiling assembly. As an alternate to jack chain the contractor may use a pre-manufactured aircraft cable suspension and fastening system as manufactured by Gripple (Gripple Cat. #HF02-10F2). Provide minimum 2 per fixture.**

### 3.2 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

### 3.3 DELIVERIES

- .1 Fixtures are to be completely assembled at the manufacturer’s plant and delivered to the project site in original unitized containers. Ensure that a dry, protected, and secure space is available for proper storage before scheduling delivery of fixtures.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).
- .2    Underwriter Laboratories of Canada (ULC).
- .3    International Electrotechnical Commission.
- .4    International Organization for Standardization (ISO).
- .5    National Electrical Manufacturers Association (NEMA).

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings in accordance with Section 26 01 16.
- .2    Submit composite wiring diagrams and control schedule for each room control circuit type as proposed to be installed. Include load type, sequence of operation, sensor parameters, time delays, sensitivities and daylighting set points.
- .3    Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

**1.3                SCOPE**

- .1    This contractor is responsible to supply and install all equipment and control wiring as specified for the digital occupancy and daylight control systems. This contractor must coordinate these control systems with the lighting fixtures being supplied for the project to ensure intended function as specified.
- .2    Control Intent: Control Intent includes, but is not limited to:
  - .1       Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
  - .2       Initial sensor and switching zones.
- .3    All equipment must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.
- .4    Reference section 26 51 13 for Lighting Equipment
- .5    Reference section 26 05 75 Auxiliary System

**1.4                SYSTEM DESCRIPTION AND OPERATION**

- .1    System based upon the following concepts:
  - .1       Networkable intelligent lighting control devices.
  - .2       Standalone lighting control zones using distributed intelligence.
  - .3       Optional system backbone for remote, time-based, and global operation.

- .4 Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.
- .5 System capable of interfacing directly with networked luminaires such that either low-voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.
- .6 Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
- .7 Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.
- .8 Lighting control zones (wired and wireless) support at least 128 devices per zone.
- .9 Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.
- .10 Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.
- .11 System to include one or more system controllers that provide time-based control.
- .12 System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
- .13 System controller supports both low voltage wired and wireless RF communication within a single controller device.
- .14 System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.
- .15 System capable of reporting lighting system events and performance data to management software for display and analysis.
- .2 Wired Networked Control Zone Characteristics:
  - .1 Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable, compliant with CAT5e specifications or higher. Use of mixed types of low-voltage network cables is unacceptable.
  - .2 Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.

- .3 Pre-terminated, plenum-rated, low-voltage network cabling supplied with hardware.
- .4 Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).
- .5 The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
- .6 System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.
- .7 Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.
- .8 Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:
  - .9 Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.
  - .10 Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
- .3 Supported Sequence of Operations:
  - .1 Control Zones:
    - .1 Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.
    - .2 Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.

- .2 Wall Station Capabilities:
  - .1 Wall stations support the following capabilities:
    - .1 On/Off of a local control zone.
    - .2 Continuous dimming control of light level of a local control zone.
  - .2 Multi-Way Control: Multiple wall stations capable of controlling the same local control zones, to support "multi-way" switching and dimming control.
- .3 Occupancy Sensing Capabilities:
  - .1 Occupancy sensors configurable to control a local zone.
  - .2 Multiple occupancy sensors capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
  - .3 Occupancy sensing sequence of operation modes:
    - .1 On/Off Occupancy Sensing.
    - .2 Partial-On Occupancy Sensing.
    - .3 Partial-Off Occupancy Sensing.
    - .4 Vacancy Sensing (Manual-On / Automatic-Off).
  - .4 On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:
    - .1 Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
    - .2 Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
    - .3 System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
    - .4 Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
    - .5 Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.
  - .5 Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:
    - .1 Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.

- .2 Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
- .3 System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.
- .4 System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
- .5 Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.
- .6 Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.
- .6 Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.
- .4 Photosensor Sensing Capabilities (Automatic Daylight Sensing):
  - .1 Photosensor devices configurable to control a local zone.
  - .2 Photosensor-Based Control:
    - .1 Continuous Dimming: Control zone automatically adjusts dimming output in response to photosensor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.
- .5 Schedule Capabilities:
  - .1 System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.
  - .2 System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.
  - .3 Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.
    - .1 Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.
- .6 Wired Networked Wall Station Scene-Control Capabilities:
  - .1 Preset Scenes that activate a specific combination of light levels across multiple local and global channels.
  - .2 Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.



- .3 Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.
- .4 Configurable Parameters:
  - .1 Fixture light level.
  - .2 Occupancy time delay.
  - .3 Response to occupancy sensors (including enabling/disabling response).
  - .4 Response to daylight sensors (including enabling/disabling response).
  - .5 Enabling/disabling wall stations.
  - .6 Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.

## **1.5 WARRANTY**

- .1 Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.
- .2 The labour required to replace these products must be included in the above warranty, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

## **1.6 QUALITY ASSURANCE**

- .1 Manufacturer: Minimum 10-years experience in manufacture of lighting controls.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
  - .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECY or comparable product by one of the following:
    - .1 Cooper Industries, Inc.
    - .2 Wattstopper, Inc.
  - .2 System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.
  - .3 System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.
  - .4 System Controller Functions:
    - .1 Time-based control of downstream wired and wireless network devices.
    - .2 Linking into an Ethernet network.

- .3 Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
  - .4 Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
- .2 Substitutions:
- .1 All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 7 working days prior to the bid date and must be made available to all bidders.
  - .2 By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

## 2.2 WIRED LOW VOLTAGE NETWORKED DEVICES

- .1 Wired Networked Wall Switches, Dimmers, Scene Controllers:
- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; (nPODMA-2L-WH), (nPODMA- DX-WH) and (nPODMA-WH) or comparable product by one of the following:
    - .1 Cooper Industries, Inc.
    - .2 Wattstopper
  - .2 Mounting: Suitable for installation in single-gang switch box.
  - .3 Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
  - .4 All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
  - .5 Devices with mechanical push buttons provide tactile and LED user feedback.
  - .6 Devices with mechanical push buttons manufactured with custom button labeling.
  - .7 Wall switch and dimmer options:
    - .1 Number of control zones: [1] [2] [3] as indicated on drawings.
    - .2 Control Types Supported:
      - .1 On/Off.
      - .2 On/Off/Dimming.
      - .3 On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
      - .4 Color: White or as noted on drawings.
    - .3 Scene Controller Options:
      - .1 Number of Scenes: [1] [2] as indicated on drawings.
      - .2 Control Types Supported:
        - .1 On/Off.
        - .2 On/Off/Dimming.
        - .3 Preset Level Scene Type. As indicated on drawings.
        - .4 On/Off/Dimming/Preset Level for Correlated Color Temperature.

- .5 Reprogramming of other devices within daisy-chained zone to implement user-selected lighting scene including manual start/stop from the scene controller, or optionally programmed automatic stop after a user-selectable duration between five minutes and 12 hours.
- .6 Selecting a lighting profile to be run by device's upstream controller to implement a selected lighting profile across multiple zones including manual start/stop from the scene controller, or optionally programmed automatic stop after a user selectable duration between five minutes and 12 hours.
- .7 Color: White or as noted on drawings.

### 2.3 WIRED NETWORKED AUXILIARY INPUT/OUTPUT (I/O) DEVICES

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO series or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper
- .2 Plenum rated.
- .3 Mounting: [in-line wired] [screw mountable] [extended chase nipple for mounting to a **1/2" (16 mm)** knockout].
  - .1 Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
- .4 Auxiliary Input/Output Devices Options:
  - .1 Contact closure or pull-high input.
  - .2 Input programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
  - .3 0-10V analog input.
  - .4 Input supports zero to 10 V dimming output control from a dimmer switch.
  - .5 Input programmable to function as a daylight sensor.
  - .6 RS-232/RS-485 digital input.
  - .7 Input supports activation of up to four local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
  - .8 Provides relay and dimming level status to external device (e.g. Touchscreen) when polled.
  - .9 0-10V dimming control output, capable of sinking up to 20mA.
  - .10 Output programmable to support all standard sequence of operations supported by system.
  - .11 Digital control output via eldoLED LEDcode communication.
  - .12 Output programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

## 2.4 GENERAL REQUIREMENTS

- .1 Operating Voltages:
  - .1 PoE Class 2 Device.
  - .2 24 V(dc) (not used if using PoE), 7 W maximum power consumption.
- .2 Operating Temperature: Minus 32 to plus 113°F (0 to 45°C).
- .3 Retain one of first two subparagraphs below based on Project requirements.
- .4 DIN-Rail Mounted on DIN 43880 (35/7.5) rail.
- .5 NEMA Type 1 enclosure.
  - .1 Enclosure Size: 10" (260 mm) wide by 13" (330 mm) high by 4.5"(114 mm) deep.

## 2.5 FEATURES

- .1 Lighting control ports supports:
  - .1 Communication through lighting control (RJ-45) ports that supply 40 mA of power to each device via standard Category 5e low-voltage network cabling.
  - .2 Detection of valid communication and blinking of a unique LED pattern to visually indicate a potential wiring issue.
- .2 Dry contact closure input to connect with external control systems to control a lighting control zone or scene.
- .3 Ethernet Ports:
  - .1 Support IEEE 802.3af Power-over-Ethernet in absence of 24V(dc).
  - .2 Support auto-negotiated 10/100MB connections speeds.
  - .3 Support IEEE 802.1AB Link Layer Discovery Protocol.
- .4 Test Functions:
  - .1 Operate without need of a configuration PC to check local wiring.
  - .2 Test connectivity with DMX lights and networked luminaire or all normal power lighting load types.
- .5 Complies with the following:
  - .1 RoHS 2011/65/EU + A1 2015/863.
  - .2 FCC.

## 2.6 WIRED NETWORKED LOW VOLTAGE CEILING/WALL OCCUPANCY AND PHOTSENSORS

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nCM-PTD-10, nMV-PDT-16 and nCM-PTD-09 (or as indicated on drawing) or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper, Inc.

- .2 Detect the presence of human activity within space and fully control the on/off function of lights.
- .3 Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).
- .4 Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) and PIR/Ultrasonic are acceptable. Refer to drawing for sensor type.
- .5 All sensing technologies are acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology and /or ultrasonic.
- .6 Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors. Cables to be CAT5E suitable for plenum rating.
- .7 All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- .8 Sensor programming parameter available and configurable remotely from the software and locally via the device push button.
- .9 Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only.
- .10 Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.
- .11 Photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation. If applicable.
- .12 Photosensor provides one on/off set-point and include a dead band to prevent the artificial light from cycling. Delay incorporated into the photosensor to prevent rapid response to passing clouds. If applicable.
- .13 Photosensor and dimming sensor's set-point and dead band automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set-point may be manually entered or modified. If applicable.
- .14 Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- .15 Dual zone option available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. The secondary daylight zone capable of being controlled as an "offset" from the primary zone.

## **2.7 WIRED NETWORKED LOW VOLTAGE WALL SWITCH OCCUPANCY SENSOR**

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nWSXA PDT LV or nWSXA PDT DX (as indicated on drawing) or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper, Inc.
- .2 Mounting: Suitable for installation in single-gang switch box.
- .3 Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
- .4 All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- .5 Devices with mechanical push buttons provide tactile and LED user feedback.
- .6 Wall Switch Sensor Options:
  - .1 User Input Control Types: [On/Off] or [On/Off/Dimming] or as indicated on drawing.
  - .2 Occupancy Sensing Technology: Dual technology acoustic or as indicated on drawing.
  - .3 Daylight Sensing Option: Inhibit Photosensor.
  - .4 Color: White or as indicated on drawing.

## **2.8 WIRED NETWORKED EMBEDDED FIXTURE SENSORS**

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nES or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper
- .2 Network system sensors with occupancy sensors and/or dimming photosensors that can be embedded into luminaire such that only the lens shows on luminaire face.
- .3 Occupancy sensor detection pattern suitable for 7.5 to 20-ft. (2.2 to 6-m) mounting heights.
- .4 Embedded Sensor Options:
  - .1 Occupancy Sensing technology: Dual technology as indicated on drawing.
  - .2 Sensing Option: [Occupancy only] [Daylight only] [Combination Occupancy/Daylight sensor], as indicated on drawing.

## **2.9 WIRED NETWORKED POWER PACKS**

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 (D) series or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper, Inc.

- .2 Plenum rated.
- .3 Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
- .4 Supply Voltage: [120 to 277] or [347] V(ac). As indicated on drawing.
- .5 Relay Output: Class 1 relay rated for 16 A at [277] [347] V(ac) and 1/2 HP at 120 V(ac).
- .6 Dimming Output: 0-10 VDC Dimming output.
- .7 Sink Current: 100 mA at 0-10 V(dc).
- .8 Mounting: Integral 1/2-inch (16-mm) chase nipple. Plastic clips into junction box are unacceptable.

## **2.10 WIRED STANDALONE LOW VOLTAGE OCCUPANCY AND PHOTOSENSORS**

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide Sensor Switch; Acuity Brands Lighting, Inc.; CM-PTD-10, MV-PDT-16 and CM-PTD-09 (or as indicated on drawing) or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper, Inc.
- .2 Detect the presence of human activity within space and fully control the on/off function of lights.
- .3 Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) and PIR/Ultrasonic are acceptable. Refer to drawing for sensor type.
- .4 All sensing technologies are acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology and /or ultrasonic.
- .5 Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors. Cables to be CAT5E suitable for plenum rating.
- .6 All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- .7 Sensor programming parameter available locally via the device push button.
- .8 Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only. As indicated on drawing.
- .9 Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.
- .10 Photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation. If applicable.
- .11 Photosensor provides one on/off set-point and include a dead band to prevent the artificial light from cycling. Delay incorporated into the photosensor to prevent rapid response to passing clouds. If applicable.

- .12 Photosensor and dimming sensor's set-point and dead band automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set-point may be manually entered or modified. If applicable.
- .13 Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- .14 Dual zone option available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. The secondary daylight zone capable of being controlled as an "offset" from the primary zone.

## **2.11 WIRED STANDALONE POWER PACKS**

- .1 Basis-of-Design Product: Subject to compliance with requirements, provide Sensor Switch; Acuity Brands Lighting, Inc.; PP20 series or comparable product by one of the following:
  - .1 Cooper Industries, Inc.
  - .2 Wattstopper, Inc.
- .2 Plenum rated.
- .3 Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
- .4 Supply Voltage: [120 to 277] or [347] V(ac). As indicated on drawing.
- .5 Relay Output: Class 1 relay rated for 16 A at [277] [347] V(ac) and 1/2 HP at 120 V(ac).
- .6 Dimming Output: 0-10 VDC Dimming output.
- .7 Sink Current: 100 mA at 0-10 V(dc).
- .8 Mounting: Integral 1/2-inch (16-mm) chase nipple. Plastic clips into junction box are unacceptable.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- .2 When using wire for connections other than the DLM local network (LMRJ Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.
- .3 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
  - .1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.



- .4 Install power packs in accessible maintenance areas unless noted otherwise. Provide access doors if power packs are installed above drywall ceilings.
- .5 Install sensors in gym where noted on plan at mid-height of wall or as indicated by manufacturer recommendations.
- .6 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer's recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to cover the respective rooms properly and completely.
- .7 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - .1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - .2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - .3 Load Parameters (e.g. blink warning, etc.)
- .8 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

### **3.2 FACTORY COMMISSIONING**

- .1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- .2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
- .3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
- .4 Factory commissioning shall include functional testing and documentation of the control system conforming to the "Functional Testing" requirements included in the current ASHRAE standard. This cost shall be included in the Tender Price.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.
- .2 ULC-S525 (latest edition), Audible Signal Appliances for Fire Alarm Systems.
- .3 CAN/ULC-S526 (latest edition), Visual Signal Appliances, Fire Alarm.
- .4 CAN/ULC-S527 (latest edition), Control Units, Fire Alarm.
- .5 CAN/ULC-S528 (latest edition), Manual Pull Stations.
- .6 CAN/ULC-S529 (latest edition), Smoke Detectors.
- .7 CAN/ULC-S530 (latest edition), Heat Actuated Fire Detectors, Fire Alarm.
- .8 CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.
- .9 CAN/ULC-S537 (latest edition), Verification of Fire Alarm Systems.
- .10 CAN/ULC-S552 (latest edition), Inspection, Testing and Maintenance of Smoke Alarms.
- .11 OBC-2012, Ontario Building Code.

**1.2 DESCRIPTION OF SYSTEM**

- .1 System includes:
  - .1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
  - .2 Trouble signal devices.
  - .3 Power supply facilities.
  - .4 Addressable and conventional manual alarm stations.
  - .5 Addressable and conventional automatic alarm initiating devices.
  - .6 Audible and visual signal devices.
  - .7 End-of-line devices.
  - .8 Annunciators.
  - .9 Ancillary devices.
  - .10 Interface and zone modules.
  - .11 Remote trouble indicator.

**1.3 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 This system is subject to review by local building department officials, local fire department officials. **Therefore, submission of verification certificate and field technician device verification sheets is required prior to inspection by these officials. Schedule accordingly.**

#### 1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Electrical General Requirements Section.
- .2 Include:
  - .1 Layout of equipment.
  - .2 Zoning.
  - .3 Complete wiring diagram.

#### 1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Electrical General Requirements Section.
- .2 Include:
  - .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
  - .2 Technical data - illustrated parts lists with parts catalogue numbers.
  - .3 Copy of approved shop drawings.
  - .4 List of recommended spare parts for system.

#### 1.6 MAINTENANCE MATERIALS

- .1 Include:
  - .1 10% spare glass rods for total number of manual pull box stations if applicable.

#### 1.7 TRAINING

- .1 Arrange and pay for on-site demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system. **Obtain written receipt of training session and include in maintenance manual.**

#### 1.8 SYSTEM OPERATION

- .1 Operation of any alarm initiating device to:
  - .1 Cause audible and visual signal devices to sound throughout building.
  - .2 Transmit signal to fire department via monitoring station.
  - .3 Cause zone of alarm device to be indicated on control panel and remote annunciator(s).
  - .4 Cause air conditioning and ventilating fans to shut down and to function so as to provide required control of smoke movement.
  - .5 Cause fire doors and smoke control doors if normally held open, to close automatically.
  - .6 Log the alarm in the historical alarm log file.
- .2 System Reset
  - .1 It shall not be possible to reset the fire alarm system until all the alarm zones have been properly reset or cleared.

- .3 System Trouble Operation
  - .1 Any system trouble shall cause the following to occur:
    - .1 An audible and visual trouble signal shall sound at the main control panel LCD Display Only until acknowledged by an operator.
    - .2 Log the trouble condition in the separate Historical Trouble Log File.

## **1.9 PERFORMANCE CRITERIA**

- .1 These specifications describe the minimum functional requirements for an electronically supervised, microprocessor based, fully integrated system. The initial installation shall include all the necessary electronic hardware, software and memory for a completely operable system in accordance with these specifications.

## **1.10 QUALITY ASSURANCE**

- .1 Each and all items of the fire alarm system shall be listed as the products of a single manufacturer under the appropriate category by the Underwriter's Laboratories of Canada and shall bear the "U.L.C." label.
- .2 Each and all items of the fire alarm system shall be covered by a one-year parts and labour warranty covering defects resulting from faulty workmanship and materials. The warranty shall be deemed to begin on the date the system is accepted by the Project Manager on issuance of the substantial performance certificate for the project.
- .3 All control equipment must have Transient Protection Devices to comply with U.L.C. requirements.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 The fire alarm system shall be an addressable, single stage, zoned, non-coded, indicating, fully integrated fire alarm. It should be capable of connecting existing conventional devices.
- .2 The fire alarm control panel shall allow for loading or editing of special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate expansion, and changes required by local codes. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
- .3 The ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing and Special Coded Operations is also to be incorporated in the resident software programming of the system.
- .4 The system shall have the ability to manually disable and enable any device/circuit individually for maintenance or testing purposes.
- .5 It shall be possible to reprogram selected or all smoke detector initiating zones for alarm verification.
- .6 All on site programming changes to the fire alarm system shall be password protected.

- .7 Wiring to any remote annunciator (s) shall be supervised for open and ground conditions. A separate annunciator trouble indicator must be provided at the control panel, which shall illuminate, and an audible trouble signal shall sound at the control panel upon the detection of an open or ground condition.
- .8 All Control Panels and Remote Annunciator Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable. The green coloured grounding loop shall be a minimum #14 AWG insulated copper conductor run in conduit. The ground loop shall be connected to building water supply to the line side of the water meter. Ground wire must not be run in the same conduit as the Fire Alarm wiring.

## **2.2 POWER REQUIREMENTS**

- .1 The control panels shall receive 120 VAC power via a dedicated overcurrent protected circuit. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A green 'Power On' LED shall be displayed continuously while incoming power is present.
- .2 Control Panel output power supply shall have the following operating characteristics:
  - .1 Rated for five Amps continuous duty.
  - .2 24 VDC filtered and regulated.
  - .3 Power limited with a range of 20.4 VDC to 32 VDC.
  - .4 Automatic "Brownout" transfer to standby batteries when supply voltage falls to 102 VAC.
- .3 The system shall be provided with sufficient standby capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four hours with two hours of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
- .4 The system batteries shall be supervised so that a low battery condition or disconnection of the batteries shall be audibly and visually annunciated at the control panel.
- .5 Battery charger shall have the following operating characteristics:
  - .1 Ability to charge a range up to 33 AH to 70% of their capacity within 12 hours.
  - .2 Compatible with either lead acid or nicad batteries.
- .6 All circuits requiring system operating power shall be individually fused at the control panel.
- .7 The system shall be modular in design to allow future expansion with a minimum of hardware additions and system interruptions.

## **2.3 FIRE ALARM CONTROL PANEL**

- .1 The fire alarm control panel construction shall be modular in design with solid state microprocessor-based electronics. An 80-character Liquid Crystal Display (LCD) shall indicate alarms, supervisory service conditions and any troubles. The panel shall include but not be limited to the following:
  - .1 80-character LCD display
  - .2 Local Energy, Shunt Master Box, or Reverse Polarity Remote Station Connection
  - .3 Form C Trouble Contact
  - .4 Earth Ground Supervision Circuit
  - .5 Basic 8 A power supply
  - .6 Automatic Battery Charger
  - .7 Standby Batteries
  - .8 Resident non-volatile programmable operating system memory for all operating requirements.
  - .9 Five Programmable Multi-Function keys with status LED's
  - .10 Red Alarm LED and Acknowledge Button
  - .11 Yellow Supervisory Service LED and Acknowledge Button
  - .12 Yellow Trouble LED and Acknowledge Button
  - .13 Green Power on LED
  - .14 Alarm/Signal Silence Button
  - .15 System Reset Button
  - .16 Operator Interface Keypad for Manual Control and System Information Access
  - .17 Addressable Interface Control Card
  - .18 Supervised Annunciator Circuit
- .2 The control Panel shall be capable of chronologically logging and storing 300 events in an alarm log and 300 events in a trouble log. The historical logs shall be stored in the CPU's memory and shall be protected by a lithium battery that is supervised for a low battery condition. Each recorded event shall include the time and date of that event's occurrence. The alarm log file must be separate from the trouble log file. It shall be possible for the user to generate a report of both logs upon request.
- .3 All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.
- .4 Signal Circuits shall be independently supervised and fused such that a fault on one circuit shall not affect the operation of any of the other circuits. All signal circuits shall be configured as follows:
  - .1 Class "B" wiring, current limited.
  - .2 Rated at two Amps of continuous power.
  - .3 Capable of powering polarised 24 VDC audible and visual signalling appliances.

- .5 Provide dry contact auxiliary control circuits as follows:
  - .1 Central Station alarm output.
  - .2 Central Station trouble output.
  - .3 SPDT Form C relays fused at 2 A @ 24 VDC.
- .6 System Expansion Modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected the system trouble indicator must illuminate and audible trouble signal must sound.
- .7 The Fire Alarm Control Panel shall be capable of supporting RS-232-C I/O ports. CPU data output to the I/O ports shall be in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.
- .8 A walk test feature must be provided.
- .9 All system controls shall be housed in a surface wall mounted steel cabinet. Finish shall be according to the manufacturer's standards.
- .10 All modules shall be secured behind hinged locked door with a full viewing tempered plastic window. The hinged locked doors shall give access to all the operating controls but shall not expose live connections.
- .11 All internal wiring, control circuits, connections and terminals shall only be accessible behind a removable metal retainer plate.
- .12 All Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable.
- .13 The system must provide communication with addressable initiating devices. All these devices will be annunciated on the control panel's main LCD display. Annunciation shall include the following conditions for each point:
  - .1 40 Character Zone/Device Location
  - .2 Type of Device
  - .3 Detector Status (Normal/Alarm/Trouble)
  - .4 Device Missing/Failed
- .14 The communication format must be a completely digital poll/response protocol to allow tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- .15 Each addressable device must be uniquely identified by an address code entered on each device base at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- .16 It shall be possible for the owner's representative to change a smoke detector without any special tools or programming.
- .17 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions. Systems, which cannot support 100% of their point capacity in alarm simultaneously, cannot assure appropriate system response and are not acceptable.

- .18 **The appropriate quantity of isolator modules shall be installed so that a wiring fault (short, open, or ground) within one floor area shall not prevent the normal operation of other addressable devices on other floor areas.**
- .19 The system shall maintain the sensitivity level set, for each sensor, over time by automatically compensating for environmental factors such as dust and dirt accumulations in a smoke sensor's chamber. The smoke sensor shall be a smoke density measuring device having no self-contained set-point. **The control panel shall determine the alarm decision for each sensor.**
- .20 The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value a 'Dirty Sensor' trouble condition shall be audibly and visually indicated at the control panel for the individual sensor.
- .21 All data transmissions, **including the analogue value**, between the smoke sensors and the control panel shall be digitally transmitted and incorporate parity and checksum digital data checks of each transmission.
- .22 An operator from the control panel, having a proper access level, shall have the ability to:
  - .1 Manually access and print the following information for each sensor in a report format that can be easily understood by the user:
    - .1 Primary Status
    - .2 Device Type
    - .3 Present Average Value
    - .4 Present Sensitivity Selected
    - .5 Highest Peak Detection Values
    - .6 Sensor Chamber Status (Normal, Almost Dirty, Dirty, Excessively Dirty)
  - .2 Manually control the following of each sensor:
    - .1 Clear Peak Detection Values
    - .2 Enable or Disable the Point
    - .3 Clear Verification Tally
    - .4 Control a Sensor's Relay Driver Output
- .23 It shall be possible to program the control panel to **automatically** change the sensitivity settings of each sensor based on **time-of-day** and **day-of-week**.

## 2.4 ADDRESSABLE MANUAL ALARM STATIONS

- .1 Manual alarm stations shall be addressable, single action, non-coded, semi-flush mounted type. Pull stations shall be break-glass style. Contacts are to activate when the handle is pulled down.
- .2 Addressable pull station electronics shall be mounted to the back plate of the station. The station's address will be set at the time of installation. Device addressing shall be accomplished by either an electrical or mechanical means.
- .3 Where noted on drawings, stations are to be equipped with tamperproof guard equal to Stopper II Cat. # STI-1100.



## 2.5 INTELLIGENT DETECTORS-GENERAL OPERATION

- .1 Addressable devices shall use simple to install and maintain decade, numbered 0 to 9, address switches. Detectors that have expanded addressing will have decade switch numbered from 0 to 15 for the most significant digit to allow detector addressing from 1 to 250.
- .2 Device addressing shall be accomplished by either an electrical or mechanical means.
- .3 Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel signalling line circuits.
- .4 Addressable smoke detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
- .5 The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
- .6 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.
- .7 The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
- .8 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- .9 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).
- .10 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- .11 Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
- .12 Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

- .13 The sensors shall be of a low-profile design and ULC listed for both ceiling and wall mount applications.
- .14 Automatic smoke sensors shall be equipped with a dust cover, which shall be removed at the time of verification to prevent dust and dirt entering the smoke chamber during construction.
- .15 A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

## **2.6 INTELLIGENT MULTI-DETECTOR**

- .1 The intelligent multi-detector shall be an addressable device, which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device. This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smouldering fires (photoelectric), and heat (thermal) all within a single sensing device.
- .2 The multi-detector shall include two bicolor LEDs, which flash green in normal operation and turn on steady red in alarm.
- .3 Detectors are to be provided with relay base where noted on the drawings.
- .4 Separately mounted photoelectric ionization and heat detectors in the same location are not acceptable alternatives.

## **2.7 FIXED TEMPERATURE HEAT DETECTOR**

- .1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the/ time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. The heat detector shall have a nominal alarm point rating of 57°C (135°F). The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

## **2.8 FIXED TEMPERATURE / RATE OF RISE HEAT DETECTOR**

- .1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm, The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 57°C (135°F) and a rate-of-rise alarm point of 9°C (15°F) per minute. The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

## **2.9 PHOTOELECTRIC SMOKE DETECTOR**

- .1 The intelligent photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging, and humidity. The photo detector shall be rated for ceiling installation at a minimum of Soft (Olin) centres and be suitable for wall mount applications.
- .2 The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:
  - .1 Temperature: 0°C to 49°C (32°F to 120°F)
  - .2 Humidity: 0-93% RH, non-condensing
  - .3 Elevation: no limit
- .3 Detectors are to be provided with relay base where noted on the drawings.

## **2.10 STANDARD DETECTOR MOUNTING BASES**

- .1 Provide standard detector mounting bases suitable for mounting on North American 1-gang, 85mm (3 ½ ") or 100 mm (4") octagon box and 100 mm (4") square box. The base shall, contain no electronics, support all detector types and have the following minimum requirements:
  - .1 Removal of the respective detector shall not affect communications with other detectors.
  - .2 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

## **2.11 INTELLIGENT DUCT SMOKE DETECTOR**

- .1 The smoke detector housing shall accommodate an intelligent photoelectric detector (as noted above) that provides continuous analog monitoring and alarm verification from the panel.
- .2 When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
- .3 Duct smoke detector sensor assemblies shall be complete with duct housing, photoelectric smoke detector, and sampling tubes as required. The duct-housing base shall come complete with an auxiliary set of form C dry contacts rated at 120 VAC, 3 Amps.
- .4 The system shall automatically indicate when an individual duct sensor needs cleaning.

## **2.12 AUDIBLE/VISUAL SIGNAL DEVICES**

- .1 Horn: flush mounted temporal horn, 24Vdc operation, 94 dBA rating at 3 m (10'), red finish, FM and ULC listed.
- .2 Mini Horns: flush mounted temporal mini horn, 24Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10'), white or red cover plate, FM and ULC listed. Suitable for mounting on a single gang box.
- .3 Strobe: semi-recessed, 24Vdc operation, complete with selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe, red finish, FM and ULC listed. Suitable for mounting on a single gang box.
- .4 Mini Horn/Strobe: flush mounted temporal combination mini horn/strobe, 24 Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10') selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe white or red cover plate, FM and ULC listed. Suitable for mounting on a single gang box.

### **NOTES:**

- .1 **Signal devices with integral strobe lights in high abuse areas (i.e. gymnasium, change rooms, etc.) must be provided with protective wireguards.**
- .2 **Any surface mounted signal devices must be provided with suitable backboxes supplied by the manufacturer.**
- .3 **Provide synchronization modules to suit signal devices (if required by manufacturer).**
- .4 **Set signal devices in classrooms to LOW setting.**

## **2.13 END OF LINE RESISTORS**

- .1 End-of-line resistors for signalling circuits shall be sized to ensure the correct supervisory current flows in each circuit.
- .2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.

## **2.14 REMOTE ANNUNCIATOR PANELS**

- .1 Each remote panel in the installed system shall include remote control display annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LED-s with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.
- .2 The remote-control display annunciators shall provide the system with individual zone and device annunciation.
- .3 Annunciator must be keyed similar to control panel.

## **2.15 GRAPHIC DISPLAY (PASSIVE)**

- .1 Black and white layout of facility showing all zones as specified/indicated.
- .2 Display is to be found behind Plexiglas, approximate size: 500 mm x 500 mm (20" x 20").
- .3 Finish frame to architects' direction.

## **2.16 ANCILLARY DEVICES**

- .1 Relay unit to initiate fan shutdown on makeup air units.
- .2 Relay unit to facilitate elevator recall functions as indicated.

## **2.17 INTELLIGENT MODULES – GENERAL OPERATION**

- .1 The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
  - .1 Temperature: 0°C to 49°C (32°F to 120°F).
  - .2 Humidity: 0-93% RH, non-condensing.

## **2.18 MONITOR MODULE**

- .1 The monitor modules shall have the following operating characteristics:

A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).
- .2 The monitor modules shall have the following features:

Nominal operating voltage:	15 to 32 VDC.
Maximum current draw:	5.1 mA (LED on)
Average operating current:	400 uA (LED flashing)
EOL resistance:	47K ohms.
Temperature range:	0°C to 49°C (32°F to 120°F)
Humidity range:	10% to 93% noncondensing
Dimensions:	114.3mm (4.5") high x 101.6 mm (4") wide x 31.75 mm (1.25") deep. Mounts to a 101.6 mm (4") square x 53.975 mm (2.1/8") deep box.

## **2.19 ISOLATOR MODULE**

- .1 Fault isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The fault isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. If a wire-to-wire short occurs, the fault isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the fault isolator module shall automatically reconnect the isolated section of the SLC loop. The fault isolator module shall not require any address-setting, and its' operations shall be totally automatic. It shall not be necessary to replace or reset a fault isolator module after its normal operation. The fault isolator module shall mount in a standard 10.16 cm (4") deep electrical box, in a surface-mounted backbox, or in the fire alarm control panel. It shall provide a single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

## **2.20 CONTROL MODULE**

- .1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
- .2 The control module NACs may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% or all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
- .3 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 Amps at 30 VDC.

## **2.21 DOOR HOLD OPEN DEVICES**

- .1 Units to be complete with the following features:
  - .1 Wall mounted style.
  - .2 Long life electromagnet.
  - .3 Low current operation.
  - .4 Completely silent operation.
  - .5 25 lbf (111N) minimum holding force.
  - .6 Adjustable swivel contact plate.
  - .7 Brushed zinc finish.
  - .8 Maintenance free operation.
  - .9 Water resistant design.
  - .10 ULC, CSA, and FM approved.

## **2.22 REMOTE TROUBLE INDICATOR**

- .1 A system remote trouble indicator where noted on the drawings shall be provided complete with the following features:
  - .1 Flush mounted in a double gang box.
  - .2 Trouble LED.
  - .3 Trouble buzzer.

## **2.23 SYSTEM WIRING**

- .1 The system wiring must be FSA rated in conformance with the Electrical Safety Code to suit the type of installation.
- .2 Wiring shall be minimum #18 AWG twisted shielded pair in conduit. "Securex 2" armoured cable will be permitted to be used for "drops" to devices on accessible ceilings.
- .3 As indicated on system riser diagram initiating device wiring shall be run in a loop with a home run from the last device to the control panel (Class 'A' configuration). Wiring from the "loop" module to conventional devices must be supervised, run in conduit, and conform to the standards of the Electrical Safety Code.

- .4 Signal wiring is to be cross connected in a class 'B' configuration.
- .5 Install isolator modules and end of line resistors in service rooms no higher than 2.4 M AFF. Provide location of these devices at the time of shop drawing submission.
- .6 **These are the basic wiring requirements for system operation. Prior to tender close manufacturer and contractor are to confirm all necessary wiring specifications and requirements.**
- .7 **Fire alarm riser diagram is for diagrammatic purpose, this contractor shall review the fire alarm system with the fire alarm contractor to verify all necessary wiring and requirements for a complete, functional and approved system.**

**2.24 APPROVED EQUIPMENT**

<u>DEVICE</u>		<u>NOTIFIER</u>	<u>EDWARDS</u>	<u>SIMPLEX</u>	<u>MIRCOM</u>
<u>Control Panel</u>					
		NFS2-3030 1-10 loops 318 add/loop	EST 4	4010-ES -2 loop -250 add	FX-4000 Series
<u>Intelligent Devices</u>					
Manual Alarm Stations 1-Stage		NBG 12LX	SIGA-270	4099-9001	MS-401AD
Addressable Multi-Sensor		FSP-851TA	SIGA2-PS		MIX-2251TB
Addressable Base		B710LPA	SIGA-SB	4098-9792	B210LPA
Addressable Base c/w Relay		B224RBA	SIGA-RB	4098-9791 c/w 2098-9737	B224RBA
Heat Sensor		FST-851RA	SIGA2-HRS or SIGA2-HFS	4098-9733	MIX-5251RBA Series
Smoke Detectors		FSI-851A	SIGA-PS	4098-9714	MIX-2251BA

Duct Type Smoke Detector (c/w Air Sampling Tubes)		FSD-751PA + ST-X	SIGA-SD c/w SIGA-PS	4098-9755 and 4098-9714	DNRA (Housing) MIX-2251BRA (Detector) DST (Tubes)
Monitor Module		FMM-1A	SIGA-CT Series	ZAM-Monitor 4090-9001	MIX-M500MA
Control Module		FCM-1 or FRM-1	SIGA-CR	ZAM-Control 4090-9002	MIX-M500RA
Isolator Module		ISO-XA	SIGA-IM	4090-9116	M500XA
Annunciator		ACM-32 AEM-32 ACM-32AY	EST3-6ANN	4603-9101 (GEO-7000 Series flush enclosure)	RAX-LCD RAM-1032TZ/RAM-1016TZ RAX-1048
<b><u>Conventional and Auxiliary Devices</u></b>					
Horn		Spectralert Series	757 Series	True Alert Series	FH-340
Mini Horn		MHRA (System Sensor)	Genesis G1R-HD	4901-9858	FH-340R
Door Holder		FMM Series	1500 Series	2088 Series	DH Series
Mini Horn complete with strobe		P2RA (System Sensor)	Genesis G1R-HDVM	4906-9127	FHS-340R
Strobe		SRA (System Sensor)	G1R-VM	4906-9101	FS-340R
Remote Trouble Indicator		RTB	RTU	RT1-1C	RTI-1



### Part 3 Execution

#### 3.1 INSTALLATION

- .1 The entire system shall be installed in accordance with CAN/ULC-S524 (latest edition) and approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation, all wiring shall be of the type recommended by the Electrical Safety Code, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.
- .2 Install main control panel and connect to ac power supply. AC power to be dedicated.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. **Do not mount detectors within 1 m (39") of air outlets.** Maintain at least 600 mm (24") radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 Connect alarm circuits to main control panel.
- .6 Locate and install signal devices and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of applicable alarm and signalling circuits.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.
- .10 Locate and install door releasing devices.  
**Note: Door holders must release by way of local smoke detector and signal from main control panel. Provide additional relays to suit.**
- .11 **Connect Fire/smoke damper integral detector outputs to monitor modules for alarm condition and for monitoring of AC power to fire/smoke damper as trouble condition at fire alarm panel based on module address.**

#### 3.2 FIELD QUALITY CONTROL

- .1 The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

#### 3.3 ACCEPTABLE INSTALLER

- .1 The fire alarm / life safety system specified herein shall be installed by an Authorized Electrical Contractor who is CFAA certified.

#### 3.4 EXAMINATION

- .1 Prior to the commencement of any of the work detailed herein, an examination and analysis of the area(s) where the Fire Alarm / Life Safety System and all associated components are to be installed shall be made.

- .2 Any of these area(s) which are found to be outside the manufacturers' recommended environments for the particular specified products shall be noted on a Site Examination Report which shall be given to the Building Owners Representative, and the Consultant.
- .3 Any shorts, opens, or grounds found on existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

### 3.5 DEMONSTRATION

- .1 Each of the intended operations of the installed Fire Alarm / Life Safety System shall be demonstrated to the Building Owners' Representative and the Consultant.

### 3.6 SYSTEM TEST

- .1 Perform tests in accordance with General Electrical Requirements Section and CAN/ULC-S537- (latest edition) Standard for the Verification of Fire Alarm Systems.
- .2 Fire alarm system:
  - .1 Test each device and alarm circuit to ensure noted devices transmit alarm to control panel and actuate general alarm and ancillary devices.
  - .2 Check annunciator panels to ensure zones are shown correctly.
  - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
  - .4 Class A circuits.
    - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
    - .2 Test each conductor on all circuits for capability of providing alarm signals during ground-fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
  - .5 Class B circuits
    - .1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .3 The control panel shall continuously perform as automatic self-test routine on each sensor, which will functionally check the sensor electronics and ensure the accuracy of the valves being transmitted to the control panel.
- .4 Automatic testing will occur at a rate of one sensor every four minutes.
- .5 The sensor's average analogue value is the average of the last 2000 recorded analogue entries of its chamber.
- .6 Any sensor that fails this test shall indicate a '**SELF-TEST ABNORMAL**' trouble condition with the sensor's address at the control panel.

- .7 The system shall automatically indicate when an individual sensor needs cleaning. When the sensor's average value reaches a predetermined value, a **'DIRTY SENSOR'** trouble condition shall be audibly and visually indicated at the local control panel for that sensor. IF a **'DIRTY SENSOR'** indication is left unattended and its average value increases to a second predetermined value, an **'EXCESSIVELY DIRTY SENSOR'** trouble condition shall be indicated at the local control panel for that sensor. To prevent false alarms, these **'DIRTY'** conditions shall in no way decrease the amount of smoke obscuration necessary to generate an alarm condition.
- .8 An operator having a proper access level, shall have the capability to manually access the following information from the control panel:
  - .1 Primary Status
  - .2 Device Type
  - .3 Present Average Value
  - .4 Present Sensitivity Selected\*
  - .5 Highest Peak Detection Values (HVP)\*
  - .6 Sensor Range (Normal, Dirty, Excessively Dirty)\* Values shall be in 'percent of smoke obscuration' format so that no interpretation is required by the operator.
- .9 **Provide "Integrated Testing" of this life safety system in conformance with the noted specification section. Include all associated costs in tender.**

### **3.7 AUDIBILITY TESTING**

- .1 Audibility Testing:
  - .1 The contractor is to coordinate an audibility test prior to occupancy of the facility. The test is to be performed by the representatives of the fire alarm manufacturer in the presence of the consultant. The test report is to be in chart form indicating:
    - .1 Project
    - .2 Date of test
    - .3 Room name and number
    - .4 Ambient dB level
    - .5 Alarm dB level.
    - .6 Name of testing technician
  - .2 The test results are to be submitted to the consultant for review prior to issuing to owner's representatives and/or authorities having jurisdiction.

### **3.8 EQUIPMENT ALLOWANCES**

- .1 The manufacturer and electrical contractor are to include in their bid the cost to add five (5) additional signaling devices to be installed and verified in locations as directed by the consultant. Note: This installation and verification and subsequent audibility test will be occurring after the initial audibility testing is complete.

- .2 The manufacturer and electrical contractor are to include in their bid the cost to add three (3) additional fire detection devices (heat or smoke detectors) to be installed and verified in locations as directed by the consultant.
- .3 The manufacturer and electrical contractor are to include in their bid the cost to add three (3) additional fire alarm zones with associated zone modules and including six (6) additional isolation modules to be installed and verified as directed by the consultant.

**END OF SECTION**

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 31 22 13 - Rough Grading.
  - .2 Section 31 23 16 - Excavation.
- 1.2 REFERENCES
  - .1 OPSS.MUNI 201 (April 2019): Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders.
  - .2 OPSS.MUNI 801 (Nov. 2019): Construction Specification for the Protection of Trees.
- 1.3 EXISTING CONDITIONS
  - .1 Prevent damage to items scheduled to remain.
  - .2 Protect trees designated to remain to OPSS.MUNI 801.
  - .3 Provide protective temporary fencing as required, placed at dripline of trees to protect root systems against passage of heavy equipment.
  - .4 Where excavation must occur through root system, excavate by hand, cut roots with sharp axe and seal cuts.
- 2 Products
- 2.1 REGULATORY REQUIREMENTS
  - .1 Conform to applicable regulatory requirements for disposal of debris in accordance with authorities having jurisdiction.
- 3 Execution
- 3.1 CLEARING
  - .1 Conform to OPSS.MUNI 201.
  - .2 Clear Place of the Work of debris and vegetation.
  - .3 Remove trees and shrubs within marked areas.
  - .4 Cut off trees, shrubs, stumps and other vegetation to within 100 mm of original ground surface.
  - .5 Perform close-cut clearing so that existing insulative layer of fibrous material is not damaged.
  - .6 Cut off unsound branches and cut down dangerous trees overhanging area cleared.
  - .7 Cut off isolated trees designated for removal at a height of 300 mm above ground.
  - .8 Grub out isolated tree stumps.
  - .9 Grub out stumps and roots to not less than 300 mm below original grade.
  - .10 Grub out visible rock fragments and boulders greater than 200 mm in greatest dimension, but less than 0.25 m<sup>3</sup> in volume.
- 3.2 REMOVAL AND DISPOSAL
  - .1 Remove cleared and grubbed materials from Place of the Work.

- .2 Useable timber and rocks become property of Contractor.
- .3 Leave ground surface in condition suitable for immediate earthwork operations, as specified in Sections 31 22 13 and 31 23 16.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 31 11 00 - Clearing and Grubbing.
  - .2 Section 31 22 13 - Rough Grading.
  - .3 Section 31 23 16 - Excavation.
  - .4 Section 31 23 33 - Trenching and Backfilling.
- 1.2 EXISTING CONDITIONS
  - .1 Protect rock outcropping, trees, shrubs, lawns and other features remaining as part of completed Project.
  - .2 Protect bench marks, existing structures, fences, roads, sidewalks, paving and curbs.
- 2 Products
- 2.1 REGULATORY REQUIREMENTS
  - .1 Conduct chemical analyses of top soil and subsoil being exported from Place of the Work to determine disposal site requirements, as required by authorities having jurisdiction.
- 3 Execution
- 3.1 PREPARATION
  - .1 Identify required lines, levels, contours and datum.
  - .2 Identify known below grade utility services. Stake and flag locations.
  - .3 Notify utility company to remove and relocate affected utility services.
- 3.2 TOPSOIL STRIPPING
  - .1 Strip topsoil from areas to be further excavated, re-landscaped or regraded.
  - .2 Stockpile topsoil in area designated at Place of the Work, to depth not exceeding 2 500 mm.
  - .3 Do not bury excess topsoil.
  - .4 Remove excess topsoil from Place of the Work and dispose of in accordance with authority having jurisdiction.
- 3.3 SUBSOIL STRIPPING
  - .1 Strip subsoil from areas to be re-landscaped or regraded.
  - .2 Stockpile subsoil in area designated at Place of the Work, to depth not exceeding 2 500 mm.
  - .3 Remove excess subsoil from Place of the Work and dispose of in accordance with authority having jurisdiction.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 14 00 - Earth Stripping and Stockpiling.
- .2 Section 31 23 16 - Excavation.
- .3 Section 31 23 23 - Fill.
- .4 Section 31 23 33 - Trenching and Backfilling.
- .5 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 ASTM D6461/D6461M-18: Standard Specification for Silt Fence Materials.
- .2 OPSS.MUNI 206 (April 2019): Construction Specifications for Grading.
- .3 OPSS.MUNI 805 (Nov. 2021): Construction Specification for Temporary Erosion and Sediment Control Measures.

1.3 EXISTING CONDITIONS

- .1 Protect rock outcropping, trees, shrubs, lawns and other features remaining as portion of final landscaping.
- .2 Protect bench marks, existing structures, fences, roads, sidewalks, paving and curbs.

2 Products

2.1 MATERIALS

- .1 Subsoil: Native stripped and excavated soil or similar imported soil; graded free of lumps larger than 150 mm OD, rocks larger than 75 mm OD and debris.
- .2 Erosion Control Blanket: To OPSS.MUNI 805.
- .3 Silt and Sediment Fence: To ASTM D6461/D6461M; 915 mm high, woven polypropylene fibre geotextile fabric secured to support posts; having 67 percent filter efficiency; eg. Terrafence by Terrafix Geosynthetics Inc.

3 Execution

3.1 PREPARATION

- .1 Identify required lines, levels, contours and datum.
- .2 Provide temporary erosion and sediment control measures to OPSS.MUNI 805.
- .3 Provide silt and sediment fencing as indicated on Drawings. Space support posts at 2 440 mm OC.

3.2 ROUGH GRADING

- .1 Conform to OPSS.MUNI 206.
- .2 Cut and fill to levels required.
- .3 Establish and maintain line and grade stakes for duration of grading operations.
- .4 Conform to grades indicated on Drawings.



- .5 Unless otherwise noted, uniformly slope grades between elevations indicated.
- .6 Do not exceed slopes of 4:1 unless indicated otherwise on Drawings.
- .7 Contour lines indicated on Drawings are approximate only and may require minor adjustments at Place of the Work.
- .8 Smoothly contour tops and toes of slopes and banks.
- .9 Establish contours parallel to finished grades.
- .10 Shape contours to ensure adequate drainage.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 22 13 - Rough Grading.
- .2 Section 31 23 23 - Fill.
- .3 Section 31 23 33 - Trenching and Backfilling.

1.2 DEFINITIONS

- .1 Rock: Defined as a solid rock formation, wherever found, that can be removed only by drilling and blasting; is more than one cubic metre in volume; and does not include glacial till, hardpan or layered rock in its original location that, in Consultant's opinion, can be ripped by a single rear-mounted tooth on D-8 crawler type tractor or similar equipment.

1.3 REFERENCES

- .1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Geotechnical Investigation Report: As described in Section 00 31 00.

1.4 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit field quality control reports as specified in Section 01 40 00.
- .2 Field Quality Control Reports: Soil bearing capacity test reports, indicating specified and actual results for compaction, moisture content, suitability and other required standards for sub-surface material.

1.5 EXISTING CONDITIONS

- .1 For excavation purposes, determine classification of existing soils as defined by Occupational Health and Safety Regulations for Construction Projects.

2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Conduct chemical analyses of subsoil being exported from Place of the Work to determine disposal site requirements, as required by authorities having jurisdiction.

3 Execution

3.1 PREPARATION

- .1 Identify required lines, levels, contours and datum.

3.2 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions indicated on Drawings, or in absence of such information, in accordance with recommendations of geotechnical investigation report.
- .2 Remove concrete, masonry, paving, walks, demolished foundations, lumped subsoil, boulders, rubble and other obstructions encountered during excavation.
- .3 In the event Rock is encountered within limits of excavation, notify Consultant and await instructions before proceeding with its removal.

- .4 Machine slope banks to angle of repose or less until shored. Refer to geotechnical investigation report for recommended slope of excavations.
- .5 Excavation cut not to interfere with normal 45 degree bearing splay of foundation.
- .6 Stockpile excavated material in area designated at Place of the Work. Remove and dispose of surplus and unsuitable excavated material.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Hand trim, make firm and remove loose material and debris from excavations.
- .9 Ensure bottoms of excavations are undisturbed soil, level, free from loose, soft or organic matter.
- .10 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with lean concrete as specified in Section 31 23 23.
- .11 Grade top perimeter of excavation to prevent surface water from draining into excavation.
- .12 Correct areas over excavated by error. Refer to Section 31 23 23.

### 3.3 TRENCHING

- .1 Perform trenching as specified in Section 31 23 33.
- .2 Do not excavate more than 30 metres of trench in advance of installation operations.
- .3 Do not leave open more than 15 metres of trench at end of each Working Day.
- .4 Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.

### 3.4 ABANDONED EXISTING ITEMS

- .1 Cut off and cap abandoned piping.
- .2 Cut off and seal ends of tree roots encountered during excavation.
- .3 Fill in old drains, wells and cisterns encountered and not affecting the bearing of any footing. Use only clean earth from excavation, well tamped and consolidated.

### 3.5 UNDERPINNING

- .1 Excavation for underpinning or any other excavation likely to undermine existing footings is to be carried out with caution.
- .2 Install adequate shoring prior to such excavation.
- .3 Use tapes or similar devices to monitor any movement in existing walls.
- .4 Excavate in sections not exceeding 1 830 mm in length.
- .5 Do not use heavy equipment for underpinning.

### 3.6 PUMPING AND DE-WATERING

- .1 Refer to Section 01 57 00.
- .2 Keep excavations free from accumulation of water.
- .3 Conduct de-watering when required so as to avoid damage to the Work and adjacent property. Prevent weakening of bearing soil and stability of embankments and slopes.

3.7 UNSUITABLE SUBSURFACE CONDITIONS

- .1 Where unsuitable subsurface conditions are encountered and confirmed by third-party testing, excavate to additional depth as necessary to achieve suitable conditions.
- .2 Arrange for representative of testing and inspection company to be present and oversee additional excavation.
- .3 Minimize additional excavation to that recommended by testing and inspection representative.
- .4 Request testing and inspection company to confirm and document revised founding elevation.
- .5 Requests for additional payment resulting from additional excavation caused by unsuitable conditions shall include verification documentation from testing and inspection company.

3.8 FIELD QUALITY CONTROL

- .1 Notify Consultant when bottom of excavation is reached. Obtain Consultant review of completed excavation.
- .2 Conduct field inspection and testing as specified in Section 01 40 00.
  - .1 Confirm suitable subsurface conditions when acceptable founding elevations are achieved.
  - .2 Document site information necessary for verification of additional costs resulting from additional work required by unsuitable conditions.
  - .3 Inspect, analyse and confirm soil bearing capacities using either static cone penetrometer or by hand probing and visual observation.

3.9 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- .3 Protect bottom of excavations and soil adjacent to and beneath foundation from frost, freezing, softening and other disturbances.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-In-Place Concrete.
- .2 Section 07 21 00 - Thermal Insulation.
- .3 Section 07 26 16 - Below-Grade Vapour Retarders.
- .4 Section 31 22 13 - Rough Grading.
- .5 Section 31 23 16 - Excavation.
- .6 Section 31 23 33 - Trenching and Backfilling.
- .7 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 OPSS.MUNI 501 (Nov. 2017): Construction Specification for Compacting.
- .3 OPSS.MUNI 1010 (Nov. 2013): Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .4 OPSS.MUNI 1860 (Nov. 2018): Material Specification for Geotextiles.
- .5 Geotechnical Investigation Report: As described in Section 00 31 00.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 40 00.
- .2 Verification Samples: A 4.5 kg sample of each type of fill material delivered to testing laboratory in air-tight containers.

1.4 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control reports as specified in Section 01 40 00.
- .2 Source Quality Control Reports: Include moisture content, suitability and other required standards for fill materials.

1.5 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit field quality control reports as specified in Section 01 40 00.
- .2 Field Quality Control Reports: Include specified and actual results for compaction, moisture content and other required standards for fill.

2 Products

2.1 MATERIALS

- .1 Fine Granular Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.
- .2 Coarse Granular Fill: To OPSS.MUNI 1010, Granular Class B, Type II; moisture content within plus or minus two percent of requirements in ASTM D698.

- .3 Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter.
- .4 Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded as follows:
  - .1 Minimum Size: 6 mm.
  - .2 Maximum Size: 16 mm.
- .5 Clear Crushed Stone Fill: Pit run, washed natural stone; free of shale, clay, friable material, sand, debris; graded as follows:
  - .1 Minimum Size: 16 mm.
  - .2 Maximum Size: 19 mm.
- .6 Structural Fill: Clean granular compactable material, approved for use by geotechnical engineer.
- .7 Subsoil: Re-used or imported subsoil, free of debris and gravel larger than 75 mm in size.
- .8 Concrete: Lean concrete, with minimum compressive strength of 7 MPa at 28 days.

## 2.2 ACCESSORIES

- .1 Geotextile Fabric: To OPSS.MUNI 1860, non-woven type.
- .2 Below-Slab Vapour Retarder: As specified in Section 07 26 16.
- .3 Below-Grade Thermal Insulation: Extruded polystyrene rigid board insulation, as specified in Section 07 21 00, types as follows:
  - .1 Vertical Applications: Type INS-RB-1.
  - .2 Horizontal Applications: Type INS-RB-2.

## 2.3 SOURCE QUALITY CONTROL

- .1 Inspect and test proposed backfill materials as specified in Section 01 40 00.
- .2 Conduct tests on submitted verification samples described above.
- .3 Do not proceed with backfill operations until verification samples have been accepted.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify foundation perimeter subdrainage has been inspected.

### 3.2 PREPARATION

- .1 Generally, compact subgrade to density requirements for subsequent backfill materials.
- .2 Cut out soft areas of subgrade not capable of insitu compaction and compact.
- .3 Install below-grade insulation in locations indicated on Drawings and as specified in Section 07 21 00.
- .4 Proof roll subgrade prior to placement of backfill in presence of Owner's geotechnical engineer.
- .5 Correct soft areas and obtain geotechnical engineer's acceptance of existing conditions prior to placing backfill.

### 3.3 BACKFILL

- .1 Backfill to contours and elevations as indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.
- .2 Do not use frozen material.
- .3 Systematically backfill to allow maximum time for natural settlement.
- .4 Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- .5 Place geotextile fabric where indicated on Drawings prior to placing next lift of fill.
- .6 Granular Fill: Place and compact materials in continuous layers not exceeding 150 mm compacted depth.
- .7 Native Soil Fill: Place and compact material in continuous layers not exceeding 200 mm compacted depth.
- .8 Employ placement method that does not disturb or damage adjacent construction.
- .9 Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- .10 Slope grade away from building minimum 150 mm in 3 000 mm, unless noted otherwise.
- .11 Make grade changes gradual. Blend slope into level areas.

### 3.4 ENGINEERED STRUCTURAL FILL

- .1 Provide engineered structural fill to raise founding elevations below building footings, foundations and slabs-on fill to levels indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.
- .2 Place and compact materials in continuous layers not exceeding 250 mm loose lift thickness.
- .3 Unless indicated otherwise on Drawings, extend area of engineered fill horizontally 1 000 mm beyond outside edge of exterior footings and extend downward at 1:1 slope to sound bedrock or stiff, compact native soil surface.

### 3.5 COMPACTING

- .1 Compact fill to OPSS.MUNI 501.
- .2 Do not use heavy equipment within 1 830 mm of basement walls. Compact with hand controlled equipment in such areas.

### 3.6 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Conduct tests and analysis of fill to ASTM D698.
- .3 If tests indicate completed installation does not meet specified requirements, remove non-compliant fill, replace with new compacted fill, and re-test at no additional cost to Owner.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 16 - Excavation.
- .2 Section 31 23 23 - Fill.
- .3 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 OPSS.MUNI 401 (Nov. 2021): Construction Specification for Trenching, Backfilling and Compacting.
- .3 OPSS.MUNI 1001 (Nov. 2021): Material Specification for Aggregates - General.
- .4 OPSS.MUNI 1010 (Nov. 2013): Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating shoring, bracing and underpinning, complete with design calculations and supporting data.
- .3 Prepare Shop Drawings under direct supervision of a professional engineer licenced to practice at Place of the Work.
- .4 Shop Drawings must be stamped, signed and dated by Submittal engineer.

1.4 EXISTING CONDITIONS

- .1 Size, depth and location of existing utilities and structures indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Temporary Shoring, Bracing and Underpinning: As specified in Section 01 57 00 and in accordance with applicable regulatory requirements. Protect existing features.
- .3 Existing Soil: For excavation purposes, verify classification of existing soils as defined by Occupational Health and Safety Regulations for Construction Projects.

2 Products

2.1 MATERIALS

- .1 Fine Granular Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.
- .2 Sand: To OPSS.MUNI 1001, natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- .3 Select Subsoil: Re-used and imported subsoil; free of debris and gravel larger than 75 mm OD; and having moisture content less than optimum.



3 Execution

3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify foundation perimeter drainage installation has been inspected.
- .3 Confirm locations of buried utilities by careful test excavations.

3.2 PREPARATION

- .1 Identify required lines, levels, contours and datum.
- .2 When necessary, compact subgrade surfaces to density requirements for backfill material.
- .3 Maintain and protect existing underground utilities and structures encountered. Obtain direction of Consultant before moving or otherwise disturbing existing utilities or structures.
- .4 Conduct condition survey of existing buildings, trees, plants, lawns, fencing, service poles, wires, paving, survey bench marks and monuments which may be affected by Work.

3.3 EXCAVATION

- .1 Conform to OPSS.MUNI 401.
- .2 Excavate subsoil required for underground site services to lines, grades, elevations and dimensions indicated on Drawings. In the absence of such information, conform to recommendations of geotechnical investigation report.
- .3 Cut trenches sufficiently wide to enable installation of utilities and allow inspection.
- .4 Remove lumped subsoil, boulders and rock up to 0.25 m<sup>3</sup>, measured by volume. Remove larger material as specified in Section 31 23 16.
- .5 Excavation shall not interfere with normal 45 degree bearing splay of foundations.
- .6 Fill over-excavated areas under pipe bearing surfaces as directed by Consultant.
- .7 Stockpile excavated material in area designated at Place of the Work.
- .8 Remove excess and unsuitable materials from Place of the Work.

3.4 BEDDING AND BACKFILLING

- .1 Conform to OPSS.MUNI 401.
- .2 Provide bedding materials as indicated on Drawings, or in the absence of such information, in accordance with recommendations of geotechnical investigation report.
- .3 Support pipe and conduit during placement and compaction of bedding fill.
- .4 Backfill trenches to final contours and elevations.
- .5 Place and compact granular and other select fill materials in continuous layers not exceeding 150 mm loose depth.
- .6 Place and compact subsoil and other common fill material in continuous layers not exceeding 200 mm loose depth.
- .7 Maintain optimum moisture content of backfill materials to attain required compaction density.
- .8 Remove surplus backfill materials from Place of the Work.

3.5 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Conduct tests and analysis of fill material to ASTM D698.
- .3 If tests indicate completed installation does not meet specified requirements, remove non-compliant fill, replace with new compacted fill, and re-test at no additional cost to Owner.

3.6 RESTORATION

- .1 Upon completion, remove surplus materials and debris, trim slopes and correct defects noted by Consultant.
- .2 Replace topsoil as indicated on Drawings.
- .3 Reinstall existing pavement and lawns designated to remain to condition and elevation which existed before excavation.
- .4 Clean and reinstall affected areas.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 07 26 16 - Below-Grade Vapour Retarders.
- .3 Section 31 23 16 - Excavation.
- .4 Section 31 23 23 - Fill.
- .5 Section 31 23 33 - Trenching and Backfilling.
- .6 Section 32 12 16 - Asphalt Paving.
- .7 Section 32 13 13 - Concrete Paving.
- .8 Section 32 16 13 - Concrete Curbs and Gutters.

1.2 REFERENCES

- .1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 OPSS.MUNI 501 (Nov. 2017): Construction Specification for Compacting.
- .3 OPSS.MUNI 1004 (Nov. 2021): Material Specification for Aggregates - Miscellaneous.
- .4 OPSS.MUNI 1010 (Nov. 2013): Material Specification for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.
- .5 Geotechnical Investigation Report: As described in Section 00 31 00.

1.3 SAMPLES

- .1 Submit samples as specified in Section 01 40 00.
- .2 Verification Samples: A 4.5 kg sample of each type of fill, delivered to testing laboratory in air-tight containers.

1.4 SOURCE QUALITY CONTROL SUBMITTALS

- .1 Submit source quality control reports as specified in Section 01 40 00.
- .2 Source Quality Control Reports: Include moisture content, suitability and other required standards for aggregates.

1.5 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit field quality control reports as specified in Section 01 40 00.
- .2 Field Quality Control Reports: Include specified and actual results for compaction, moisture content and other required standards for aggregate base courses.

2 Products

2.1 MATERIALS

- .1 Fine Aggregate Fill: To OPSS.MUNI 1010, Granular Class A; moisture content within plus or minus two percent of requirements in ASTM D698.
- .2 Fine Crushed Stone Fill: To OPSS.MUNI 1004, Open Graded 19.0 mm Crushed Rock.

- .3 Coarse Aggregate Fill: To OPSS.MUNI 1010, Granular Class B, Type II; moisture content within plus or minus two percent of requirements in ASTM D698.
- .4 Coarse Crushed Stone Fill: Pit run, washed natural limestone; free of shale, clay, friable material, sand, debris; graded as follows:
  - .1 Minimum Size: 38 mm.
  - .2 Maximum Size: 50 mm.
- .5 Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter.
- .6 Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded as follows:
  - .1 Minimum Size: 6 mm.
  - .2 Maximum Size: 16 mm.

### 3 Execution

#### 3.1 PREPARATION

- .1 Generally, compact subgrade to density requirements for subsequent backfill materials.
- .2 Cut out soft areas of subgrade not capable of insitu compaction and compact.
- .3 Proof roll subgrade prior to placement of backfill in presence of Owner's geotechnical engineer.
- .4 Correct soft areas and obtain geotechnical engineer's acceptance of existing conditions prior to placing aggregate base courses.

#### 3.2 PLACEMENT

- .1 Provide aggregate sub-base and base courses to compacted thicknesses and in locations as indicated on Drawings, including below:
  - .1 Concrete slabs-on-fill.
  - .2 Asphalt paving.
  - .3 Reinforced concrete paving.
  - .4 Concrete sidewalks, curbs and gutters.
- .2 Where sub-base and base course thicknesses are not identified on Drawings, conform to recommendations of geotechnical investigation report.
- .3 Backfill areas to contours and elevations with unfrozen materials.
- .4 Systematically backfill to allow maximum time for natural settlement.
- .5 Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- .6 Place and compact materials in continuous layers not exceeding 150 mm compacted depth.
- .7 Employ placement method that does not disturb or damage adjacent Work.
- .8 Make grade changes gradual. Blend slope into level areas.
- .9 Compact aggregate sub-base and base courses to OPSS.MUNI 501; at compaction rates recommended by geotechnical investigation report.

#### 3.3 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Conduct tests and analysis of fill to ASTM D698.

- .3 If tests indicate completed installation does not meet specified requirements, remove non-compliant fill, replace with new compacted fill, and re-test at no additional cost to Owner.

END OF SECTION

- 1 General
- 1.1 RELATED SECTIONS
  - .1 Section 32 11 23 - Aggregate Base Courses.
  - .2 Section 32 17 23 - Pavement Markings.
- 1.2 REFERENCES
  - .1 ASTM D698-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .2 OPSS.MUNI 310 (Nov. 2017): Construction Specification for Hot Mix Asphalt.
  - .3 OPSS.MUNI 1003 (Nov. 2013): Material Specification for Aggregates - Hot Mix Asphalt.
  - .4 OPSS.MUNI 1101 (Nov. 2016): Material Specification for Performance Graded Asphalt Cement.
  - .5 OPSS.MUNI 1103 (Nov. 2019): Material Specification for Emulsified Asphalt.
  - .6 OPSS.MUNI 1150 (Nov. 2020): Material Specification for Hot Mix Asphalt.
  - .7 Geotechnical Investigation Report: As described in Section 00 31 00.
- 1.3 FIELD QUALITY CONTROL SUBMITTALS
  - .1 Submit field quality control reports as specified in Section 01 40 00.
  - .2 Field Quality Control Reports: Include specified and actual results for compaction, suitability and other required standards for asphaltic material.
- 1.4 AMBIENT CONDITIONS
  - .1 Conform to OPSS.MUNI 310.
  - .2 Do not install Products during rainy or inclement weather.
- 2 Products
- 2.1 MATERIALS
  - .1 Asphalt Cement: To OPSS.MUNI 1101.
  - .2 Aggregate for Asphaltic Concrete Mix: To OPSS.MUNI 1003; graded as follows:
    - .1 Binder Course Mix: 100 percent passing a 26.5 mm sieve.
    - .2 Surface Course Mix: 100 percent passing a 16 mm sieve.
  - .3 Primer, Tack and Sealer Coats: To OPSS.MUNI 1103; SS-1 asphaltic emulsion.
- 2.2 MIXES
  - .1 Asphaltic Concrete Mixes: To OPSS.MUNI 1150; ready-mixed, hot laid asphaltic concrete, as follows:
    - .1 Binder Course: Type HL 8.
    - .2 Surface Course: Type HL 3.

- 3 Execution
- 3.1 EXAMINATION
  - .1 Refer to Section 01 71 00.
  - .2 Verify aggregate base course is compacted, dry and ready to support paving and imposed loads.
  - .3 Verify aggregate base course gradients and elevations are correct.
- 3.2 PREPARATION
  - .1 Shape finished subgrade parallel to proposed finished grades.
  - .2 Proof roll subgrade to 100 percent Standard Proctor maximum dry density.
  - .3 Where existing asphalt pavements are designated to be removed, replaced or extended, saw cut existing edges to form a neat joint between existing and new construction. Remove and dispose of abandoned materials.
- 3.3 PLACEMENT
  - .1 Lay asphalt paving to OPSS.MUNI 310, rolled to firm compaction.
  - .2 Apply asphalt courses to compacted thicknesses as indicated on Drawings. In the absence of such information, conform to recommendations of geotechnical investigation report.
  - .3 Lay mixture on dry aggregate base course, free of standing water.
  - .4 Spread mixture with mechanical self-propelled power spreader capable of spreading mixture to a line and grade.
  - .5 Before roller compaction is started, check surface for inequalities and flat spots, and adjust.
  - .6 Finished Surface: Smooth and true to established crown, free from depressions.
- 3.4 FIELD QUALITY CONTROL
  - .1 Perform field inspection and testing as specified in Section 01 40 00.
  - .2 Conduct tests and analysis to ASTM D698.
  - .3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products and re-test at no cost to Owner.
- 3.5 ADJUSTING
  - .1 Repair low or defective areas by cutting out affected course and replace it with fresh, hot mixture. Immediately compact to conform to surrounding area.
  - .2 Ensure 100 percent bond to existing adjacent paving.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 32 11 23 - Aggregate Base Courses.
- .2 Section 32 16 13 - Concrete Curbs and Gutters.
- .3 Section 32 17 23 - Pavement Markings.

1.2 REFERENCES

- .1 ASTM A1064/A1064M-22: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 ASTM C309-19: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM D1751-23: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .4 CSA A23.1:19: Concrete Materials and Methods of Concrete Construction.
- .5 CSA A23.2:19: Test Methods and Standard Practices for Concrete.
- .6 CSA G30.18-09 (R2014): Carbon Steel Bars for Concrete Reinforcement.
- .7 OPSS.MUNI 350 (Nov. 2021): Construction Specification for Concrete Pavement and Concrete Base.
- .8 OPSS.MUNI 351 (Nov. 2021): Construction Specification for Concrete Sidewalk.
- .9 OPSS.MUNI 1350 (Nov. 2023): Material Specification for Concrete - Materials and Production.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating reinforcing steel design, as follows:
  - .1 Prepared according to RSIC Manual of Standard Practice.
  - .2 Clearly indicate bar sizes, spacings, location and quantities of reinforcement, welded wire fabric, chairs spacers and hangers with identifying code marks to permit correct placement without reference to Drawings.
  - .3 Prepare details to show placement of reinforcing where special conditions occur.
  - .4 Shop Drawings will not contain reproductions of Contract Documents.
- .3 Mill Tests: Submit upon request one certified copy of mill tests for reinforcing steel, showing physical and chemical analysis.

1.4 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit field quality control reports as specified in Section 01 40 00.
- .2 Field Quality Control Reports: Include specified and actual results for slump at point of placement, compressive strength, cement content, water-to-cement ratio, air entrainment and other required standards for concrete material.

1.5 QUALIFICATIONS

- .1 Applicator: A firm specializing in producing commercial-quality concrete paving, having minimum 10 years documented experience.



1.6 AMBIENT CONDITIONS

- .1 Place Products only when ambient conditions are to CSA A23.1.
- .2 Ensure temporary heating is provided for cold weather work.

2 Products

2.1 MANUFACTURERS

- .1 Manufacturers of tactile walking surface indicators having Product considered acceptable for use:
  - .1 ADA Solutions, Inc.
  - .2 Kinesik Engineered Products Inc.
- .2 Substitution Procedures: Refer to Section 01 25 00.

2.2 MATERIALS

- .1 Concrete: To OPSS.MUNI 1350; as follows:
  - .1 Compressive Strength: 32 MPa at 28 days;
  - .2 Water-to-Cement Ratio: 0.40;
  - .3 Air Entrainment: 7 to 10 percent.
- .2 Formwork: SPF species; NLGA Light Framing classification, Utility Grade; with grade stamp clearly visible.
- .3 Release Agent: Non-staining oil-based material, which will not impair natural bonding or colour characteristics of coating intended for use on concrete; eg. Duoguard ECO-Coat by W. R. Meadows of Canada Limited.
- .4 Reinforcing Steel: To CSA G30.18, Grade 400R; high bond deformed bars made from new billet steel, sizes as indicated on Drawings.
- .5 Welded Wire Reinforcement: To ASTM A1064/A1064M; flat sheets; 152 x 152 MW 18.7 X MW 18.7 size.
- .6 Tie Wire: To ASTM A1064/A1064M; minimum 3 mm OD, annealed type.
- .7 Chairs, Bolsters, Bar Supports and Spacers: Adequate for strength and support of reinforcing construction conditions.
- .8 Expansion Joint Filler: To ASTM D1751; 10 mm thick, preformed asphalt-impregnated fibre board.
- .9 Curing and Sealing Compound: To ASTM C309, Type 1, Class B; transparent, non-yellowing; eg. CS-309 by W. R. Meadows of Canada Limited.
- .10 Concrete Sealer: eg. Sealtight HIAC acrylic concrete sealer by W. R. Meadows of Canada Limited.
- .11 Below-Grade Thermal Insulation: Extruded polystyrene rigid board insulation, Type INS-RB-1 as specified in Section 07 21 00.
- .12 Tactile Walking Surface Indicators - Cast-in-Place (TWSI-CIP): 610 x 915 mm rectangular units, two-piece polymeric assembly consisting of a 32 mm deep cast-in-place base pan with hexagonal nylon anchors, and a 5 mm thick cover tile complete with 5 mm high, 23 mm OD truncated domes, spaced at 61 mm OC and aligned in an in-line pattern; bevelled edges; eg. Replaceable Cast in Place Access Tiles as distributed by Kinesik Engineered Products Inc., colour as selected by Consultant.

- .13 Tactile Walking Surface Indicators - Surface-Applied (TWSI-SA): 610 x 915 mm rectangular units, one-piece 5 mm thick polymeric tile complete with 5 mm high, 23 mm OD truncated domes, spaced at 61 mm OC and aligned in an in-line pattern; bevelled edges; eg. Surface Applied Access Tiles as distributed by Kinesik Engineered Products Inc., colour as selected by Consultant.
- .14 TWSI Adhesive/Sealant: eg. Access Tile Tactile Bond & Seal as distributed by Kinesik Engineered Products Inc.
- .15 TWSI Fasteners: Stainless steel screw type fasteners, size and length as recommended by manufacturer.
- .16 Stair Nosings: Extruded aluminum cast-in-place stair inserts complete with non-slip silicon carbide insets; Ecoglo S2 as distributed by Kinesik Engineered Products Inc., colour as selected by Consultant.
- .17 Non-Slip Strips: 50 mm wide carborundum grit tape strip inserts, colours as selected by Consultant and in accordance with barrier free requirements.
- .18 Joint Sealer and Saw Cut Filler: Lithoreal Joint Sealant by L. M. Scofield Company, multiple colours required, to match adjacent surfaces.

## 2.3 MIXING

- .1 Mix concrete to OPSS.MUNI 1350 and CSA A23.1.

## 3 Execution

### 3.1 EXAMINATION

- .1 Refer to Section 01 71 00.
- .2 Verify subgrade elevations.

### 3.2 PREPARATION

- .1 Shape finished subgrade parallel to proposed finished grades.
- .2 Proof roll subgrade to 95 percent Standard Proctor maximum dry density.
- .3 Where existing concrete pavements are designated to be removed, replaced or extended, saw cut existing edges to form a neat joint between existing and new construction. Remove and dispose of abandoned materials.

### 3.3 PLACEMENT

- .1 Place below grade insulation where noted on Drawings.
- .2 Construct concrete pavements to OPSS.MUNI 350.
- .3 Construct concrete sidewalks to OPSS.MUNI 351.
- .4 Place reinforcement, supported on concrete chairs at mid-thickness of concrete slabs. Do not continue reinforcement through expansion joints.
- .5 Install stair nosings in formwork where indicated on Drawings. Brace against dislodgement during concrete pour.
- .6 Place concrete to thicknesses indicated on Drawings and vibrate to CSA A23.1.
- .7 Broom finish surface to a slight crown to shed water.
- .8 Provide tooled edge and mark into panels not more than 1 525 mm in size.

- .9 Saw cut concrete surfaces and fill with saw cut filler as indicated on Drawings.
- .10 Provide asphalt-impregnated board expansion joint at maximum 7 500 mm OC.
- .11 Cure and seal concrete pavements subject to action of salt with curing and sealing compound.
- .12 Apply concrete sealer to concrete that has cured for minimum 7 days.
- .13 Apply non-slip strips to concrete surfaces to barrier free ramp in pattern as indicated on Drawings. Ensure concrete surfaces are properly cured, smooth, dry, clean and free of foreign materials such as dust, paint, grease, and oils. Roll non-slip strips with J-hand roller to ensure proper bond with substrate.
- .14 Provide tapered concrete sidewalks in conjunction with drop curbs, with maximum 1:12 slope. Finish to sandblast texture.

### 3.4 TACTILE WALKING SURFACE INDICATORS

- .1 Install tactile walking surface indicators where indicated on Drawings.
- .2 Embed cast-in-place TWSI assembly in freshly poured concrete, tamping to correct level. Create 6 mm wide joint around TWSI assembly and then float concrete surface around assembly perimeter.
- .3 Adhere surface-applied TWSI tile to roughened and cleaned concrete surface using recommended TWSI adhesive/sealant. Allow adhesive to cure.
- .4 Clean and seal perimeter with TWSI adhesive/sealant.

### 3.5 FIELD QUALITY CONTROL

- .1 Perform field inspection and testing as specified in Section 01 40 00.
- .2 Conduct tests and analysis of concrete to CSA A23.2.
- .3 If tests indicate completed installation does not meet specified requirements, remove non-compliant Products, replace with new Products, and re-test at no additional cost to Owner.

### 3.6 PROTECTION

- .1 Protect concrete from harmful effects of sunshine, drying winds and cold running of surface water for minimum 5 days.
- .2 Remove temporary protective covering from tactile walking surface indicator surfaces after concrete has cured.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 32 11 23 - Aggregate Base Courses.
- .2 Section 32 13 13 - Concrete Paving.
- .3 Section 32 17 23 - Pavement Markings.

1.2 REFERENCES

- .1 ASTM A1064/A1064M-22: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 ASTM D1751-23: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .3 CSA A23.1:19: Concrete Materials and Methods of Concrete Construction.
- .4 CSA A23.2:19: Test Methods and Standard Practices for Concrete.
- .5 CSA G30.18-09 (R2014): Carbon Steel Bars for Concrete Reinforcement.
- .6 OPSS.MUNI 353 (Nov. 2021): Construction Specification for Concrete Curb and Gutter Systems.
- .7 OPSS.MUNI 1350 (Nov. 2023): Material Specification for Concrete - Materials and Production.

1.3 FIELD QUALITY CONTROL SUBMITTALS

- .1 Submit field quality control reports as specified in Section 01 40 00.
- .2 Field Quality Control Reports: Include specified and actual results for slump at point of placement, compressive strength, cement content, water-to-cement ratio, air entrainment and other required standards for concrete.

2 Products

2.1 MATERIALS

- .1 Concrete: To OPSS.MUNI 1350; as follows:
  - .1 Compressive Strength: 35 MPa at 28 days;
  - .2 Water-to-Cement Ratio: 0.40;
  - .3 Air Entrainment: 7 to 10 percent.
- .2 Formwork: Wooden forms, as specified in Section 32 13 13.
- .3 Release Agent: As specified in Section 32 13 13.
- .4 Reinforcing Steel: To CSA G30.18, Grade 400R; high bond deformed bars made from new billet steel, sizes as indicated on Drawings.
- .5 Welded Wire Reinforcement: To ASTM A1064/A1064M; flat sheets; 152 x 152 MW 18.7 X MW 18.7 size.
- .6 Tie Wire: To ASTM A1064/A1064M; minimum 3 mm OD, annealed type.
- .7 Chairs, Bolsters, Bar Supports and Spacers: Adequate for strength and support of reinforcing construction conditions.
- .8 Expansion Joint Filler: To ASTM D1751; 10 mm preformed asphalt impregnated fibre board.

- .9 Curing and Sealing Compound: eg. CS-309 by W. R. Meadows of Canada Limited.
- .10 Concrete Sealer: eg. Sealtight HIAC acrylic concrete sealer by W. R. Meadows of Canada Limited.
- 2.2 EQUIPMENT
  - .1 Concrete Curb Extruder: Proprietary concrete extruder, designed to form profile of concrete curb automatically by extrusion process.
- 2.3 MIXING
  - .1 Mix concrete to OPSS.MUNI 1350 and CSA A23.1.
- 3 Execution
- 3.1 EXAMINATION
  - .1 Refer to Section 01 71 00.
  - .2 Verify subgrade elevations.
- 3.2 PREPARATION
  - .1 Proof roll base to 95 percent Standard Proctor maximum dry density.
  - .2 Where existing concrete curbs and gutters are designated to be removed, replaced, or extended, saw cut existing edges to form a neat joint between existing and new construction. Remove and dispose of abandoned materials.
- 3.3 PLACEMENT
  - .1 Erect formwork as specified in Section 32 13 13.
  - .2 Construct concrete curbs and gutters to OPSS.MUNI 353.
  - .3 Place reinforcement, supported on concrete chairs at mid-thickness of concrete curbs. Do not continue reinforcement through expansion joints.
  - .4 Place concrete to scheduled thickness and vibrate to CSA A23.1.
  - .5 A concrete curb extruder may be used for non-reinforced curbs.
  - .6 Provide asphalt-impregnated board expansion joint at maximum 7 500 mm OC.
  - .7 Cure and seal concrete with curing and sealing compound.
  - .8 Apply concrete sealer to concrete that has cured for minimum 7 days.
  - .9 Provide drop curbs in conjunction with tapered sidewalks, as indicated on Drawings.
- 3.4 FIELD QUALITY CONTROL
  - .1 Perform field inspection and testing as specified in Section 01 40 00.
  - .2 Conduct tests and analysis of concrete to CSA A23.2.
  - .3 If tests indicate completed installation does not meet specified requirements, remove defective Products, replace with new Products and re-test at no cost to Owner.
- 3.5 ADJUSTING
  - .1 Remove formwork no sooner than 24 hours after pouring.

3.6 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect concrete from harmful effects of sunshine, drying winds and cold running of surface water for 5 days.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 32 12 16 - Asphalt Paving.
- .2 Section 32 13 13 - Concrete Paving.
- .3 Section 32 16 13 - Concrete Curbs and Gutters.

1.2 REFERENCES

- .1 OPSS.MUNI 710 (Nov. 2021): Construction Specification for Pavement Marking.
- .2 OPSS.MUNI 1716 (Nov. 2021): Material Specifications for Water-Borne Traffic Paint.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.
- .2 Stencils: Submit stencils to Owner upon completion of pavement marking application.

1.4 AMBIENT CONDITIONS

- .1 Conform to OPSS.MUNI 710.
- .2 Do not install Products during rainy or inclement weather.
- .3 Apply pavement markings only when ambient conditions are as follows:
  - .1 Air Temperature: > 10 degrees C.
  - .2 Wind Speed: < 60 kph.
  - .3 Precipitation: None forecasted for the next 48 hours.

2 Products

2.1 MATERIALS

- .1 Traffic Paint: To OPSS.MUNI 1716; ready-mixed, homogeneous, water-borne traffic paint of uniform consistency, Flat gloss level; colours as follows:
  - .1 Existing Linework Designated to be Abandoned: Black.
  - .2 Depressed Sidewalks and Drop Curbs: White.
  - .3 Crosswalks: White.
  - .4 Barrier Free Parking Symbol: Yellow border, Blue field, Yellow symbol.
  - .5 Electric Vehicle Parking Symbol: White border, Green field, White symbol.
  - .6 Play Area Game Lines: White.
  - .7 All Other Pavement Markings: Yellow.

2.2 EQUIPMENT

- .1 Stencils: Re-usable stencils, 3 mm thick heavy duty plastic; lettering and symbols as indicated on Drawings, by U-Line.

3 Execution

3.1 APPLICATION

- .1 Lay out pavement markings as indicated on Drawings.
- .2 Apply pavement markings to OPSS.MUNI 710.
- .3 Apply traffic paint evenly at rate of 3 L/m<sup>2</sup>.

- .4 Do not thin paint.
- .5 Provide symbols and lines as indicated, using stencils specified above.
- .6 Provide lines of uniform colour and density, with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
- .8 Paint markings to be within plus or minus 12 mm of dimensions indicated.
- .9 Make Good incorrect markings.
- .10 Protect pavement markings until dry.

END OF SECTION



## **PART 1 - GENERAL**

### **1.1 Description**

- .1 General Requirements:  
Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.
- .2 Work Included:  
Provision of all labour, equipment, material, machines, tools, services and incidentals to supply and spread topsoil and fine grade.
- .3 Related Work Specified Elsewhere:  
Section 32 93 00 - Planting  
Section 32 92 23 - Sodding

### **1.2 Quality Assurance**

- .1 Topsoil Evaluation
  - .01 An evaluation is required for all organic soils intended for work of this Contract.
  - .02 Use an approved independent agricultural soil testing agency.  
For example: SGS  
503 Imperial Road North, Unit 1  
Guelph ON N1H 6T9  
1-800-265-7175/1-519-837-1600 Contact: Jack Legg
  - .03 When organic soil from one source is exhausted and more soil is required, organic soil from a new source shall be evaluated before continuing work.
  - .04 Test for N, P, K, and minor element values, soluble salt content, organic matter, pH value, and mineral and organic contents of soil as measured by weight when dry.  
For example: SGS GUELPH  
Topsoil Basic Package + Total Salts + Sand, Silt,  
Clay + Toxic Chemicals (Atrazine)
  - .05 Classify soil by visual procedures for organic soils as defined by the MTC Soil Classification Manual.
  - .06 Submit evaluation report before commencing work.
  - .07 Have agricultural soil testing agency confirm suitability of organic soil for specified plantings and that soils tested, meet, or can be amended to meet the requirements specified herein.
  - .08 Conform to recommendations from agricultural soil testing agency with respect to improvement of tested soil.
  - .09 Adjust fertilizer requirements and rates as well as addition of other additives, to conform to soil testing recommendation, at no extra cost to the Contract.

.2 Subcontractor Qualifications

- .01 All planting and related work shall be done by experienced, qualified personnel, under the direction and supervision of foreman with at least 10 years of horticultural and planting experience.

**1.3 Standards**

- .1 Conform to the standards of Agriculture Canada.
- .2 Contractor shall meet the requirements of O Reg 406/19 On-Site and Excess Soil Management.

**1.4 Submittals**

- .1 Topsoil Evaluation Reports :  
Submit evaluation reports specified.
- .2 Submit samples of organic soil that represent soils subject to evaluation.

**1.5 Review of Materials and Work**

- .1 Make all materials available for review at source of supply or upon arrival on the site.
- .2 Give timely notice, in writing, to the Consultant when materials are available for review.
- .3 The Consultant reserves the right to reject any topsoil whether stockpiled or not, which does not conform to the specifications and/or drawings. Remove all rejected materials from the site immediately.
- .4 Arrange for review of subgrade prior to placement of topsoil.

**1.6 Delivery, Handling and Storage**

- .1 Supply and deliver all materials, such as fertilizers, bonemeal and mulches in standard containers clearly indicating contents, weight, analysis and name of manufacturer.
- .2 Where such materials are supplied in bulk, written statements shall be submitted to the Consultant indicating the same information as if supplied in standard containers.
- .3 Stockpile and handle topsoil in order that soil texture is preserved. Cover if necessary to prevent wind or water erosion.
- .4 Do not allow topsoil to be contaminated by mixing with subgrade materials. Contaminated topsoil will be rejected.
- .5 The Contractor shall haul topsoil to the areas of the site to be topsoiled and fine-graded along approved routes and shall carefully avoid damage to existing site features and all on-site construction whether complete or in-progress.

**PART 2 - PRODUCTS**

**2.1 Topsoil**

- .1 Import topsoil for all work.

- .2 Use topsoil that is a fertile, friable natural loam, and the following :
- .01 Consist of mineral and organic materials, water and air at the following percentages by volume :
- Mineral Material consisting of:
- |                   |     |
|-------------------|-----|
| Clay              | 10% |
| Silt              | 20% |
| Sand              | 14% |
| Organic Material  | 6%  |
| Water (capillary) | 25% |
| Air (aeration)    | 25% |
- .02 Consist of mineral and organic materials, at the following percentages by weight when dry:
- |                  |     |
|------------------|-----|
| Organic Material | 4%  |
| Clay             | 22% |
| Silt             | 44% |
| Sand             | 30% |
- .03 Be a medium texture clay loam, well tilled, with good tilth.
- .04 Have an acidity range from pH 6.0 to 7.5.
- .05 Be free of any admixture of subsoil, lumps, stones and rocks over 20mm dia. and other extraneous matter, and reasonably free of weeds, weed seeds, and rhizomes.
- .06 Be completely free of any toxic chemical.
- .07 Be capable of sustaining vigorous plant growth.

## 2.2 Peatmoss

- .1 Partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with a texture varying from porous to spongy fibrous with a pH value ranging from 4.5 to 6.0.
- .2 It shall be baled and free of decomposed colloidal residue, wood, sulphur, and iron, be brown in colour and finely shredded with particles not exceeding 6mm in size.
- .3 The use of peat, supplied in bulk, will not be permitted unless approved by the Owner upon submission of sample and location of source and supply.

## 2.3 Fertilizer

- .1 Inorganic fertilizers complete, commercial fertilizers of approved manufacturer not less than 60% urea-formaldehyde by weight.
- .2 The following fertilizer requirements have been included for tendering purposes only. The requirements and rates shall be adjusted to conform to soil testing reports and subsequent recommendations. Such adjustments shall be made at no extra cost to the Owner.

10-6-4 @ 9 kg. per 25mm tree caliper.

10-6-4 @ 1 kg. per 1 cu. metre of soil mixture for all planting beds.

#### **2.4 Bonemeal**

- .1 Commercial, raw bonemeal, finely ground, and with a minimum analysis of 2% nitrogen and 11% phosphoric acid.

#### **2.5 Lime**

- .1 Lime to be used in all cases where the pH of the soil is less than 6.0: Limestone containing not less than 8% of calcium and magnesium carbonates combined, finely ground to pass a #10 mesh sieve with at least one half passing a #100 mesh sieve. Rate of application shall be determined after determining the pH of the topsoil.

### **PART 3 - EXECUTION**

#### **3.1 Site Conditions**

- .1 Visit and examine the site and soil conditions and be satisfied that work can be carried out in accordance with requirements or contract documents.
- .2 Verify that grades are correct. If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.

#### **3.2 Preparation of Existing Grade**

- .1 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .2 Remove debris, roots, branches, stones in excess of 10mm diameter. Dispose of removed material off site. Remove topsoil that has been contaminated with oil, gasoline, or calcium chloride. Dispose of removed materials as directed
- .3 Coarse cultivate entire area which is to receive topsoil to a depth of 150mm.  
  
Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.
- .4 Remove topsoil that has been contaminated with subgrade soils.

#### **3.3 Placing and Spreading of Topsoil**

- .1 Place topsoil after Consultant has accepted subgrade.
- .2 Place topsoil uniformly over unfrozen subgrade, free of standing water.
- .3 Do not perform topsoil operations during heavy rain conditions.
- .4 Topsoil depth for sod by Section 02924
- .5 Topsoil depth for seed by Section 02923.

#### **3.4 Final Grading**

- .1 Final grade constitutes a smooth, firm, loose texture, surface free of all pockets and depressions.

- .2 Finished grades are defined as the final grade elevations indicated for plans and details after completion of work.
- .3 Notify the Consultant in writing if the grades provided by rough grading will not permit proper drainage.
- .4 Scarify the subgrade to a minimum depth of 50 mm to produce an even, loose textured surface free of all stones, roots, branches, extraneous materials, etc. larger than 80 mm in diameter and live weeds.
- .5 Establish uniform slopes between points for which finish grades are indicated or between such points and existing grade.
- .6 Round and smooth grades at top and toe of slopes and banks.
- .7 Blend smoothly and flush with existing grades.
- .8 Spread topsoil evenly over approved subgrade to compacted depth of 100mm.
- .9 Fine grade with small bulldozer and/or farm tractor equipment.
- .10 Clean surface of all stones, rocks, branches, extraneous material etc. larger than 30 mm in diameter and live weeds.
- .11 Get approval by Consultant of finish grading, prior to commencement of any subsequent work.
- .12 Topsoil and sub-soil contamination of granular and paved surfaces shall be cleaned up to the satisfaction of the Consultant and Owner at no extra cost to the Owner.

### **3.5 Protection**

- .1 Assume full responsibility for protection of topsoil areas until acceptance of work.
- .2 Erect protective barriers and post signs where necessary and maintain same until acceptance. Remove same after final review.
- .3 Remedy damages, wash-outs and eroded areas resulting from weather, improper protection, or other causes.
- .4 Report, in writing, to the Consultant, all damages resulting from vandalism or any other causes beyond Contractor's control not provided for by these documents.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 Description**

- .1 General Requirements:  
Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.
- .2 Work Included:  
Provision of all labour, equipment, material, machines, tools, services and incidentals to supply and spread topsoil, fine grade, supply and install sod and maintain until acceptance.
- .3 Related Work Specified Elsewhere:  
Section 32 93 00 - Plants, Planting, and Transplanting  
Section 32 91 19.13 - Topsoil

### **1.2 System Description**

- .1 Tolerance:
  - .01 For finish grade:  
Surface grade tolerance: +/- 6 mm of elevations indicated or required.
  - .02 For drainage swales:  
Surface grade shall be smooth, true to line and level and free from depressions exceeding 6mm as measured with a 3m straight edge in direction of drainage.

### **1.3 Standards**

- .1 Conform to the advocated practices of Landscape Ontario and the Nursery Sod Growers Association.

### **1.4 Qualifications**

- .1 Use experienced, qualified personnel under the direction and supervision of a foreman with at least 5 years of experience of Landscape horticultural experience and a superintendent with at least 10years of Landscape horticultural maintenance experience. Pesticides personnel shall be licensed.
- .2 Contractor to be a member in good standing of Landscape Ontario.

### **1.5 Review of Materials and Work**

- .1 Make all materials available for review upon arrival on the site, or at source of supply when requested.
- .2 Supply name of sod supplier.
- .3 Give timely notice, in writing, when materials and sodding work are available for review.
- .4 Arrange for review of finished grade before starting sodding work.
- .5 The Consultant reserves the right to reject sodding work after it has been completed if it does not conform to the specifications and/or drawings.

- .6 Remove all rejected materials from the site immediately.
- .7 Give timely notice to the Consultant, in writing, when all sodding work has been completed. All sodding work is to be inspected upon completion. Acceptance of Work will be allowed only if, in the Consultant's opinion, the grasses specified are well established and in healthy growing condition.

#### **1.6 Delivery, Handling and Storage**

- .1 Protect sod during transportation and deliver to the site in a fresh and healthy condition.
- .2 Sod not laid within 48 hours after harvesting will be found unacceptable.
- .3 Install sod immediately upon arrival on site. Protect sod from drying out if immediate installation is not possible.
- .4 Supply and deliver all materials, such as fertilizers and similar materials, in standard containers, clearly marked with contents, weight, analysis and name of manufacturer.

#### **1.7 Warranty**

- .1 During the warranty period, replace sod where necessary and make periodic inspections of all sodded areas. Notify the Owner, in writing, of any corrective or preventative measures prior to treatment necessary to maintain grass in the specified condition. Replace all sod which has failed to establish into a healthy, vigorously growing condition, as a result of faulty materials, workmanship, and/or erosion.

#### **1.8 Maintenance Before Acceptance of Work**

- .1 Maintain sodded areas from time of installation until acceptance of work, but not less than thirty (30) days after installation and after at least one (1) mowing.
- .2 Maintenance shall include measures necessary to establish and maintain sodded areas in a healthy, vigorous growing condition, free of thin, poor or burned-out patches.
- .3 Mow grass regularly to maintain a maximum height of 60mm.
- .4 Roll sodded areas, where necessary, to remove depressions and irregularities.
- .5 Water, when necessary, with sufficient amounts to saturate the upper 100mm of topsoil and apply fertilizers when necessary.
- .6 Check sodded areas for diseases and weeds and take immediate measures to eliminate diseases and control weed growth.
- .7 Use chemicals for disease and weed control in strict accordance with the Pesticides Act and manufacturer's recommendations. Assume full responsibility for the use of such chemicals and repair, replace or remedy otherwise damage resulting from the use of such chemicals. Get necessary permits.
- .8 Re-sod areas which show deterioration, or which are thin, bare or burned-out and repair damages resulting from erosion and washouts or any other causes.

- .9 At time of final review, all placed sod shall be healthy, actively growing and green in leaf colour. All placed sod shall be in the same location as originally placed and shall not have moved, eroded, slipped or sloughed. Sod shall show evidence of rooting into the underlying soil. The sod shall be of sufficient density that no surface soil is visible. There shall be no competitive growth beyond that detailed under 2.1, emerging from under the sod, at edges or between joints.

## **PART 2 - PRODUCTS**

### **2.1 Sod**

- .1 Sod shall be a certified No. 1 cultivated turf grass sod as specified in the planting notes and grown by a member in good standing with the Nursery Sod Growers Association of Ontario. Composition of sod shall be of improved proprietary Kentucky Bluegrass varieties. Varieties shall be chosen from top 50% of current NTEP evaluations.

- .2 At time of delivery it shall have a strong fibrous root system free of stones, burned, or bare spots and contain not more than 1% twitch grass or other weeds. Sod shall be uniform in texture and in good healthy condition with no sign of decay. Sod shall be of sufficient density that no surface soil is visible.

The soil portion of the sod shall be well permeated with roots. It shall be a good mineral type with a thickness of 10 mm minimum and 15 mm maximum. Individual sod pieces shall be of a condition that each may be lifted, rolled, transported and placed without breaking or tearing and without loss of soil under normal handling conditions.

- .3 Cut sod shall be a maximum thickness of 78 mm and a minimum thickness of 25 mm, 1 square metre in area.

### **2.2 Inorganic Fertilizers**

- .1 Complete, commercial fertilizers of approved manufacturer, containing not less than 60% urea-formaldehyde by weight.

- .2 The following fertilizer requirements have been included for tendering purposes only. The requirements and rates shall be adjusted to conform to soil testing report and subsequent recommendations. Such adjustment shall be made at no extra cost to the Contract.

10-10-10 9 kg. per 81 square metres and/or 0-20-10 @ 5.4 kg. per 81 square metres and/or Superphosphate @ 11 kg. per 81 square metres.

- .3 Commercial superphosphate: finely ground with a minimum analysis of 20% P2O5.

- .4 Lime: to be used in cases where the pH of the soil is less than 6.0: Lime containing not less than 85% of calcium and magnesium one half passing, a #100 mesh sieve. Rate of application shall be determined after determining the pH of the topsoil.

### **2.3 Topsoil**

- .1 By Section 32 91 19.13 - Topsoil.

- .2 Topsoil depth minimum 150 mm.



### **PART 3 - EXECUTION**

#### **3.1 Site Conditions**

- .1 Site visit and examine the site and soil conditions and be satisfied that work can be carried out in accordance with requirements or contract documents.

#### **3.2 Topsoil**

- .1 Keep topsoil approximately 25 mm below finished grade to allow for thickness of sod.
- .2 Fine grade topsoil, eliminating rough and low areas to ensure positive drainage.
- .3 Ensure that ditches and swales are properly graded with adequate falls for draining.
- .4 Fine grade area to a smooth, even, loose-textured surface, free of roots, debris, stone 10mm diameter and larger and to the Consultants approval.
- .5 Before sodding, mix in lime and fertilizers required.

#### **3.3 Placement of Sod**

- .1 Lay sod as soon as possible upon arrival on the site but within 48 hours of harvesting.
- .2 Handle sod in such a manner to prevent breaking or tearing. Do not lay damaged and broken pieces, but remove from site. Do not stretch during handling.
- .3 Place sod closely knit together in such a manner that no open joints are visible, or pieces overlapping. End joints of adjacent sod pieces shall be staggered.
- .4 Blend sod smoothly and uniformly with paved areas as detailed on drawings. No voids shall be left between the soil portion of the sod and the underlying ground surface.
- .5 When sodding adjacent to existing established sodded areas, cut in as required to ensure a clean flush edge between new and existing sod.
- .6 Lay sod to a width of three (3) metres in swales and place perpendicular to direction of swales.
- .7 Sod shall be securely placed across the face of slopes. Stake as required on slopes to prevent movement.
- .8 Immediately after installation of sod, water area with sufficient amounts to saturate sod and upper 100mm of topsoil.
- .9 After sod and soil has dried sufficiently to prevent damage, roll area with 80 kg. roller to ensure good bond between sod and soil and to remove minor irregularities. All edges must be tamped to ensure that the root zone is not exposed.

#### **3.4 Protection**

- .1 Assume full responsibility for protection of sodded areas until end of maintenance period and/or acceptance of work.

- .2 Erect protective barriers and post signs where necessary and maintain same until acceptance. Remove same after final review.
- .3 Remedy damages, wash-outs and eroded areas resulting from weather, improper protection, or other causes.
- .4 Report, in writing, to the Consultant, all damages resulting from vandalism or any other causes beyond Contractor's control not provided for by these documents.

### **3.5 Performance Requirements**

- .1 If the completed work does not meet performance requirements at the time of the 30-day review, the Contractor shall re-apply the specified materials according to this specification within 14 days of receiving notification. The Contractor shall maintain the site and control erosion until conditions meet application or re-application of sod. All replaced sod shall be subject to a further maintenance period of 30 consecutive days.
- .2 Consultant will accept the Work only if areas are properly established (and have rooted) and are free of eroded, bare and dead spots and 98 percent free of weeds.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 Description**

- .1 General Requirements:  
Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.
- .2 Work Included :  
Provide all labour, materials, tools, services and incidentals to do all planting, including the preparation of planting mixes, placing of topsoil planting mix in tree pits, and all other work required and/or indicated on the Drawings and specified herein.
- .3 Related Work Specified Elsewhere:  
  
Section 32 91 19.13: Topsoil  
Section 32 92 23: Sodding

### **1.2 Quality Assurance**

- .1 Topsoil Evaluation by Section 32 91 19.13.
  - .01 An evaluation is required for all organic soils intended for the Work of this Contract.

### **1.3 Standards**

- .1 Conform to the advocated practices of Landscape Ontario and the Canadian Nursery Trades Association "Guide Specification for Nursery Stock", latest edition.

### **1.4 Submittals**

- .1 Topsoil Evaluation Reports by Section 32 91 19.13.
- .2 Certificates:  
Furnish all inspection certificates as may be required by federal, provincial and other applicable regulations.

### **1.5 Review of Materials and Work**

- .1 Make all materials available for review at source of supply or upon arrival on the site.
- .2 Give timely notice, in writing, to the Consultant when materials are available for review.
- .3 Approval of plant material at source of supply does not impair the right of the Consultant to inspect plants upon arrival on project site or during the course of construction.
- .4 Such review may result in rejection of plant materials which have been damaged or which, in any way, do not conform to the specifications.
- .5 The Consultant reserves the right to reject any plants, whether planted or not, which do not conform to the specifications and/or drawings. Remove all rejected materials from the site immediately.
- .6 Do not remove any labels from plants until plants have been reviewed and approved by the Consultant.

- .7 Remove rejected materials immediately from the site.
- .8 Completion certificates will only be issued if in the Consultant's opinion, plantings are in a healthy growing condition.

#### **1.6 Delivery, Handling and Storage**

- .1 Supply and deliver all materials, such as fertilizers, bonemeal and mulches in standard containers clearly indicating contents, weight, analysis and name of manufacturer.
- .2 Where such materials are supplied in bulk, written statements shall be submitted to the Consultant indicating the same information as if supplied in standard containers.
- .3 Protect plants from damage and drying out from the time of digging until planting.
- .4 Plants with broken or abraded trunks or branches or with broken or cracked rootballs or plants which are strongly desiccated, will be subjected to rejection upon arrival on the project site.
- .5 All plant materials which cannot be planted immediately upon arrival on the site, shall be properly heeled in or well protected with soil or similar material to prevent drying out and shall be kept moist until commencement of planting.

#### **1.7 Warranty**

- .1 Extended Warranty :
  - .01 Submit an extended warranty of the Work of this Section covering the period for one (1) year beyond the expiration of the warranty period specified in the General Conditions of the Contract.
  - .02 Submit written warranty to the effect that :
    - .001 When Completion of the Contract has been achieved during the period from January 1st to July 15th, plantings shall be warranted until July 15th two (2) years following.
    - .002 When Completion of the Contract has been achieved during the period from July 15th to December 31st, plantings shall be warranted for a period of two (2) years from the date of Completion of Contract.
- .2 The warranty periods, listed above, shall apply to all "nursery-grown" plants.
- .3 During the warranty period make periodic inspection and replace all plants which are dead, missing or which are not in a healthy, vigorous growing condition.
- .4 Notify the Consultant, in writing, of any corrective or preventive measures necessary to safeguard plants prior to treatment.
- .5 Supply and plant all replacements in strict accordance with plans and specifications and warranty replacements as specified.
- .6 The warranty period for replacements shall be the same as the warranty period for the original plant material and shall extend from the date of completion of the replacement.

- 
- .7 Tag or mark, in a permanently visible manner, all replacement trees and notify the Consultant, in writing, of the date on which the replacements were planted. Include sketch showing location of replaced plants. Notify the Consultant when replacements are to be planted. Plant replacements at a time which is in accordance with good horticultural practice.
  - .8 Remove all accessories and cut at grade those trees, which are to be replaced at a later date. Remove plants, which are to be replaced, when found or notified by Consultant.

### **1.8 Maintenance Prior to Completion of Contract**

- .1 Maintain all plant materials and planting areas immediately after plants have been planted and continue such maintenance until Completion of the Contract.
- .2 Maintenance shall include all measures necessary to establish and maintain plant materials in a vigorous, healthy, growing condition.
- .3 Maintain all plant and tree accessories, such as tree wrappings, tree guys, stakes and tighteners from time of installation until Completion of the Contract.
- .4 Adjust tighteners to keep guys taut at all times. Repair or replace accessories where necessary.
- .5 Cultivate and keep planting beds and tree saucers free of weeds at all times. Remove all debris and broken branches and maintain planting beds in a neat condition at all times. Water, when necessary, with sufficient amounts to saturate root system.
- .6 Inspect plants and trees regularly for diseases and insect infestations and take immediate measures necessary to eliminate such diseases and infestations.
- .7 Use chemicals for weed control, disease and insect control in strict accordance with Pesticides Act and manufacturer's recommendations.
- .8 Assume full responsibility and repair, replace or remedy otherwise all damage resulting from the use of such chemicals at no extra cost.
- .9 At time of final inspection all plants and trees shall be completely free of diseases and/or insect infestations.
- .10 Tree guys shall be taut and all accessories in good condition as specified. All planting beds and tree saucers shall be freshly cultivated and free of all weeds and debris.

## **PART 2 - PRODUCTS**

### **2.1 Topsoil**

- .1 Topsoil by Section 32 91 19.13.

### **2.2 Peatmoss**

- .1 Partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with a texture varying from porous to spongy fibrous with a pH value ranging from 4.5 to 6.0.

- .2 It shall be baled and free of decomposed colloidal residue, wood, sulphur, and iron, be brown in colour and finely shredded with particles not exceeding 6mm in size.
- .3 The use of peat, supplied in bulk, will not be permitted unless approved by the Owner upon submission of sample and location of source and supply.

### **2.3 Fertilizer**

- .1 Inorganic fertilizers complete, commercial fertilizers of approved manufacturer not less than 60% urea-formaldehyde by weight.
- .2 The following fertilizer requirements have been included for tendering purposes only. The requirements and rates shall be adjusted to conform to soil testing reports and subsequent recommendations. Such adjustments shall be made at no extra cost to the Owner.  
  
10-6-4 @ 9 kg. per 25mm tree caliper.  
10-6-4 @ 1 kg. per 1 cu. metre of soil mixture for all planting beds.

### **2.4 Bonemeal**

- .1 Commercial, raw bonemeal, finely ground, and with a minimum analysis of 2% nitrogen and 11% phosphoric acid.

### **2.5 Lime**

- .1 Lime to be used in all cases where the pH of the soil is less than 6.0: Limestone containing not less than 8% of calcium and magnesium carbonates combined, finely ground to pass a #10 mesh sieve with at least one half passing a #100 mesh sieve. Rate of application shall be determined after determining the pH of the topsoil.

### **2.6 Wrapping Material for Tree Trunks**

- .1 First quality heavy waterproof crepe paper.

### **2.7 Anchors**

- .1 Required for the support of large shrubs and trees and stakes for small trees, as detailed: new metal "T" bars, 38mm x 5mm, painted black.
- .2 "T" bars are to be removed at the end of the warranty period.

### **2.8 Cables**

- .1 Cables, eye bolts and turnbuckles required for supporting trees shall be zinc coated and of sufficient strength to withstand any wind pressure. Turnbuckles shall have a 150mm long opening with a 9.8 mm diameter threaded opening for tightening of turnbuckle, for trees 75 mm in caliper or over.
- .2 For smaller trees the opening shall be 75 mm long with 6mm diameter threaded opening. Spanifix may be substituted for turnbuckles for trees less than 150 mm caliper, as manufactured by C. French Ltd., Grimsby, or other approved manufacturer.

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## 2.9 Fastening Wires

- .1 Wires for fastening to anchors shall be pliable #9 gauge minimum galvanized iron wire for trees 75mm in caliper and over.

## 2.10 Tree Straps

- .1 #3718 Biodegradable Original Treestrap®, as supplied by  
Connon Nurseries Ltd. 383 Hwy 5 E, Waterdown, ON L0R 2H0  
905-689-4631, OR [www.treestrap.com](http://www.treestrap.com)  
Width 2.5cm, Length 45cm Break: 325 lbs., Cotton  
Colour: Olive drab

## 2.11 Hose

- .1 New black rubber hose, two-ply, reinforced and 12mm inside diameter, or other approved manufacture shall be used to encase wire where they circle the trunk branches.

## 2.12 Mulch

- .1 Mulch shall be a clean, shredded bark ,free of sticks and leaves and not greater than 20mm in diameter, for tree saucers and planting beds.

## 2.13 Plants

- .1 Conform to the horticultural standards of the Canadian Nursery Trades Associations with respect to grading and quality. Supplied in strict accordance with Plant List.
- .2 Substitutes for the specified plants will not be accepted unless approved in writing by the Consultant.
- .3 Give timely notice, in writing, to the Consultant, when applying for substitutions.
- .4 All plants shall be No. 1 Grade, nursery grown, under proper cultural practices with respect to fertile soil, ample spacing, regular cultivation, weed, pest control, adequate moisture and pruning, in accordance with good horticultural practices as advocated by the Canadian Nursery Trades Association. All such plants shall have been transplanted and/or root pruned regularly, but not later than nine (9) months prior to arrival on the site. The Contractor shall submit sources of plant material, in writing, if so requested by the Consultant.
- .5 Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and shall be in accordance with the approved scientific name given in the latest edition of Standardized Plant Names. The names of varieties not named therein are generally in conformity with the names accepted in the nursery trade.
- .6 Plants dug from native stands, wood lots, orchards or neglected nurseries and which have not received proper cultural maintenance as advocated by the Canadian Nursery Trades Association, shall be designated as "collected plants".
- .7 The supply and planting of "collected plants" will not be permitted.
- .8 The use of plant materials which require chemical treatments as ordered by the Canadian Department of Agriculture shall be prohibited.

- .9 Plants shall be freshly dug and shall be in a healthy, vigorous condition at arrival on site. Heeled-in plants or plants from cold storage will not be accepted. Whenever practical, trees shall be supplied from nurseries located within the same hardiness zone and having the same soil conditions and types of soils as the area of the project site. Plants specified as "B.R.", shall be moved with bare roots, while in a dormant condition. Plants specified "B&B", shall be moved with solid balls, wrapped in burlap, or approved equal. Root balls shall not be cracked or broken at time of planting.
- .10 Container-grown material is acceptable providing plants have been grown in the container for at least one growing season, but not longer than two. Containers must be large enough to permit proper root development.
- .11 Plants shall be sound, healthy, vigorous, well-branched, and densely foliated when in leaf. They shall be free of disease, insect pests eggs or larvae and shall have healthy, well-developed root systems. All shrubs and trees shall possess all characteristics of the specified kind with all the leaders intact, undamaged and uncut, growing from and unmulitlated root system. The stems shall be free from sunscalds, frost cracks, abrasions, fire and crust. All old injuries shall be completely callused over. Pruning wounds must show vigorous bark on all edges and all parts show live, green cambium tissue when cut.
- .12 All plants shall conform to the measurements specified in the plant list, except that plants larger than specified may be used if approved by the Consultant. Use of such plants shall not increase the contract price. If larger plants are approved, the ball of earth shall be increased in proportion to the size of the plant.
- .13 All plants shall be measured when the branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to root base or from branch tip to branch tip. Where trees are measured by caliper (cal.) reference is made to the diameter of the trunk measured 150mm above ground as the tree stands in the nursery for trees up to 100mm cal. and 300mm for trees larger than 100mm cal.
- .14 The sizes of root balls for trees shall be as specified below. Ball sizes are minimum and shall be adjusted accordingly to growth habits of plants. At any rate ball sizes shall be sufficiently large to contain at least 75% of the fibrous root system.

Deciduous Trees		Coniferous Trees	
<i>Caliper</i>	<i>Root Ball Diameter</i>	<i>Caliper</i>	<i>Root Ball Diameter</i>
45mm	550mm	100cm	450mm
50mm	700mm	125cm	500mm
60mm	700mm	150cm	600mm
70mm	800mm	175cm	700mm
80mm	900mm	200cm	800mm
90mm	900mm	250cm	900mm
100mm	1000mm	275cm	1000mm
125mm	1200mm	300cm	1220mm
150mm	1500mm	350cm	1270mm
175mm	1750mm		
200mm	2000mm		

- .15 The ball depth-ratio shall be not less than as follows:



- Diameter up to 500mm depth not less than 75% of diameter.
- Diameter of 500\_1000mm depth not less than 66\_2/3% of diameter.
- Diameter of 1000\_1500mm depth not less than 60% of diameter.
- Diameter of 1500mm and up depth of not less than 50% of diameter.

- .16 To be wrapped with Hessian burlap or approved equal. Balls from 457mm to 762mm in diameter shall be double burlapped. Balls 914mm and larger in diameter shall be double burlapped and drum laced with 6mm rope at 200mm spacing.

## 2.1 Planting Accessories

- .1 Heavy Duty Straight Profile Edging: PermaLoc CleanLine, 1/8 inch (3.2 mm) x 3" (76 mm) [4" (102 mm)] [5-1/2" (140 mm)] high, 3/16 inch (4.8 mm) x 4" (102 mm) [5-1/2" (140 mm)] high, extruded aluminum, 6063 alloy, T-6 hardness, landscape edging for straight-line and curvilinear applications in corrugated straight profile, as manufactured by PermaLoc Corporation, Holland MI 49424, telephone (800) 356-9660. Section shall have loops on side of section to receive stakes spaced approximately 2 to 3 feet (610 mm to 915 mm) apart along its length.
- .2 Thickness: 1/8 inch (3.2 mm) gage section at 0.072 inch (1.83 mm) minimum thick with 0.135 inch (3.4 mm) exposed top lip and 3/16 inch (4.8 mm) gage section at 0.116 inch (2.95 mm) minimum thick with 0.187 inch (4.75 mm) exposed top lip.
- .3 Length: 16 feet (4.88 meters), selected products in 8 feet (2.44 meters) sections.
- .4 Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design.
- .5 Stake: 12 inch (305 mm) PermaLoc Standard Stake, 0.10 inch (2.5 mm) thick, with optional extruded aluminum, heavy duty 0.125 inch (3.2 mm) thick x 16 inches (406 mm), 18 inches (457 mm), or 24 inches (610 mm) long stakes. Stakes to interlock into section loops.
- .6 Finish: Natural Mill Aluminum, Black DuraFlex Painted, Green DuraFlex Painted, Bronze DuraFlex Painted, and Black Anodized (Class II). Paint finish shall comply with AAMA 2603 for electrostatically baked on paint.

## PART 3 - EXECUTION

### 3.1 Site Preparation

- .1 Stake out all tree locations and planting beds and obtain approval from Consultant before excavating. Cooperate with Consultant where minor adjustments to such locations is necessary.
- .2 The location of trees and planting areas, where shown on drawings, is approximate only and may require adjustment due to site conditions.
- .3 The outline of all planting beds shall be staked out on site and finalized to the Consultant's approval.

### 3.2 Excavation

- .1 Excavate planting pits for trees to the following diameters unless detailed otherwise:

- 
- .01 Root ball diameter plus 600mm.
  - .2 Excavate planting beds to the following minimum depths:
    - .01 Shrubs and Evergreens 500mm minimum
    - .02 Ground Cover and Perennials 350mm minimum
    - .03 Lining-out stock/Whips To allow for full root spread/depth
  - .3 Remove from site all excavated material from planting beds and tree pits and dispose of, unless directed otherwise.
  - .4 Scarify sub-grade planting beds and tree pits to a minimum depth of 300mm.

### 3.3 Soil Preparation

- .1 STANDARD PLANTING SOIL MIX: Backfill tree pits and planting beds with a soil mixture consisting of five (5) parts topsoil, two (2) parts sand, one (1) part peat moss, one (1) part mushroom compost or one (1) part sterilized manure.
- .2 Mix topsoil, peatmoss and other additives thoroughly on the site, not more than two (2) days before backfilling.
- .3 Add commercial fertilizers in accordance with soil testing report.
- .4 Add bonemeal to the soil mixture at the rate of .6 kg. per cubic metre.
- .5 Do not mix or backfill when topsoil or soil mixture is in a muddy or frozen condition.
- .6 Backfill to a height above finished grade sufficient to allow for normal, natural settlement.
- .7 Finished grade, after settlement, shall be as shown on drawings.
- .8 Backfill soil mixture in layers not exceeding 150mm in depth.
- .9 Tamp each layer firmly before placing subsequent layers.

### 3.4 Weed Barrier

- .1 Provide weed barrier in those planting beds shown on drawings and details.
- .2 Prior to planting of materials in planting beds cover bed areas completely with weed barrier fabric.
- .3 Provide overlap of fabric at joints and turn edges under adjoining materials and edges.
- .4 Affix or pin weed barrier fabric to soil to prevent dislodgment while other planting operations are carried out.
- .5 When planting, cut or slice a cross or X pattern in the weed barrier fabric to accommodate the planting of the plant.

- .6 After planting, ensure that the weed barrier fabric is returned to encircle the plant root area, touching the stem or trunk of the plant.
- .7 Prior to mulching, clean weed barrier surface to be free of soil, debris, etc.

### **3.5 Planting**

- .1 Planting shall be done during periods suitable with respect to weather conditions and locally accepted practice and to the Owner's approval. Plants shall be set plumb in the centre of the pit and 100mm higher than relation to grade as originally grown, after settlement has taken place.
- .2 Planting shall be done in a continuous operation, completing total areas, rather than individual species.
- .3 Trees and other plant materials shall be faced to give the best appearance or relationship to adjacent structures, and to the approval of the Consultant.
- .4 Set plants in partly filled pits or beds or soil mixture, allowing at least 150mm of soil mixture under each plant.
- .5 Remove all ropes and wires and pull burlap away from top of root ball.
- .6 Constantly tamp soil around root ball to eliminate air pockets.
- .7 Soak soil mixture thoroughly with water when hole is filled halfway.
- .8 Fill hole completely, leaving a shallow saucer directly over root ball, slightly smaller in diameter than the excavation.
- .9 Water trees and planting beds thoroughly immediately after planting.

### **3.6 Tree Guying**

- .1 After planting and wrapping support all trees, as detailed on drawings.
- .2 Cover wires and cables with rubber hose at points of contact with bark.
- .3 Keep guy wires and cables taut at all times without subjecting tree to undue strain.
- .4 Trees not guyed are subject to all requirements of this specification including warranties.

### **3.7 Pruning**

- .1 Do pruning only as necessary to remove dead and broken branches and to compensate for the loss of roots as a result of digging operations in nursery.
- .2 Preserve the natural form and character of plants and do not remove small twigs along tree trunks.
- .3 Use only sharp, clean tools and make cuts flush without leaving stubs and treat all cuts, 12mm in diameter and larger with approved tree paint.

.4 Trace back to living tissue all cuts, bruises and scars on the bark and treat with tree paint. Smooth and shape wood so as not to retain water.

.5 Defoliate trees only when approved by the Consultant.

### **3.8 Watering**

.1 Keep all plants well watered from time of planting until completion.

.2 Apply sufficient water to saturate root system, but do not over-water.

### **3.9 Mulching**

.1 Install approved mulch in all tree saucers and planting beds to an average depth of 70mm unless otherwise indicated.

.2 Mix with sufficient soil to prevent blowing away.

.3 Cultivate soil and remove weeds before placing mulch.

### **3.10 Clean-Up**

.1 Immediately after planting remove all debris and excess material from the site, leaving the area neat and tidy. Clean all areas, which are contaminated as a result of planting operations.

.2 Do not burn debris and rubbish unless approved by the Consultant.

.3 Maintain all areas neat and tidy at all times until completion.

### **3.11 Protection After Completion**

.1 Assume full responsibility for protection of all planted areas until all project work has been completed, approved and accepted.

.2 Erect protective fencing and post signs where necessary and maintain such works until completion and remove same after completion of work, unless otherwise directed.

### **3.12 Final Review for Completion of Contract**

.1 Final review and completion of planting work shall coincide with final review and completion of the Work included in the Contract.

.2 At time of final review all plants shall be in a healthy vigorous, growing condition, planted in full accordance with drawings and conditions.

.3 Planting beds and tree saucers shall be freshly cultivated and free of weeds and debris.

**END OF SECTION**



2050 Guelph Line, Burlington, ON.

## Glenview Public School

Gym Addition

143 Townsend Ave.,  
Burlington, ON. L7T 1Z1

Architects



**Snyder Architects Inc.**

100 Broadview Ave, Suite 301,  
Toronto, ON M4M 3H3  
t. 416.966.5444, w. snyderarchitects.ca

Consultants

Mechanical and Electrical Consultants

**DEI & Associates Inc.**

55 Northland Rd.  
Waterloo, Ontario, N2V 1Y8  
Tel: 519-725-3555

Structural Consultant

**Kalos Engineering Inc.**

300 York Boulevard  
Hamilton, ON L8R 3K6  
Tel: 905-333-9119

Civil Consultant

**Flora Designs Inc.**

1109 Britannia Rad East,  
Mississauga, ON L4W 3X1  
Tel: 647-496-8055

Landscape Consultant

**OMC Landscape Architecture**

270 Sherman Ave. N., Suite 315-MILL  
Hamilton, ON L8L 6N4  
Tel: 905-681-7604

# GLENVIEW PUBLIC SCHOOL - GYM ADDITION

143 Townsend Ave., Burlington, Ontario, L7T 1 Z1

## ARCHITECTURAL: STRUCTURAL:

A000	COVER SHEET	S1.1	FOUNDATION PLAN
A101	SITE PLAN	S1.2	ROOF FRAMING PLAN
A102	OBC DATA MATRIX & FIRE SEPARATION DIAGRAM		
A103	PARTIAL SITE PLAN - DEMOLITION		
A104	PARTIAL SITE PLAN - NEW WORK		
A201	PARTIAL FIRST FLOOR & ROOF PLAN - DEMOLITION		
A202	PARTIAL FIRST FLOOR & ROOF PLAN - NEW & RENO		
A301	PARTIAL RCP & FLOOR FINISH PLAN - DEMO & NEW		
A401	BUILDING ELEVATIONS - NEW WORK		
A402	BUILDING & WALL SECTIONS - DEMO & NEW WORK		
A701	ENLARGED PLANS & INT. ELEVATIONS - CHANGE ROOMS, WRs & RENO		
A901	DOOR SCHEDULE & DETAILS		

## MECHANICAL:

M101	SITE PLAN, LEGEND AND SCHEDULES
M102	GROUND FLOOR DEMOLITION & RENOVATION DRAWINGS
M103	PARTIAL ROOF PLAN & DETAILS - MECHANICAL

## ELECTRICAL:

E101	LEGEND, SITE PLAN, NOTES AND KEY PLAN
E102	DETAILS AND SCHEDULES
E201	PARTIAL FLOOR PLAN - LIGHTING DEMOLITION AND RENOVATION
E202	PARTIAL FLOOR PLAN - POWER DEMOLITION AND RENOVATION
E203	PARTIAL ROOF RENOVATION PLAN
E301	DISTRIBUTION RISER DIAGRAM AND PANEL SCHEDULE
E302	PARTIAL FIRE ALARM - RISER DIAGRAM AND PASSIVE GRAPHIC

## CIVIL:

SG-1	SITE GRADING PLAN
SS-1	SITE SERVICING PLAN

## LANDSCAPE:

L1	PLANTING PLAN
L2	PLANTING PLAN
L3	DETAILS

## AVAILABLE PROJECT INFORMATION:

ARBORIST REPORT:  
TITLED: ARBORIST REPORT & TREE PRESERVATION PLAN  
PREPARED BY: GLN FARM & FOREST RESEARCH CO. LTD.  
DATED: FEBRUARY 6, 2024

GEOTECHNICAL INVESTIGATION REPORT:  
TITLED: GEOTECHNICAL INVESTIGATION REPORT  
PREPARED BY: PETO MACCALLUM LTD.  
DATED: NOVEMBER 16, 2023

SITE SURVEY:  
TITLED: PLAN OF SURVEY OF PARCEL A REGISTERED PLAN PF834 AND PART OF LOT 5 BROKEN FRONT CONGRESSION (ORIGINALLY IN TOWNSHIP OF EAST FLAMBOROUGH), CITY OF BURLINGTON  
PREPARED BY: TARASICK MCMILLAN KUBICKI LTD.  
PROJECT NO.: 3964-SR/PR-T  
DATED: FEBRUARY 20, 2024

## GLENVIEW PUBLIC SCHOOL

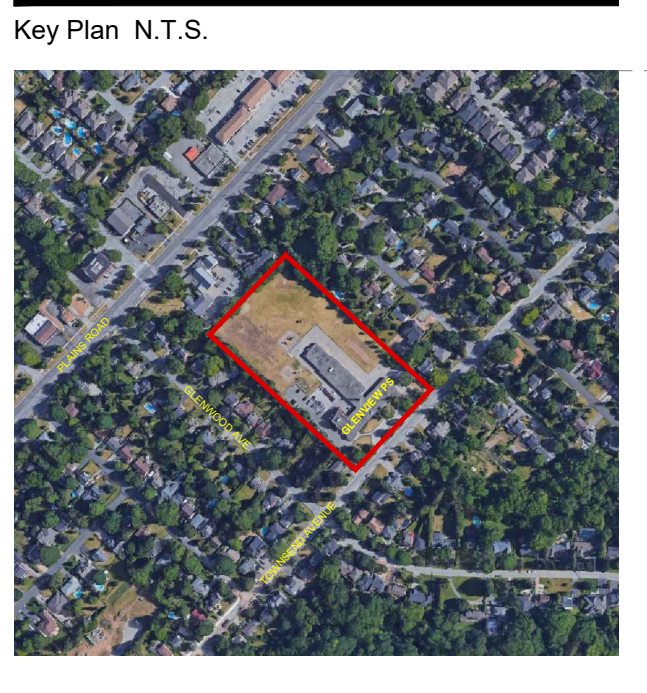
### GYM ADDITION

143 TOWNSEND AVE.,  
BURLINGTON, ONTARIO

PROJECT # **2314**

ISSUED FOR TENDER  
2024 05 03





**SITE PLAN NOTES**

- OWNER
  - HALTON DISTRICT SCHOOL BOARD
  - 2050 Guelph Line, Burlington, ON L7P 5A8  
Tel: 905-333-3685
- MUNICIPAL ADDRESS OF PROJECT
  - 143 TOWNSEND AVE., BURLINGTON, ON.
- LEGAL DESCRIPTION / SURVEY INFORMATION
  - LEGAL DESCRIPTION  
PARCEL A, REGISTERED PLAN PFB34 AND PART OF LOT 5, BROKEN FRONT CONCESSION (ORIGINALLY IN TOWNSHIP OF EAST FLAMBOROUGH), CITY OF BURLINGTON, REGIONAL MUNICIPALITY OF HALTON
  - SURVEY INFORMATION TAKEN FROM:  
COMPILED TOPOGRAPHIC SURVEY DATED NOVEMBER 28, 2023 - BY: BORYS KUBICKI  
TARASZUK-MULLAN KUBICKI LIMITED (ONTARIO LAND SURVEYORS)  
TEL: 905-869-8849
- OCCUPANCY CLASSIFICATION  
O.B.C. BUILDING CLASSIFICATION -  
- EXISTING BUILDING DOES NOT FIT IN ANY CURRENT OBC BUILDING CLASSIFICATION.  
- NEW GYM BUILDING 3.2.2.25
- EXISTING USE - ELEMENTARY SCHOOL
- BUILDING AREA EXISTING 2,814.00 m<sup>2</sup>
- PROJECT DATA
 

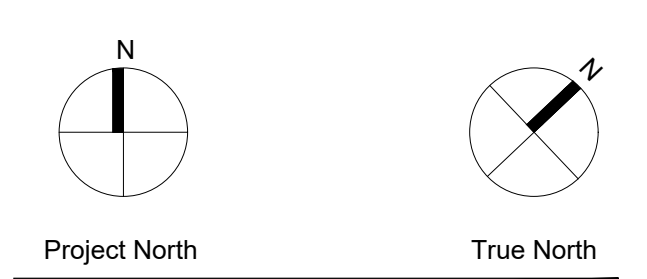
5.1 LOT AREA	2.44 Ha (24,419 m <sup>2</sup> )
5.2 EXISTING LOT COVERAGE (TOTAL EXISTING CLASSROOMS= 15)	11.52%
5.3 EXISTING GROSS FLOOR AREA	2,802.70 m <sup>2</sup>
5.4 GYM BLDG. GROSS FLOOR AREA	634.85 m <sup>2</sup>
5.5 TOTAL GROSS FLOOR AREA	3,437.55 m <sup>2</sup>
- PARKING
 

PARKING REQ'D (1.5 SPACES / 1 CLASS RM)	1.5x20
(TOTAL EXISTING CLASSROOMS= 15)	=30
(TOTAL EXISTING PORTABLES= 5)	=10
TOTAL PARKING REQUIRED	40
BARRIER FREE PARKING REQUIRED	2
BARRIER FREE PARKING PROVIDED	2
TOTAL PARKING PROVIDED	55
BICYCLE PARKING REQ'D (1 SPACE / 10 STUDENTS)	404/10
(TOTAL STUDENTS = 404)	=40.4
(1 SPACE / 35 STAFF, TOTAL STAFF = 35)	=1
TOTAL BICYCLE PARKING REQUIRED	41
TOTAL BICYCLE PARKING PROVIDED	76
- BUILDING SETBACKS
 

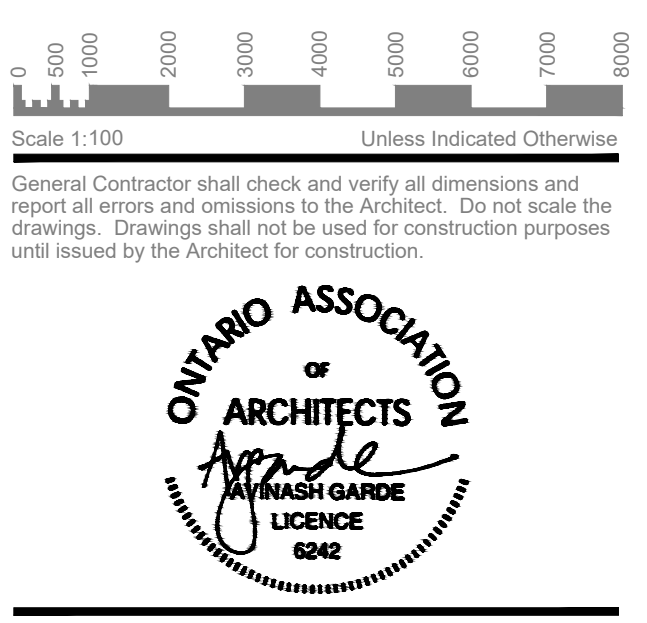
FRONT YARD	Existing
REAR YARD	Existing
EAST SIDE YARD	Existing
WEST SIDE YARD	Existing
15.00 m	
- BUILDING HEIGHT- EXISTING & NEW 1 STOREY

**SITE PLAN LEGEND**

ASPHALT AREA HEAVY DUTY - NEW	TRAFFIC SIGN
ASPHALT AREA HEAVY DUTY - REPLACE EXISTING	EX CB EX CATCH BASIN SEE CIVIL DWGS
ASPHALT AREA MEDIUM DUTY - REPLACE EXISTING	EX MH EX MANHOLE SEE CIVIL DWGS
CONC. WALKWAY	CB MH CATCH BASIN MANHOLE SEE CIVIL DWGS
SOD / LANDSCAPE AREA - REFER TO LANDSCAPE DWGS.	M MANHOLE SEE CIVIL DWGS
MULCH PLAY AREA REFER TO LANDSCAPE DWGS.	W WALL MOUNTED LIGHT SEE ELEC DRAWINGS
CHAIN LINK FENCE (CLF)	PARKING LOT LIGHT STANDARD SEE ELEC DRAWINGS
PAVEMENT MARKING PAINT	NEW TREES REFER TO LANDSCAPE DWGS.



No.	Revisions	Date
3.	Issued for Tender	2024 05 03
2.	Issued for Building Permit	2024 02 02
1.	Issued for SPA Submission	2024 02 27
No.	Revision	Date



Drawing Title:

**SITE PLAN**

Scale: AS NOTED Date: 2024 02 27  
 Drawn by: AP Checked by: AG  
 Job No. Drawing No.

**2314 A101**  
 This drawing is sized for 30"x42" sheet size.   
 Use the above scale, unless otherwise indicated.

