

**Town of Taber**

**Emergency Services Building**

**1415-057-00**

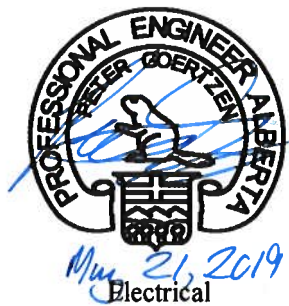
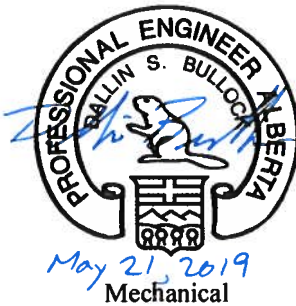
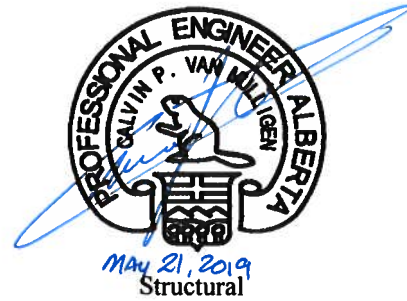
Bid Documents Divisions 0-16

Pre-Bid Meeting and Site Inspection:  
Will begin Tuesday, May 28<sup>th</sup>, 2019 at 10:00 am  
at the Town of Taber Post Office  
at 5203 49 Ave, Taber, AB T1G 1A0.

**Closing Location: Town of Taber Administration Office**  
**Closing Date: 2:00:00 pm, Thursday, June 13<sup>th</sup>, 2019 local time.**

**Tender Inquiries:** (403) 317-3625, Dallin Bullock, P.Eng.

**Municipal District of Taber**  
**Operations and Maintenance Facility**



PERMIT TO PRACTICE  
MPE ENGINEERING LTD.  
PERMIT NUMBER: P 3680  
The Association of Professional Engineers,  
Geologists and Geophysicists of Alberta

Prepared by MPE Engineering Ltd.

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**1415-057-00**

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PREAMBLE

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The format of these Specifications is based on "MasterFormat" published jointly by Construction Specifications Canada and The Construction Specifications Institute. This Table of Contents generally reflects the "MasterFormat" division and section arrangement.

Where it is indicated that a division of "MasterFormat" is "Not Used", or where a division heading is omitted entirely, this means only that the division has not been included in the Specification. It does not necessarily mean that the work normally specified in that division is not required.

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MasterFormat

Broadscope Heading	Section Number	Section Title
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**1415-057-00**

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**Appendix A: GEOTECHNICAL INVESTIGATION**

**DRAWING PACKAGE - List of drawings on cover page of drawing package**

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**1. BID SUBMISSION**

.1 Bidders may submit bids at the following location only.

**Town of Taber Administration Office  
A - 4900, 50th Street  
Taber, AB  
T1G 1T2**

- .2 Bidders may submit bids only before *2:00:00 p.m.* local time on the date set by for receiving bids.
- .3 The official time of receipt of a bid shall be established using the time recorder clock used by the Owner's representative to time and date stamp bid submissions.
- .4 Bidders must submit bids on the forms issued by the Owner's representative with the Bid Documents.
- .5 Bidders must submit bids on forms supplied with Bid Documents, sealed in an envelope clearly displaying the following information:

Bidder's Name: \_\_\_\_\_  
Address: \_\_\_\_\_

**TENDER**

*Town of Taber  
Emergency Services Building*

*1415-057-00  
Closing before 2:00:00 PM,  
local time, on June 13th, 2019*

- .6 The Bidder must indicate its name and address clearly in the upper left-hand corner of the envelope so that the tender submission can be identified.
- .7 Oral, telephoned, telegram, fax, or e-mail bids will not be accepted nor acknowledged.
- .8 The foregoing states the date and time before which Bids will be received, hereinafter called the "bid closing time." The Owner may extend the bid closing time by addendum.
- .9 Bids shall be prepared and submitted and the bidding process will be administered in accordance with these bidding requirements.

**2. SUMMARY**

- .1 The intent of this bid call is to solicit and receive formal offers for:

**Town of Taber  
Emergency Services Building**

- .2 Refer to Section 01110 - Summary of Work for a summary of the Project, including requirements pertaining to Contract Time.

**3. BASIS OF BID - UNIT PRICE**

- .1 Bids shall be on a stipulated price basis.
- .2 The unit prices, lump sums and allowances stated in the Schedule of Prices shall form the basis of the bid price.
- .3 Make entries in the Schedule of Prices in figures only. Ensure that figures are legible.
- .4 Where, in the Owner's opinion, there is a question as to the legibility of figures entered by the Bidder, the Owner will make a determination as to legibility. The Owner may, at the Owner's sole discretion, declare as invalid and reject any bid that contains figures which, in the Owner's opinion, are illegible or open to dispute.
- .5 Extensions of unit prices and addition of extended unit prices, lump sums and allowances entered in the Schedule of Prices will be checked by the Owner. If arithmetical errors are discovered, the unit prices shall be considered as representing the Bidder's intentions and the unit price extensions and the total amount entered in the Schedule of Prices and the Bid Form will be corrected by the Owner. The Bidder shall be bound to such corrected amounts.
- .6 If no unit price is stated for an item, but an extended amount is stated, a unit price determined by dividing the extended amount by the estimated quantity shall be considered as representing the Bidder's intentions.
- .7 The total amount of the bid shall be the arithmetically correct sum of the arithmetically correct unit price extensions, lump sums and allowances in the Schedule of Prices.
- .8 Each unit price stated in the Schedule of Prices shall be a reasonable price for that item of work.
- .9 Unless otherwise indicated, quantities specified in the Schedule of Prices are estimated quantities and shall not be considered as actual quantities of work to be performed. Subject to Contract terms, unit prices stated in the Schedule of Prices shall be applied to actual quantities of work performed as measured in accordance with the Contract.

**4. SUFFICIENCY OF BID**

- .1 The submission of a bid shall constitute an incontrovertible representation by the Bidder that:
  - .1 the Bidder has complied with all bidding requirements,
  - .2 the Bidder is qualified and experienced to perform the Work in accordance with the Bid Documents,
  - .3 the bid is based upon performing the Work in accordance with the Bid Documents, without exception, and
  - .4 the price or prices stated in the bid cover all the Bidder's obligations under the Contract and all matters and things necessary for the performance of the Work in accordance with the Bid Documents.

**5. BID DOCUMENTS**

- .1 The Bid Documents are the documents issued or made available to Bidders by the Owner for the purpose of preparing a bid. The Bid Documents consist of the following:
  - .1 Instructions to Bidders.
  - .2 Bid Security.
  - .3 Pre-Bid Meeting.
  - .4 Bid Form and Bid Form Supplements.
  - .5 Bid Modification form.
  - .6 Agreement Form.
  - .7 Definitions.
  - .8 Payment Conditions.
  - .9 Contract Performance Security.
  - .10 Security for Payment of Claims.
  - .11 Insurance Conditions.
  - .12 General Conditions of Contract.
  - .13 Supplementary Conditions.

- .14 Specifications, Divisions 1 to 16 inclusive.
- .15 Drawings.
- .16 Addenda issued during the bid period.
- .17 Contract Information Documents.

**6. BID FORM**

- .1 Fill-in all blanks in the Bid Form and sign as follows:
  - .1 Limited Company: Print or type in the space provided the full name of the company and the name(s) and status of authorized signing officer(s). Authorized signing officer(s) shall sign. Sign the Bid Form in the presence of a witness who shall also sign, or in the absence of a witness, affix the corporate seal.
  - .2 Limited Company Joint Venture: Each joint venture company shall sign as for a limited company.
  - .3 Partnership: Print or type in the space provided the firm's name and the name(s) of person(s) signing. One or more of the partners shall sign in the presence of a witness who shall also sign.
  - .4 Sole Proprietorship: Print or type in the space provided the business name and the name of the sole proprietor. The sole proprietor shall sign in the presence of a witness who shall also sign.
- .2 Complete the Bid Form in its entirety. Any required information that is omitted or illegible, any alterations to the text, or any conditions added on or submitted with the Bid Form, may cause the bid to be declared invalid and rejected.

**7. BID FORM SUPPLEMENTS**

- .1 Prepare and submit each of the following Bid Form Supplements together with the Bid Form:
  - .1 Section 00431 - Schedule of Prices: Complete the Schedule in its entirety, including all extensions and additions, and attach it to the Bid Form.
- .2 Any required information that is omitted or illegible, any alterations to the text, or any conditions added or submitted with a Bid Form Supplement, may cause the bid to be declared invalid and rejected.
- .3 Enclose and submit all Bid Form Supplements in a sealed envelope, together with the Bid Form.

- .4 The Owner may, after bid closing time and before contract award, require any Bidder to submit, in a form prescribed by or acceptable to the Owner, supplementary information about any aspect of the Bidder's bid which, in the Owner's opinion, is necessary for bid evaluation purposes.

**8. BID MODIFICATION**

- .1 A bid submitted in accordance with these bidding requirements may be modified, provided the modification:
  - .1 is in the form of a fax transmittal received at the fax number (403) 223-5530 before the bid closing time, or
  - .2 is in the form of a letter received at the address specified in 1.1 before the bid closing time, and
  - .3 states the name of the Bidder, and the nature of the modification, and is signed by an authorized person.
- .2 For bid closing purposes, the official time of receipt of faxed bid modifications shall be the time of receipt automatically printed on the fax transmission by the receiving fax machine.
- .3 When submitting a modification directing a change in a bid amount, do not reveal the original amount nor the revised amount:
  - .1 On unit price bids, state only the amount to be added to or deducted from each original unit price or lump sum in the Schedule of Prices. Bidders may use the Section 00491 – Unit Price Bid Modification Form included in the Bid Documents.
- .4 By submitting a bid modification, the Bidder acknowledges and accepts that its bid modification supersedes all Bidder's previous bid modifications including those containing modifications to its other bid items. Previously submitted bid modifications are all null and void.
- .5 Modify the list of Addendum Number(s) on the Bid Modification Form, if different from what was indicated on the originally submitted Bid Form.
- .6 The Bidder accepts full responsibility for any lack of confidentiality arising from submitting a bid modification using a facsimile submission process.
- .7 Failure of a bid modification to arrive before the closing time, accurately or completely for any reason will render this bid modification null and void. Failure of a faxed bid modification to arrive at the fax machine at the fax number listed herein will render it null and void.

- .8 The Owner will assume no responsibility or liability for the content of modifications, or for modifications that are, for any reason, delayed, illegible, unclear as to intent, ambiguous, contrary to these instructions, or otherwise improperly received.

**9. BID WITHDRAWAL AND ACCEPTANCE**

- .1 A bid may be withdrawn at any time before the bid closing time, provided the request is in the form of:
- .1 a fax transmittal received and printed out in its entirety at the fax number specified above under Bid Modification, before the bid closing time, or
  - .2 a letter received at the address specified in 1.1 before the bid closing time.
- .2 Withdrawn bids may be resubmitted in accordance with these bidding requirements providing the resubmitted bid is received at the office indicated in 1.1, before the bid closing time.
- .3 A bid may not be withdrawn at or after bid closing time and shall be open to acceptance by the Owner until:
- .1 some other Bidder has entered into a contract with the Owner for the Work, or
  - .2 60 days after the bid closing time,
- whichever occurs first.
- .4 The 60 day period referred to above shall commence at midnight of the date of the bid closing and shall terminate at midnight of the 60th day thereafter. If the 60th day falls on a statutory holiday, such day, and any subsequent contiguous holidays, shall be omitted from the computation.
- .5 The 60 day acceptance period referred to above may be extended at the Owner's request and subject to the Bidder's written agreement to the extension.
- .6 The Contract shall be established upon the Owner issuing to the successful Bidder, a letter accepting the bid without qualification or, if the letter accepting the bid contains one or more qualifications, upon the Bidder's written acceptance of all such qualifications.
- .7 The lowest or any bid will not necessarily be accepted and the Owner may reject any and all bids.
- .8 The Owner may negotiate contract terms with the Bidder submitting the lowest valid bid, provided that the negotiated changes to the Bid Documents result in either no change to the bid price or a reduced bid price. Such changes may be formalized in the form of a Post-Bid Addendum that, upon written acceptance by the Bidder, shall form part of the Contract Documents.

**10. BID OPENING**

- .1 Bids will be opened in public immediately after the bid closing time, at the address specified in 1.1.
- .2 The name of each Bidder and the bid price stated on the Bid Form will be read aloud. The reading aloud of a bid price shall not be considered a representation or warranty that the price is correct or that the bid is valid.

**11. IRREGULARITIES**

- .1 A bid that is informal, incomplete, qualified, non-compliant with the requirements of the Bid Documents, or otherwise irregular in any way, may be declared invalid and rejected.
- .2 The Owner may accept or waive a minor and inconsequential irregularity, or where practicable to do so, the Owner may, as a condition of bid acceptance, request a Bidder to correct a minor and inconsequential irregularity with no change in the bid price.
- .3 The determination of what is, or is not, a minor and inconsequential irregularity, the determination of whether to accept, waive or require correction of an irregularity, and the final determination of the validity of a bid, shall be at the Owner's sole discretion.
- .4 Discrepancies between words and figures will be resolved in favour of words.

**12. SAFETY PREQUALIFICATION**

- .1 Prime contract Bidders shall possess, prior to contract execution, a valid Certificate of Recognition (COR) as issued by the Alberta Construction Safety Association (ACSA) or another certifying organization authorized by Alberta Human Resources and Employment to issue CORs.
- .2 Bidders not in possession of a valid COR qualify if in possession of a valid Temporary Letter of Certification (TLC) issued by the ACSA at the time of contract execution.
- .3 A bid from a Bidder who does not possess a valid COR or TLC may be declared invalid and may be rejected.
- .4 The Owner will confirm that the Bidder possesses a valid COR or TLC through the Alberta Construction Safety Association.
- .5 Prospective Bidders who do not possess a COR, and wish to obtain information about obtaining a COR or TLC, are advised to contact:

The Alberta Construction Safety Association  
WEB address: [www.acsa-safety.org](http://www.acsa-safety.org)

225 Parsons Road SW, Edmonton, Alberta, T6X 0W6

*Toll Free Numbers* **Ph:** 1-800-661-2272, **Fax:** 1-877-441-0440  
*Email* edmonton@acsa-safety.org

*OR*

101 292060 Wagonwheel Link, Rocky View, Alberta, T4A 0E2  
*Toll Free Numbers* **Ph:** 1-800-661-6090, **Fax:** 1-877-258-5881  
*Email* calgary@acsa-safety.org

**13. AVAILABILITY OF BID DOCUMENTS**

- .1 Bid Documents are available at the following address only:

MPE Engineering Ltd.  
Suite 300, 714 – 5 Avenue South  
Lethbridge, AB  
T1J 0V1  
Tel: (403) 329-3442  
Fax: (403) 329-9354

- .2 A Bid Document deposit is not required.
- .3 The Owner will assume no responsibility or liability for the completeness of any Bid Documents obtained from a source other than the address specified in 13.1.

**14. RETURN OF BID DOCUMENTS**

- .1 Bid documents are not required to be returned.

**15. EXAMINATION OF BID DOCUMENTS AND THE SITE**

- .1 Bidders shall, before submitting a bid:
- .1 examine and read the Bid Documents thoroughly,
  - .2 visit the site and its surroundings and other locations to become familiar with local and other conditions affecting the Work,
  - .3 consider the effect of regulatory requirements applicable to the Work,
  - .4 study and correlate Bidder's Site observations with the Bid Documents,
  - .5 immediately notify the Owner of all perceived omissions and discovered conflicts, errors and discrepancies in the Bid Documents, and



- .6 understand the Bid Documents and be competent to undertake and complete the Work.
- .2 Refer to Section 00300 – Information Documents which identifies available information pertaining to the Project and specifies the status of and the extent, if any, to which the Bidder may rely upon such Information Documents.
- .3 Before submitting a bid, each Bidder shall, at the Bidder's expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the conditions at, under, or contiguous with the site, which may affect performance of the Work and which the Bidder deems necessary to determine its bid for performing the Work in accordance with the Bid Documents. Bidders shall obtain the Owner's prior approval for access to the site for the purpose of carrying out any such activities. Bidders shall restore the site to a condition acceptable to the Owner upon completion of such activities.
- .4 Lands upon which Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Bid Documents. Additional lands and access thereto required for performance of the Work shall be provided by Contractor.
- .5 When Section 00250 - Pre-Bid Meeting, is included in the Bid Documents, a pre-bid meeting is arranged by the Owner to take place during the bid period. The date and time of the meeting will be indicated on the cover of the Bid Documents.

**16. BID SECURITY**

- .1 Provide and submit the bid security specified in Section 00210 - Bid Security.

**17. CONTRACT PERFORMANCE SECURITY**

- .1 Provide and include in the bid price for the security specified in Section 00612 - Contract Performance Security.

**18. SECURITY FOR PAYMENT OF CLAIMS**

- .1 Provide and include in the bid price for the security specified in Section 00616 - Security for Payment of Claims.

**19. EVIDENCE OF ABILITY TO PROVIDE SECURITY**

- .1 The Owner may, after the bid submission and before the contract award, require a Bidder to submit evidence of the Bidder's ability to provide the security specified in the Bid Documents.

**20. ALLOWANCES**

- .1 Include in the bid price all allowances specified in Section 01280.

**21. PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Product options: Comply with the requirements of Section 01621.
- .2 Substitutions:
  - .1 Comply with the requirements of Section 01621.
  - .2 Where products are specified by a proprietary specification, and substitutions are permitted, Bidders may base their bids on a named product or manufacturer or on unnamed substitutions, subject to the requirements specified for substitutions in Section 01621.
  - .3 During the bid period, it is the sole responsibility of each Bidder to determine whether a substitution meets the requirements specified in Section 01621.
  - .4 The Owner will not consider requests for approval of substitutions from Bidders during the bid period.
  - .5 Substitutions will be evaluated and approved or rejected by the Owner after the contract award.
- .3 Product Acceptability:
  - .1 The Owner may, after the bid submission and before the contract award, require any Bidder to submit proof that a product proposed for use complies with the requirements of the Bid Documents. Such proof shall be in the form of product data as specified in Section 01621.
  - .2 Should the Owner determine that a proposed product does not meet the requirements of the Bid Documents, the Bidder shall propose a product which, in the Owner's opinion, does meet requirements of Bid Documents, otherwise such Bidder's bid may be declared invalid and rejected.

**22. AGREEMENT**

- .1 The successful Bidder will be required to enter into a formal Agreement with the Owner for the performance of the Work.

**23. DIVISION OF WORK**

- .1 Work specified in the Specifications is divided into Divisions and Sections for reference purposes only. Except as may be otherwise specified in the Bid Documents, the division of the Work among the Contractor, Subcontractors, Sub-subcontractors and suppliers is the Bidders' responsibility.

**24. INTERPRETATION AND MODIFICATION OF BID DOCUMENTS**

- .1 Submit questions about the meaning and intent of the Bid Documents to the Owner at the office identified under "Inquiries". Interpretations and modifications considered necessary by the Owner in response to such questions will be issued by the Owner in writing in the form of an Addendum.
- .2 Addenda may also be issued by the Owner to modify the Bid Documents as deemed necessary by the Owner.
- .3 Submit questions as early as possible in the bid period. The Owner may not respond to questions received too close to the bid closing time to permit issuance of an Addendum.
- .4 Submit inquiries as early as possible in the bid period. If an inquiry requires an interpretation or modification of the Bid Documents, but is received too close to the bid closing time to permit issuance of an Addendum, the Owner may be unable to respond to that inquiry.
- .5 Any replies to inquiries or interpretations or modifications of the Bid Documents made verbally, by e-mail, or by any manner other than in the form of a written Addendum, shall not be binding.

**25. ADDENDA**

- .1 Addenda, when issued, will become part of the Bid and Contract Documents.
- .2 Each Bidder shall ascertain before bid submission, and before each bid amendment, that it has received all Addenda issued by the Owner, and shall indicate in the Bid Form, or amendment, the Addendum number(s) of all Addenda received.
- .3 During the Bid period, all Addenda issued by the Owner will be sent by fax, e-mail, or courier to the address for all Parties recorded by the Owner as having obtain hard copy Bid Documents.
- .4 Bidders who have obtained Bid Documents from any another source may not automatically receive addenda via fax, e-mail, or courier.

**26. INQUIRIES**

- .1 Direct inquiries during bid period to:

**Dallin Bullock, P.Eng.**  
**Project Engineer**

MPE Engineering Ltd.  
Suite 300, 714 – 5 Avenue South  
Lethbridge, AB  
T1J 0V1

Tel: (403) 317-3625  
Fax: (403) 329-9354  
Email: dbullock@mpe.ca

**END OF SECTION**

**1. TYPE AND AMOUNT OF BID SECURITY**

- .1 Provide bid security in the form of a bid bond, bank draft or money order, in an amount not less than 10% of the bid price.
- .2 Submit bid security with the Bid Form. Bids not accompanied by bid security will be rejected.

**2. BID BONDS**

- .1 Bid bonds shall be in accordance with the Canadian Construction Documents Committee (CCDC) Standard Form of Bid Bond, CCDC Document No. 220.
- .2 Bid bonds shall be issued by a duly incorporated surety company authorized to transact business of suretyship in the Province of Alberta.
- .3 Bid bonds shall be properly executed by both the Bidder and the surety.

**3. BANK DRAFTS AND MONEY ORDERS**

- .1 Bank drafts, and money orders shall be drawn on a financial institution authorized to conduct business in the Province of Alberta and shall be made payable to the "Town of Taber".

**4. DEFAULT BY BIDDER**

- .1 If a Bidder whose bid is accepted by the Owner in writing, without qualification, and within the acceptance period specified in the Bid Documents, refuses or fails within 21 days after the date of issuance of the written acceptance of the bid:
  - .1 to sign a formal Agreement with the Owner for the performance of the Work, and
  - .2 to provide contract performance security, or security for payment of claims, or both, if and as required by the Bid Documents,

the Bidder shall be liable to the Owner for the difference between the amount of its bid and the greater amount for which a contract for the Work is entered into with some other Bidder, up to the maximum amount of the bid security provided.

**END OF SECTION**

**1. PRE-BID MEETING AND SITE INSPECTION**

- .1 A pre-bid meeting and site inspection will be held at the time and place specified on the cover of this Specification.
- .2 Purpose is to provide bidders an opportunity to familiarize themselves with the Work and with existing conditions. Owner's representative(s) will be present.
- .3 This meeting will be Bidders' only opportunity to inspect the site in the presence of the Owner's Representative.
- .4 Site access is not restricted.
- .5 All prime contract and major subcontract Bidders are strongly advised to attend. Others are invited to attend.
- .6 No information provided by the Owner or any of his representatives at the pre-bid meeting and site inspection shall be binding, unless such information is included in an Addendum.

**END OF SECTION**

**1. RELATED REQUIREMENTS**

- .1 Site visit and inspection prior to bidding: Section 00200
- .2 Information Documents: Definitions and Interpretations.

**2. CONTRACT INFORMATION DOCUMENTS**

- .1 Contract Information Documents listed in 4.1 are incorporated into the Contract.
- .2 The Bidder is entitled to rely upon the factual information or factual data contained in Contract Information Documents, or parts thereof, which have been obtained principally for the purposes of study and design and believed to be correct, within normal limits inherent in gathering such information and data, but the Bidder shall draw its own conclusions from such factual information or factual data and shall not rely on opinions or interpretations contained therein.
- .3 Contract Information Documents shall not be considered a representation or warranty that information contained therein is complete or appropriate for construction.
- .4 Information contained in Contract Information Documents may be time sensitive and dates and times shall be considered when interpreting such information.
- .5 The Bidder is encouraged to obtain specialist advice with respect to Contract Information Documents. The Owner assumes no responsibility for such interpretations and conclusions.

**3. OTHER INFORMATION DOCUMENTS**

- .1 Other Information Documents means information documents not listed in 4.1 herein, and are not part of the Contract Documents.
- .2 The Bidder is not entitled to rely upon the factual information or factual data in any Other Information Documents, nor any opinions or interpretations contained therein. Other Information Document shall not be considered accurate, complete, or appropriate.
- .3 Other Information Documents are made available to the Bidder for the purpose of providing the Bidder with access to the information available to the Owner.

**4. LIST OF CONTRACT INFORMATION DOCUMENTS**

.1 Contract Information Documents comprise the following:

- .1 Appendix A  
*Geotechnical Evaluation*  
*Town of Taber*  
*Emergency Services Building*  
*Taber, Alberta*  
*Issue May 2019*  
*Prepared by MPE Engineering Ltd.*

**END OF SECTION**



**1415-057-00**

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1. FROM (Bidder): \_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Address)

TO: **Town of Taber**  
**A – 4900, 50th Street**  
**Taber, AB**  
**T1G 1T2**

PROJECT: **Emergency Services Building**

2. This Schedule of Prices forms an integral part of the Bid for the above noted project and shall be read and considered in conjunction with Section 00425 - Unit Price Bid Form.

3. It is understood and agreed that with respect to the submission of this Schedule of Prices, the following shall apply:

.1 Items of Work are priced in accordance with the Bid Documents, including Section 00630 - Payment Conditions, Section 01275 - Measurement Rules, and Section 01280 - Measurement and Payment Schedule.

.2 Every price requested shall be submitted or the Bid may be declared informal and the Bid may be rejected.

.3 Should any item be omitted or illegible, should any alteration be made to the text, or should any condition be added on or submitted with the Schedule of Prices, the Bid may be declared informal and the Bid may be rejected.

4. Schedule: See next page.

1415-057-00

**Town of Taber  
Emergency Services Building**

The undersigned, having carefully read these Specifications, hereby agrees to supply all labour, superintendence, plant and materials for the completion of the Works described in these Specifications. Payment for Work described by these Specifications will include the following items:

**SCHEDULE A: Main Addition**

	Description	Qty	Unit	Unit Price	Extension
1.	Strip and pad footings	1	L.S.	\$ _____	\$ _____
2.	Interior slab-on-grade	1	L.S.	\$ _____	\$ _____
3.	Structural steel building	1	L.S.	\$ _____	\$ _____
4.	Mechanical	1	L.S.	\$ _____	\$ _____
5.	Electrical	1	L.S.	\$ _____	\$ _____
6.	Finishing	1	L.S.	\$ _____	\$ _____

**SCHEDULE B: Site Upgrades**

	Description	Qty	Unit	Unit Price	Extension
1.	Waste Excavation	1365	cu. m	\$ _____	\$ _____
2.	Imported Fill Material	900	cu. m.	\$ _____	\$ _____
3.	Concrete/Paving	1	L.S.	\$ _____	\$ _____
4.	Utilities	1	L.S.	\$ _____	\$ _____
5.	Site Grading and Landcaping	1	L.S.	\$ _____	\$ _____

**SCHEDULE C: Renovation & Modifications to Existing Building**

	Description	Qty	Unit	Unit Price	Extension
1.	Selective Demolition	1	L.S.	\$ _____	\$ _____
2.	Mechanical	1	L.S.	\$ _____	\$ _____
3.	Electrical	1	L.S.	\$ _____	\$ _____
4.	Finishing	1	L.S.	\$ _____	\$ _____

**SCHEDULE D: Extra Work Allowances**

	Description	Qty	Unit	Unit Price	Extension
1.	Extra Work Allowances	1	L.S.	\$ <u>300,000.00</u>	\$ <u>300,000.00</u>
				<b>TOTAL SCHEDULE A</b>	\$ _____
				<b>TOTAL SCHEDULE B</b>	\$ _____
				<b>TOTAL SCHEDULE C</b>	\$ _____
				<b>TOTAL SCHEDULE D</b>	\$ <u>300,000.00</u>
				<b>G.S.T.</b>	\$ _____
				<b>TOTAL AMOUNT</b>	\$ _____

5. We, the undersigned, having examined and read the Bid Documents for the above noted contract, and having visited the site and examined all conditions affecting the Work, are satisfied we understand the Bid Documents and declare ourselves competent to undertake and complete the Work and do hereby irrevocably bid and agree to carry out the Work in accordance with the Bid Documents, for the unit prices, lump sums and allowances set out in the Schedule of Prices, the total amount of which is:

\$ \_\_\_\_\_ which amount includes GST.  
 (Total Amount In Figures Only)

6. This Bid is based on and submitted in accordance with Section 00431 - Schedule of Prices which is attached hereto and which forms an integral part of this bid.

7. This bid includes provisions of the following addenda issued during the bid period:  
 Addendum Number(s) \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

8. The total amount of the bid set out in 2. is the sum of all unit price extensions, lump sums and allowances in the Schedule of Prices. It is understood that the unit prices, lump sums and allowances set out in the Schedule of Prices form the basis of the bid price and that the extensions of unit prices and addition of unit price extensions, lump sums and allowances will be checked by the Owner and if arithmetical errors are discovered, the unit prices shall be considered as representing the Bidder's intentions and the unit price extensions and the total amount entered in the Schedule of Prices and the Bid Form will be corrected accordingly by the Owner.

9. Bid security as specified in Section 00210 of the Specifications is being submitted with this bid.

10. If notified in writing by the Owner of the acceptance of this bid within 60 days after the bid closing time, the undersigned will, within 21 days after date of issuance of such notification, execute a formal Agreement with the Owner for the performance of the Work for the above stated compensation and comply with all other requirements of the Bid Documents.

**1415-057-00**

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11. It is understood that, with respect to the Bid Form and Schedule of Prices, should any required information be omitted or illegible, should any alteration be made to the text, or should any condition be added on or submitted with the Bid Form or Schedule of Prices, the bid may be declared informal and the bid may be rejected.

12. Executed this \_\_\_\_\_ day of \_\_\_\_\_, 2019

NAME AND ADDRESS  
OF BIDDER:  
(Print or Type)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SIGNATURE OF AUTHORIZED  
REPRESENTATIVE(S):

NAME AND STATUS OF PERSON(S)  
SIGNING BESIDE: (Print or Type)

_____	_____
_____	_____

WITNESS'S SIGNATURE OR CORPORATE SEAL:

\_\_\_\_\_

**END OF SECTION**

**1415-057-00**

**TO: Town of Taber**

**PROJECT: Emergency Services Building**

1. I \_\_\_\_\_, the undersigned, being an authorized representative of the Bidder, modify the Schedule of Prices for our bid as shown in the following schedule.

Item No.	Item Name	Estimated Quantity	Change To Unit Price, or L.S. + or -	Net Change of Extended Amount + or -
<b>Increase (+) Or Reduce (-) Total Schedule A: (Not Including GST)</b>				

2. Modify here the list of Addendum Number(s), if different from what was indicated on the originally submitted Bid Form: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

The Bidder acknowledges and accepts the bid modification requirements specified in the Instructions To Bidders Section 00200, and agrees that:

3. This bid modification supersedes all previous bid modifications including those containing modifications to other bid items. Previously submitted bid modifications are all null and void.
4. The Bidder accepts full responsibility and liability for any lack of confidentiality arising from submitting a bid modification using a facsimile submission process.
5. Failure of this bid modification to arrive before the closing time, accurately or completely for any reason will render this bid modification null and void. Failure of a faxed bid modification to arrive at the fax machine at the fax number listed herein will render it null and void.

\_\_\_\_\_  
Signature of Authorized Representative

\_\_\_\_\_  
Status of Person Signing Beside (Print or Type)

\_\_\_\_\_  
Name Of Bidder (Print Or Type)

\_\_\_\_\_  
Date

**Send by Fax to: Town of Taber  
(403) 223-1799**

1415-057-00

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**AGREEMENT BETWEEN TOWN OF TABER AND CONTRACTOR**

**This Agreement** made in triplicate on the .....day of ..... 20......

**between**

TOWN OF TABER, hereinafter called the "Owner"

**and**

.....  
(name of Contractor)

.....  
(address)

.....  
.....  
hereinafter called the "Contractor"

**witnesses:** that the parties agree as follows:

**ARTICLE 1: THE WORK**

The Contractor shall perform the Work required by the Contract Documents for:

**Emergency Services Building**

and do and fulfill everything required by this Agreement.

**ARTICLE 2: CONTRACT DOCUMENTS**

The Contract Documents referred to in Article 1 of this Agreement shall be as defined in the Contract Documents. Terms used in the Contract Documents which are defined in the Definitions and Interpretation Section shall have the meanings designated therein.

**ARTICLE 3: CONTRACT TIME**

The Contractor shall attain Substantial Performance of the Work by the following date:

.....day of ..... 20..:

The Contractor shall attain Total Performance of the Work by the following date:

.....day of ..... 20..:

**ARTICLE 4: CONTRACT PRICE**

The Contract Price is ..... dollars in  
Canadian funds (**GST EXEMPT**).

**ARTICLE 5: TAXES AND DUTIES**

Unless otherwise stated in the Contract Documents, the Contractor shall pay all government sales taxes, customs duties and excise taxes with respect to the Contract.

Any increase or decrease in costs to the Contractor due to changes in such taxes and duties, after the closing date of the Tender submissions, shall increase or decrease the Contract Price accordingly.

Where an exemption from or recovery of government sales taxes, duties or excise taxes is applicable to the Contract, the procedure shall be as established in the Payment conditions and other applicable provisions in the Contract Documents.

**ARTICLE 6: PAYMENT**

The Owner shall make payment in Canadian funds to the Contractor on account of the Contract Price in accordance with the Payment Conditions and other applicable provisions in the Contract Documents.

The Owner shall hold back an amount equal to 10% from each progress payment as provided for in the Payment Conditions of the Contract Documents.

**ARTICLE 7: RIGHTS AND REMEDIES**

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the Owner or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

**ARTICLE 8: LANGUAGE AND LAW OF THE CONTRACT**

The language of the Contract is English and the Contract shall be construed and interpreted accordingly. The law prevailing in the Province of Alberta, Canada shall govern the interpretation of the Contract.

**ARTICLE 9: SUCCESSION**

The Contract Documents are to be read into and form part of this Agreement and the whole shall constitute the Contract between the parties and subject to law and the provisions of the Contract Documents shall ensure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors and permitted assigns.

**ARTICLE 10: NOTICES**

Notices to be given under the Contract shall be addressed to the parties as follows:

**The Owner at:**

.....  
(name)  
.....  
(address)  
.....  
.....

Telephone: ..... Facsimile: .....

**The Owner's Representative at:**

MPE Engineering Ltd.  
Suite 300, 714 – 5 Avenue South  
Lethbridge, AB  
T1J 0V1

Telephone: (403) 329-3442 Facsimile: (403) 329-9354

**The Contractor at:**

.....  
(name)  
.....  
(address)  
.....  
.....

Telephone: ..... Facsimile: .....



**1415-057-00**

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**In witness whereof** the parties hereto have executed this Agreement under their respective seals and by the hands of their proper officers thereunto duly authorized.

SIGNED, SEALED AND DELIVERED in the presence of:

**CONTRACTOR**

.....  
Company Name

.....  
Signature of Authorized Signing Officer

.....  
Name of Officer Title of Officer

Corporate Seal

**OWNER**

.....  
Name

.....  
Signature of Authorized Signing Officer

.....  
Name of Officer Title of Officer

Corporate Seal

**END OF SECTION**

**1. DEFINITIONS**

In the Contract the following terms shall have the meanings assigned to them:

- .1 "Additional Instruction" means a written instruction, issued by the Owner to the Contractor, clarifying or finalizing requirements of the Contract Documents and not involving a change in the Contract Price or the Contract Time.
- .2 "Agreement Form" means the document which, when executed by the Owner and the Contractor, formalizes the Contract.
- .3 "Bid" means the Contractor's priced offer to the Owner for the performance of the Work in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance.
- .4 "Certificate of Total Performance" means the certificate issued by the Engineer, when to the best of his knowledge, information and belief, the entire Work has been performed to the requirements of the Contract Documents, except for defects in the Work not discovered by the Engineer and the making good of faulty workmanship or materials during the maintenance period.
- .5 "Certificate of Warranty Performance" means the certificate issued by the Engineer following a period of twelve (12) months from the date of the Certificate of Substantial Performance, or, if a Certificate of Substantial Performance is not issued, following a period of twelve (12) months from the date of the Certificate of Total Performance, which twelve (12) month period is hereafter referred to as the "maintenance period", certifying that to the best of his knowledge, information and belief the performance of the Work (except for defects in the Work not discovered by the Engineer) has been completed.
- .6 "Change Order" means a written instruction, issued by the Owner to the Contractor on or after the date of execution of the Agreement Form, authorizing or ordering a Change in the Work or a change in the Contract Price or the Contract Time or any combination thereof.
- .7 "Change in the Work" means an addition to, deletion from or other modification of the Work consistent with the scope and intent of the Contract.
- .8 "Construction Equipment" means equipment, appliances and things required for the performance of the Work, but does not include Permanent Work or Temporary Work.
- .9 "Contemplated Change" means a written communication, issued by the Owner to the Contractor on or after the date of execution of the Agreement Form, containing a contemplated Change in the Work and requiring the Contractor to submit a quotation for executing such contemplated change, including the Contractor's proposed changes to either or both the Contract Price or the Contract Time.

- .10 "Contract" means the undertaking by the Owner and the Contractor to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents and represents the entire agreement between the Owner and the Contractor. The Contract Documents form the Contract.
- .11 "Contract Deficiency" means a deficiency in the Work, or part thereof, for which the Contractor is responsible under the Contract and includes a deficiency in any design for which the Contractor is responsible.
- .12 "Contract Documents" means: - the Letter of Acceptance; - the executed Agreement Form; - Instructions to Bidders, completed Bid Form, Schedule of Prices, and Supplements to Bid Form; - Information Documents specifically incorporated into the Contract Documents; - Definitions and Interpretation, Payment Conditions, Security Conditions, Insurance Conditions, General Conditions, Supplementary Conditions; - the Specifications; - the Drawings; - Addenda; - and such other documents as may be identified as Contract Documents, and shall include amendments thereto made pursuant to the provisions of the Contract.
- .13 "Contract Price" means the total amount payable by the Owner to the Contractor under the Contract as stated in the Agreement Form, including authorized adjustments thereto.
- .14 "Contract Time" means the period of time specified in the Contract for attainment of substantial Performance of the Work, including authorized adjustments thereto.
- .15 "Contractor" means the person, firm or corporation contracting directly with the Owner to perform the Work.
- .16 "Cost Plus Work" means a contractual arrangement that prescribes the cost of the work plus an allowance for overhead and profit, as expressly defined in the Contract, as payment for performance of the item of work to which it relates.
- .17 "Day" means a calendar day.
- .18 "Drawings" means the graphic and pictorial portions of the Contract Documents showing the design, location or dimensions of the Work, generally including plans, elevations, sections, details and diagrams.
- .19 "Engineer" means the person or persons named in these Contract Documents as the Owner's representative. Words importing persons shall include firms, corporations and joint ventures.
- .20 "Information Documents" means information of any type and in any form related to the Project and identified in the Contract Documents as such, but which does not form part of the Contract unless specifically incorporated therein.
- .21 "Invention" means any new and useful practice, process, machine, device, manufacture or composition of matter, or any new and useful improvement thereof.

- .22 "Letter of Acceptance" means the formal acceptance by the Owner of the Contractor's Bid, including any modifications to the Bid agreed to by the Owner and the Contractor and incorporated therein.
- .23 "Lump Sum Work" means a contractual arrangement that prescribes a lump sum as payment for performance of the item of work to which it relates.
- .24 "Owner" means the Owner as named elsewhere in these Contract Documents and includes a person acting for, or in place of, the Owner.
- .25 "Owner's Representative" means the employee or Engineer identified in writing by a duly authorized officer to represent the Owner under the Contract.
- .26 "Other Contractor" means any person, firm or corporation employed by or having a separate contract with the Owner for work related to the project other than that required by the Contract Documents.
- .27 "Permanent Work" means any structure, Product or thing constructed, manufactured or installed in the performance of the Work, but does not include Temporary Work.
- .28 "Products" means material, components, elements, machinery, equipment, fixtures, systems and other items forming the Work or part thereof but does not include Construction Equipment. "Products" is synonymous with "Materials".
- .29 "Project" means the total construction of which the Work to be provided under the Contract may be the whole or a part.
- .30 "Regulatory Requirements" means laws, ordinances, rules, regulations, orders, codes, and other legally enforceable requirements in effect and applicable to the performance of the Work.
- .31 "Schedule of Prices" means the completed Schedule of Prices submitted by the Contractor with his Bid, as accepted by the Letter of Acceptance.
- .32 "Site" means the designated Site or location of the Work and any other places as may be specifically designated in the Contract as forming part of the Site.
- .33 "Specifications" means that portion of the Contract Documents comprising Divisions 1 to 16 of the specification format including the General Requirements and technical specifications.
- .34 "Subcontractor" means a person, firm or corporation having a contract with the Contractor for the performance of a part of the Work at the Site.
- .35 "Sub-subcontractor" means a person, firm or corporation having a contract with a Subcontractor for the performance of a part of the Work at the Site.

- .36 "Substantial Performance of the Work" means the time when the prerequisites to Substantial Performance of the Work required by the Contract are fulfilled and the Work is ready for use or is being used for the purpose intended and the state of the work is so declared, in writing, by the Owner.
- .37 "Supplier" means a person, firm or corporation having a contract with the Contractor, a Subcontractor or a Sub-subcontractor for the supply of goods or services to be incorporated into or utilized in the performance of the Work.
- .38 "Temporary Work" means site offices, temporary structures, facilities and controls and other temporary things required for the performance of the Work, but does not include Construction Equipment.
- .39 "Total Performance of the Work" means the time when the prerequisites to Total Performance of the Work required by the Contract are fulfilled and the entire Work, except those items arising from the warranty provisions of the Contract, has been performed to the requirements of the Contract Documents and is so declared, in writing, by the Owner.
- .40 "Unit Price" means the amount payable by the Owner to the Contractor under the Contract for a single unit of each separately identified item of work for which a unit price is prescribed as the basis of payment, as stated in the Schedule of Prices.
- .41 "Unit Price Work" means a contractual arrangement that prescribes the product of a Unit Price multiplied by a number of units of measurement of a class as payment for performance of the item of work to which it relates.
- .42 "Warranty Performance of the Work" means the time when the prerequisites to Warranty Performance of the Work required by the Contract are fulfilled and all items arising from the warranty period or periods required by the Contract have been corrected by the Contractor and the state of the Work is so declared, in writing, by the Owner.
- .43 "Work" means the total construction and related services required by the Contract Documents.

## 2. INTERPRETATION

The Contract shall be interpreted as follows:

- .1 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.
- .2 Words importing the singular also include the plural and the masculine includes the feminine and vice-versa where the context requires.
- .3 "Herein", "hereby", "hereof", "hereunder" and similar expressions refer to the Contract as a whole and not to a particular part thereof, unless the context indicates otherwise.

- .4 Words and abbreviations which have well known technical meanings are used in the Contract in accordance with such recognized meanings.
- .5 Words importing persons or parties shall include firms and corporations and any organization having legal capacity.
- .6 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.
- .7 The imperative mood is used extensively in the Contract Documents, particularly the Specifications. Such language is always directed to the Contractor, and it is the Contractor's responsibility to perform the Work specified in the imperative mood, unless specifically stated otherwise.
- .8 Unless the context indicates otherwise, where a term is defined in the Contract Documents, other parts of speech or grammatical forms of the same word or expression have corresponding meanings.
- .9 Unless the context indicates otherwise, all monetary amounts shall be interpreted as amounts in the lawful currency of Canada.
- .10 When provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified, such notice, consent, approval, certificate or determination shall be in writing and the words "notify", "certify" or "determine" shall be construed accordingly. Any such consent, approval, certificate or determination shall not unreasonably be withheld or delayed.
- .11 When provision is made for a communication to be "written" or "in writing" this means any hand-written, typewritten or printed communication, including facsimile transmissions.
- .12 Except in relation to a change in the Contract Time, any period of time in the Contract within which the Owner or the Contractor is to take action or decide anything may be extended by agreement, notwithstanding that the period of time has expired.
- .13 The term "including" or "includes" shall be construed as inclusive and not exclusive, and shall be interpreted to mean including but not necessarily limited to the items referred to.
- .14 In the event of ambiguities, discrepancies and conflicts between the several documents forming the Contract Documents the following order of precedence shall apply:
  - .1 Executed Agreement Form.
  - .2 Letter of Acceptance.
  - .3 Addenda.
  - .4 Supplementary Conditions.
  - .5 Conditions of Contract, including General, Payment, Security and Insurance Conditions.
  - .6 Specifications.

- .7 Drawings.
- .8 Drawings of larger scale shall govern over those of smaller scale of the same date.
- .9 Figured dimensions shown on a Drawing shall govern even though they may differ from dimensions scaled on the same Drawing.

Notwithstanding the foregoing, documents of later date shall always govern over the documents amended.

**END OF SECTION**

**1. TYPE AND AMOUNT OF SECURITY**

- .1 Contractor shall provide security for performance of the Contract in the form of one of the following:
  - .1 Bank Draft or equivalent in the amount of 10% of the Contract Price.
  - .2 Performance Bond for 50% of the Contract Price.
- .2 Security in the form of a bank letter of credit is not acceptable.
- .3 Submit security to the Owner within 21 days after date of issuance of Letter of Acceptance.

**2. BANK DRAFT**

- .1 Bank Drafts shall be drawn on a financial institution authorized to conduct business in the Province of Alberta and shall be made payable to the Owner.
- .2 After receipt Owner will present bank drafts to the bank for payment. Contractor shall not be entitled to accrued interest on a bank draft provided as security.

**3. SURETY BOND**

- .1 Performance bond shall be in accordance with the Canadian Construction Documents Committee (CCDC) Standard Form of Performance Bond, CCDC Document No. 221. Consign performance bond to the Owner.

**4. RELEASE OF SECURITY**

- .1 When security is in the form of a bank draft, such security shall be released progressively as follows:
  - .1 Four months after Substantial Performance of the Work, not more than one third of the amount of the security shall be released to the Contractor.
  - .2 Eight months after Substantial Performance of the Work, a further amount not exceeding one third of the amount of the security shall be released.
  - .3 After the warranty period has expired the balance of the security shall be released, subject to deficiencies in materials and workmanship arising during the warranty period having been corrected to the Owner's satisfaction.
- .2 Progressive releases of security shall be made only upon written request by the Contractor.

**END OF SECTION**



**1. TYPE AND AMOUNT OF SECURITY**

- .1 Contractor shall provide security for payment to claimants for labour and material used or reasonably required for use in the performance of the Contract. Such security shall be in the form of one of the following:
  - .1 Bank Draft or equivalent in the amount of 10% of the Contract Price.
  - .2 Labour and Material Payment Bond for 50% of the Contract Price.
- .2 Security in the form of a bank letter of credit is not acceptable.
- .3 Submit security to Owner within 21 days after date of issuance of Letter of Acceptance.

**2. BANK DRAFT**

- .1 Bank Drafts shall be drawn on a financial institution authorized to conduct business in the Province of Alberta and shall be made payable to the Owner.
- .2 After receipt Owner will present bank drafts to the bank for payment. Contractor shall not be entitled to accrued interest on a bank draft provided as security.

**3. SURETY BOND**

- .1 Labor and Material bond shall be in accordance with the Canadian Construction Documents Committee (CCDC) Standard Form of Labour and Material, CCDC Document No. 222. Consign Labour and Material Bond to the Owner.

**4. RELEASE OF SECURITY**

- .1 When security is provided in the form of a bank draft, such security shall be released to Contractor provided:
  - .1 Owner has issued a Certificate of Substantial Performance,
  - .2 Builders Lien Act claims period of 45 days from date of Substantial Performance or the Work has expired,
  - .3 Third party claims received by Owner have been resolved, or addressed and course of action agreed to between Owner and Contractor,
  - .4 Contractor has submitted to Owner, completed Statutory Declaration.

**END OF SECTION**

**1. RELATED REQUIREMENTS**

- .1 Hold Harmless Agreement: General Conditions.

**2. GENERAL REQUIREMENTS FOR INSURANCE**

- .1 Without restricting the generality of the hold harmless provisions of the General Conditions of Contract and without limiting the obligations or liabilities under the Contract, Contractor shall, provide, maintain, and pay for the insurance coverages specified in this Section.
- .2 Form: Insurance policies shall be placed with Insurers, licensed to conduct business in the Province of Alberta, who comply with the Insurance Act (Alberta) and be in forms acceptable to the Owner.
- .3 Duration: Unless otherwise specified, required insurance coverages shall be maintained continuously from date of commencement of the Work until date of Total Performance of the Work.
- .4 Waiver of Recourse and Subrogation: Contractor waives all rights of recourse and subrogation against Owner for damages to Contractor's property.
- .5 Notice of Change to Policy: Each required policy shall be endorsed to provide the Owner with not less than 30 Days advance written notice of cancellation or material change restricting coverage.
- .6 Proof of Insurance: Prior to commencement of any activities on site, Contractor shall provide Owner with proof that insurance coverages are in effect and meet specified conditions. In addition, Contractor shall at any time upon request, promptly file certified true copy of any insurance policy and shall otherwise provide proof of any required insurance, in a form acceptable to the Owner.
- .7 Subcontractors' Insurance: Contractor shall ensure that Subcontractors provide their own General Liability Insurance, Automobile Liability Insurance, where such risks exist, Aircraft and Watercraft Liability Insurance, and Other Insurance equivalent to that specified herein. With respect to General Liability Insurance, Contractor may alternatively provide such insurance on a wrap-up basis insuring himself, his Subcontractors, and anyone employed directly or indirectly by himself or his Subcontractors to perform a part of the Work.

**3. GENERAL LIABILITY INSURANCE**

- .1 General Liability Insurance shall be in the name of the Contractor. The policy shall include the Owner and the Owner's Representative as Additional Insured with respect to liability arising from the Contractor's operations with regard to the work. The limits shall not be less than five million dollars inclusive per occurrence. The insurance coverage shall include at least the following extensions: Premises, Property and Operations; Occurrence basis, Owners/Contractors protective, Products and Completed Operations; Blanket Contractual; Employees as Additional Insureds; Broad Form Property Damage; Broad Form Loss of Use; Personal Injury; Incidental Malpractice; Contingent Employers Liability; Cross Liability/Severability of Interests; Non-Owned Automobile Liability including Endorsement Form 96; Intentional Injury to protect persons or property, X-plate/unlicensed/specially licensed vehicles; Attached Machinery; Voluntary Medical Payments. To achieve the desired limit, umbrella or excess liability insurance may be used. The Policy shall be endorsed to provide the Owner with not less than 30 days' notice in writing in advance of any cancellation or change or amendment restricting coverage.

**4. AUTOMOBILE LIABILITY INSURANCE**

- .1 Automobile Liability Insurance in respect of licensed vehicles shall have limits of not less than five million dollars inclusive per occurrence for bodily injury, death, and damage to property, in the following forms endorsed to provide the Owner with not less than fifteen (15) days written notice in advance of any cancellation or change or amendment restricting coverage:
  - .1 Standard Owner's Form SPF #1 Automobile Policy providing Third Party Liability and Accident Benefits Insurance and covering licensed vehicles owned or operated by or on behalf of the Contractor.

**5. AIRCRAFT AND WATERCRAFT LIABILITY INSURANCE**

- .1 Aircraft and Watercraft Liability Insurance with respect to owned or non-owned aircraft or watercraft if used directly or indirectly in the performance of the Work, including use of additional premises, shall be subject to limits of not less than two million dollars inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than one million dollars for Aircraft Passenger Hazard. Such insurance shall be in the form acceptable to the Owner. The policies shall be endorsed to provide the Owner with not less than thirty (30) days written notice in advance of cancellation, change or amendment restricting coverage.

**6. COURSE OF CONSTRUCTION AND BOILER INSURANCE**

- .1 All Risk Property Insurance shall be in the joint names of the Contractor and the Owner, insuring not less than the sum of the Contract Price and the full value, as stated in the General Requirements, of products that are specified to be provided by the Owner for incorporation into the Work. The insurance coverage shall be maintained continuously until ten (10) days after the date of the Certificate of Total Performance.
- .2 Boiler Insurance insuring the interests of the Contractor, the Owner and the Owner's Representative for not less than the replacement value of boilers and pressure vessels forming part of the Work. The insurance coverage and shall be maintained continuously from the commencement of use or operation of the property insured and until ten (10) days after the date of the Certificate of Total Performance.
- .3 Should the Owner wish to use or occupy part or all of the Work he shall give thirty (30) days written notice to the Contractor of the intended purpose and extent for such use or occupancy. Prior to such use or occupancy the Contractor shall notify the Owner in writing of the additional premium cost, if any, to maintain such insurance which shall be at the Owner's expense. If because of such use or occupancy the Contractor is unable to provide coverage, the Owner, upon written notice from the Contractor and prior to such use or occupancy, shall assume the responsibility to provide, maintain and pay for Property and Boiler Insurance insuring the full value of the Work, as in (a) and (b) above, including coverage for such use or occupancy and the Contractor shall refund to the Owner the unearned premiums applicable to the Contractor's Policies upon termination of coverage.
- .4 The Policies shall provide that, in the event of a loss or damage, payment shall be made to the Owner and the Contractor as their respective interests may appear. The Contractor shall act on behalf of the Owner and himself for the purpose of adjusting the amount of such loss or damage payment with the Insurers. When the extent of the loss or damage is determined the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract except that the Contractor will be entitled to such reasonable extension of time for completion of the Work as the Owner's Representative may decide.
- .5 Payment for Loss or Damage:
  - .1 When the property insurance has been obtained by the Contractor in accordance with the requirements of this Section: The Contractor shall be entitled to receive from the payments made by the Insurer the amount of his interest in the restoration of the work. In addition the Contractor shall be entitled to receive from the Owner (in addition to the amount due under the Contract) the amount in which the Owner's interest in the restoration of the Work has been appraised, such amount to be paid upon receipt of payment or payments from the Insurer in accordance with the Owner's Representative's certificates for payment.

- .2 When the property insurance has been obtained by the Owner pursuant to the terms of the Contract Documents: The Contractor shall be entitled to receive from the payments made by the Insurer the amount of the Contractor's interest in the restoration of the Work. In addition the Contractor shall be entitled to receive from the Owner (in addition to the amount due under the Contract) the amount in which the owner's interests in the restoration of the Work has been appraised, such amount to be paid as the restoration of the Work proceeds and in accordance with the requirements of Contract Documents.
  
- .6 The Contractor shall be responsible for deductible amounts under the policies.

**7. CONTRACTORS' EQUIPMENT INSURANCE**

- .1 All Risks Contractors' Equipment Insurance covering construction machinery and equipment owned or rented and used by the Contractor and/or Subcontractors for the performance of the Work, including Boiler Insurance on temporary boilers and pressure vessels, shall be in the form acceptable to the Owner.

**8. OTHER INSURANCE**

- .1 Contractor shall provide, maintain and pay for any additional insurance required to be provided by law, or which he considers necessary to cover risks not otherwise covered by insurance specified in the Contract Documents.

**END OF SECTION**

**1. FEDERAL GOODS AND SERVICES TAX**

- .1 Monies payable by the Owner to the Contractor shall be inclusive of the Federal Goods and Services Tax (GST).

**2. BASIS OF PAYMENT**

- .1 Payment for Lump Sum Work shall be based on the prices in the Contract and, when required by the Contract, the approved schedule of values for such work.
- .2 Payment for Unit Price Work shall be based on the Unit Prices in the Contract.
- .3 Payment for Cost Plus Work shall be based on the cost of such work, as specified herein, plus a fee in the amount of 10% of the cost of such work for the Contractor's overhead and profit except that no fee shall be applied to the cost of Construction Equipment when such cost is based on rates which already include the Contractor's overhead and profit.
- .4 The cost of Cost Plus Work shall be computed as the sum of the following cost elements as applicable to such work:
  - .1 Cost of labour (other than labour costs included in other cost elements) comprised of payroll costs for employees in the direct employ of the Contractor. Such employees shall include the superintendent and foremen at the Site. Payroll costs shall include salary, fringe benefits and statutory charges paid by Contractor. Fringe benefits shall include health care, vacations with pay, sick time allowance, and pension plan, life and disability insurance, dental and medication plan contributions. Statutory charges shall include contributions for Canada Pension Plan, Workers' Compensation, statutory holidays and Unemployment Insurance. Labour rates shall be consistent with rates actually paid for equivalent job classifications in the normal performance of Lump Sum Work or Unit Price Work or, if there are no such equivalencies, under a schedule of job classifications and labour rates agreed upon by the Owner and the Contractor, if possible before labour costs are incurred.
  - .2 Cost of Products supplied and incorporated into Permanent Work, including cost of transportation and storage thereof and Supplier's site services required in connection therewith. Cash discounts shall accrue to the Contractor. Trade discounts, rebates and refunds and returns from sale of surplus Products shall accrue to the Owner.
  - .3 Cost of Construction Equipment:
    - .1 Cost of Construction Equipment shall be paid at the rates specified in the current edition of the Equipment Rental Rates Guide published by the Alberta Roadbuilders and Heavy Construction Association, hereinafter called the "Rates Guide", subject to the following:

- .1 Rates specified in the Rates Guide shall be deemed to include all overhead and profit, regardless of whether Construction Equipment is provided by the Contractor, Subcontractors or Sub-subcontractors.
  - .2 Rates specified in the Rates Guide shall be deemed to include cost of owning, operating, loading, unloading, assembling, erecting, and dismantling.
  - .3 When applicable rates are not included in the Rates Guide, costs shall be paid at the rates agreed upon by the Owner and the Contractor, if possible before such costs are incurred.
  - .4 Cost of moving Construction Equipment to and from the Site shall not be payable, unless such cost is solely attributable to the Work and is approved as such by the Owner.
  - .5 Except for Construction Equipment traveling under its own power, travel time for Construction Equipment shall not be payable. Unless otherwise approved by the Owner, Construction Equipment shall be moved by the most economical method.
- .5 Cost of Temporary Work, including cost of transportation and maintenance thereof, used and consumed in the performance of the Work and the cost less fair market value of such work used but not consumed which shall remain the property of the Contractor.
- .6 Cost of special services, including the cost of architects, engineers, specifiers, surveyors, testing laboratories and inspection agencies.
- .7 Supplemental costs, including:
- .1 Travel and subsistence costs of Contractor's employees;
  - .2 Statutory charges, including fees, cost of permits and licenses and custom duties;
  - .3 Cost of rights-of-way and other land related costs;
  - .4 Royalty payments and patent license fees;
  - .5 Deposits lost for causes other than the Contractor's fault or negligence.
- .8 Subcontract and Sub-subcontract costs, including payments made by the Contractor to Subcontractors and by Subcontractors to Sub-subcontractors in accordance with the requirements of such contracts. Subcontractors' and Sub-subcontractors' costs and fee for overhead and profit for Cost Plus Work to be performed under such contracts shall be determined in the same manner as the Contractor's cost and fee.
- .9 With respect to Cost Plus Work:
- .1 Costs payable by Owner shall be directly related to or shall have been necessarily and properly incurred in the performance of such work.

- .2 Overhead shall include the Contractor's costs related to the operation and maintenance of his head office and branch offices, administration at head office and branch offices, general management, legal, audit and accounting services, buying organization, corporate tax, financing and other bank charges, company directors, salaries and other compensation of personnel stationed off-site, design of Construction Equipment and Temporary Work, supervision, planning and scheduling of work, expendable and unexpendable small tools, including maintenance thereof, clean up and recruitment and training of site staff.
- .3 Contractor shall obtain the Owner's prior approval to subcontract or enter into other agreements for Cost Plus Work.
- .4 Costs claimed for delay or extension of the contract will be considered only if the Contractor has clearly demonstrated the work delayed or extended the critical path of the project.
- .5 The Owner may refuse to pay all or part of the cost of any Work item under any cost element, where the item in question was, in the Owner's opinion, unsuitable for the Work performed.

**3. MEASUREMENT FOR PAYMENT**

- .1 Unless otherwise specified in the Contract, the Owner shall measure the Work for the purpose of determining payment to the Contractor in accordance with the measurement provisions of the Contract.

**4. PROGRESS PAYMENTS**

- .1 Prior to Substantial Performance of the Work, the Owner shall make monthly payments to the Contractor.
- .2 Within 7 days after the end of each monthly payment period, the Contractor shall submit to the Owner:
  - .1 Completed Statutory Declaration Form, at and after the second monthly payment period,
  - .2 Workers Compensation Board verification that the Contractor's account is in good standing,
  - .3 Any data requested by the Owner to assist the Owner to determine the amount due and payable to the Contractor, and
  - .4 For Products stored by the Contractor on the Site for incorporation in Permanent Work but not incorporated in such Work, proof of purchase price and delivery to the Site, along with a statement of the quantity of such Products and the Schedule of Prices item to which the Products relate.



- .3 The Owner shall, within 45 days after the end of each monthly payment period and subject to having received within the time specified any required information referred to in clause 4.2, pay to the Contractor the amount which the Owner determines to be due and payable to the Contractor, up to the end of the monthly payment period in respect of:
  - .1 The value of Work executed;
  - .2 The value of Work executed pursuant to authorized Changes in the Work;
  - .3 The value of Products stored by the Contractor on the Site for incorporation in Permanent Work but not incorporated in such Work;
  - .4 Adjustments due to changes in Regulatory Requirements or price fluctuation provisions of the Contract, if applicable;
  - .5 Any other amount determined by the Owner; and
  - .6 Subject to:
    - any deductions under clause 10;
    - any withholdings under clause 11; and
    - retention of the holdback amount calculated by applying the holdback percentage referred to in clause 5 to the amount payable to the Contractor under clause 4.3 after any deductions and withholdings.
- .4 For Unit Price Work, Owner may, at his discretion, make partial payment based on partial completion of the scope of a single unit of an item of Work.
- .5 If, after receipt of a progress payment from the Owner, the Contractor disagrees with the amount of such payment, such amount shall nevertheless be considered to be correct unless the Contractor, within 7 days after such receipt, notifies the Owner of the respects in which such payment is claimed by him to be incorrect. On receipt of such notice, the Owner shall review the amount of the payment and either confirm or vary it. If the Owner varies the payment, such variance shall be added to the next progress payment.
- .6 Notwithstanding the terms of this clause or any other clause of the Contract no amount shall be paid by the Owner until the contract security and proof of insurance, if required under the Contract, have been provided by the Contractor.

**5. HOLDBACK**

- .1 The Owner shall hold back the percentage specified in the Agreement Form from each progress payment referred to in clause 4.
- .2 Forty-five (45) days after the date of a Certificate of Substantial Performance, if issued, the Owner will pay to the Contractor, the unpaid balance of holdback moneys then due, provided:

- .1 Third party claims, received by the Owner pursuant to the Builders Lien Act or applicable requirements of the Contract have been resolved, or addressed and a course of action agreed to by the Owner and the Contractor,
  - .2 The Contractor has submitted to the Owner, within 7 days after the date of Substantial Performance, a letter of clearance from the Workers' Compensation Board and a completed Statutory Declaration Form,
  - .3 The Contractor has submitted to the Owner, a letter from the Contractor's Surety (if any) approving the release of the holdback,
  - .4 The Contractor has submitted to the Owner, all Record Documents, showing changes as constructed, Operating and Maintenance Manuals, guarantees, warranties, certificates, reports, spare parts and spare material required by the Contract Documents,
  - .5 The Contractor has submitted to the Owner, a statement verifying that "all payment quantities on the completed portion of the Contract have been accepted; and all claims, all demands for Extra Work, or otherwise, under or in connection with the completed portion of the Contract have been presented to the Engineer".
- .3 Forty-five (45) days after the date of Total Performance, the Owner will pay to the Contractor, the unpaid balance of holdback moneys then due, provided:
- .1 Third party claims, received by the Owner pursuant to the Builders Lien Act or applicable requirements of the Contract have been resolved, or addressed and a course of action agreed to by the Owner and the Contractor,
  - .2 The Contractor has submitted to the Owner, within 7 days after the date of Substantial Performance, a letter of clearance from the Workers' Compensation Board and a completed Statutory Declaration Form,
  - .3 The Contractor has submitted to the Owner, a letter from the Contractor's Surety (if any) approving the release of the holdback,
  - .4 The Contractor has submitted to the Owner, all Record Documents, showing changes as constructed, Operating and Maintenance Manuals, guarantees, warranties, certificates, reports, spare parts and spare material required by the Contract Documents,
  - .5 The Contractor has submitted to the Owner, a statement verifying that "all payment quantities on the completed portion of the Contract have been accepted; and all claims, all demands for Extra Work, or otherwise, under or in connection with the completed portion of the Contract have been presented to the Engineer".

**6. FINAL PAYMENT**

- .1 Upon the accepted date of Total Performance, the Owner will pay to the Contractor the unpaid balance of any monies then due under the Contract, PROVIDED THAT the Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or any part of any certificate to such an extent as may be necessary to protect the Owner from loss on account of:
  - .1 The Contractor's unsatisfactory prosecution of the Work.
  - .2 Defective or damaged Work requiring correction or replacement.
  - .3 Claims or liens filed or reasonable evidence indicating the probable filing of claims or liens.
  - .4 Failure of the Contractor to make payments promptly to subcontractors or for materials or labour.
  - .5 A reasonable doubt that the Contract can be completed for balance unpaid.
  - .6 Damage to an Other Contractor's Work which has not been settled which may result in the Other Contractor whose Work has been damaged bringing action against the Owner. In case of action, the Contractor will bear the expense of same.

When the above conditions are resolved to the satisfaction of the Owner, payment shall be made for the amounts withheld because of them.

- .2 If the final statement is considered by the Contractor to be incorrect, the Contractor shall submit to the Owner a notice of claim, including substantiation, notwithstanding the time provisions of clause 10 of the General Conditions.
- .3 If the Owner does not receive a notice of claim pursuant to clause 6.2 within the time specified, the final statement shall be considered correct.
- .4 The final payment shall represent full and final settlement of all monies due to the Contractor pursuant to the Contract except with respect to unresolved claims, if any.

**7. OWNER'S LIABILITY**

- .1 After the final payment issued has been made, the Owner shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract, except as may be provided elsewhere in the Contract, unless the Contractor shall have made a claim in respect thereof prior to or within the time specified in the Builders Lien Act.

**8. DELAY IN MAKING PAYMENT**

- .1 In respect of progress payments, payment after Substantial Performance of the Work, payment of holdback, and final payment, the Owner shall pay the Contractor an amount that the Owner considers to be due to the Contractor, pursuant to the Contract, within the time specified.

**9. RIGHT OF SET-OFF**

- .1 Without limiting any right of set-off, deduction or recovery given or implied by law or elsewhere in the Contract, the Owner may set off any amount payable to the Owner by the Contractor, or recoverable from the Contractor by the Owner, under the Contract or under any other current contract against any amount payable to the Contractor under this Contract.
- .2 For the purposes of these Payment Conditions, "other current contract" means a contract between the Owner and the Contractor under which the Contractor has an undischarged obligation to perform or supply work, labour, or material, or in respect of which the Owner has, since the date of execution of the contract agreement, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.

**10. DEDUCTIONS FROM PAYMENTS**

- .1 Owner may deduct from any amount claimed by or payable to Contractor:
- .1 An amount at least equal to the value, as determined by Owner, of Work not in accordance with Contract Documents,
- .2 The amount of any unresolved third party claim submitted pursuant to the Builders Lien Act or applicable requirements of the Contract,
- .3 The amount of any unpaid and overdue statutory account related to the Contract and of which the Owner has received notice and which is enforceable against the Owner,
- .4 The amount of any overpayment made by the Owner to the Contractor, and
- .5 Any other amount recoverable by the Owner from the Contractor under the Contract.

**11. WITHHOLDING OF PAYMENT**

- .1 Owner may withhold all or part of any amount payable to Contractor in order to protect the Owner or third parties from loss due to Contractor's:
- .1 Failure to make payments properly to Subcontractors or for labour, materials or equipment,

- .2 Failure to ensure that Subcontractors make payments properly to Sub-subcontractors or for labour, materials or equipment,
  - .3 Inability to complete the Work within the Contract Time,
  - .4 Inability to complete the Work for the unpaid balance of the Contract Price,
  - .5 Persistent failure to perform the Work in accordance with the Contract Documents.
- .2 When the causes for withholding payment pursuant to 11.1 are removed to the Owner's satisfaction, the Owner shall pay the Contractor the amount previously due and payable with the next progress payment.

**12. TITLE TO AND ACCEPTANCE OF WORK**

- .1 Contractor warrants that title to work and Products covered by any payment made by the Owner to the Contractor will pass to the Owner, at the time of payment, free and clear of all claims, interests and encumbrances.
- .2 Contractor further warrants that Products stored at the Site and for which payment has been received, shall not be removed from the Site and shall be kept secure and protected.
- .3 Payments made by Owner shall not be construed as an acceptance that the Work, Products, or any part thereof is complete, is satisfactory or is in accordance with the Contract Documents.

**END OF SECTION**

# Statutory Declaration of Payment Distribution

## Identification of Contract

Contract Name (location and description of the Work as it appears in the Contract Documents)	
	Date of This Application for Payment
	Month                  Day                  Year
	Date of Last (Immediate Preceding) Application for Payment
	Month                  Day                  Year

## Identification of Declarant (person making the declaration)

Full Name of Declarant	Position or Title (of office held with Contractor)		
Business Name (Name of Contractor)			
Business Address			
City or Town	Province	Postal Code	

## Declaration

I, the undersigned, solemnly declare that as of the date of this application for payment:

- .1 all the Contractor's lawful obligations to subcontractors and suppliers, in respect of work contracted for and performed before the date of the last (immediate preceding) application for payment, are fully discharged, except for (i) hold back monies properly retained, and (ii) payments deferred by agreement;
- .2 all the Contractor's lawful obligations to workers, in respect to work contracted for, are fully discharged;
- .3 all assessments and payments required to be made by the Contractor under law have been made in full; and that
- .4 I am an authorized signing officer of the Contractor and have personal knowledge of the contract identified and the facts stated in this statutory declaration.

I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath.

**Making a false or fraudulent declaration is a contravention of the Criminal Code of Canada, and could carry, upon conviction, penalties including fines, imprisonment, or both.**

\_\_\_\_\_

Signature of declarant

## Attestation (to be completed by a person empowered to receive declarations, e.g. Commissioner of Oaths, Notary Public, etc.)

DECLARED before me at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

City/Town and Province

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Signature of person before whom declaration is made	Authority to receive solemn declarations	Expiry date
Name (please print)	<p><b>Any changes or corrections on this Statutory Declaration must be initialled by the person before whom the declaration is made.</b></p>	

- 1. OWNER AND OWNER'S REPRESENTATIVE**
    - 1.1 Owner's Duties and Authority
    - 1.2 Owner's Representative
    - 1.3 Appointment of Assistants
    - 1.4 Instructions in Writing
    - 1.5 Owner Interpreter of Contract
    - 1.6 Owner's Determinations
    - 1.7 Owner's Review
  
  - 2. ASSIGNMENT, SUBCONTRACTING AND NOMINATION**
    - 2.1 Assignment
    - 2.2 Subcontracting
    - 2.3 Nominated Subcontractors and Suppliers
  
  - 3. DOCUMENTS**
    - 3.1 Property and Use of Contract Documents
    - 3.2 Reporting of Conflicts, Errors and Discrepancies
    - 3.3 Disruption of Progress
    - 3.4 Additional Instructions
    - 3.5 Forms
  
  - 4. GENERAL OBLIGATIONS**
    - 4.1 Contractor's Responsibilities
    - 4.2 Contract Security
    - 4.3 Site Operations and Methods of Construction
    - 4.4 Differing Physical Conditions or Obstructions
    - 4.5 Climatic and Weather Conditions
    - 4.6 Contractor's Superintendence
    - 4.7 Contractor's Employees
    - 4.8 Owner May Object
    - 4.9 Safety, Security and Protection of the Environment
  
  - 4.10** Owner's Responsibilities for Safety
  - 4.11** Care of Work
  - 4.12** Responsibility to Rectify Loss or Damage
  - 4.13** Hold Harmless Agreement
  - 4.14** Regulatory Requirements
  - 4.15** Artifacts and Fossils
  - 4.16** Patent Rights
  - 4.17** Royalties
  - 4.18** Other Contractors
  - 4.19** Permanent Work Designed by Contractor
  - 4.20** Records and Audit
  - 4.21** Record of Labour and Construction Equipment
  - 4.22** Customs
  - 4.23** Urgent Remedial Work
- 
- 5. QUALITY OF PRODUCTS AND WORK**
  - 5.1 Products and Workmanship
  - 5.2 Cost of Samples
  - 5.3 Cost of Tests Provided For
  - 5.4 Cost of Tests Not Provided For
  - 5.5 Inspection and Testing
  - 5.6 Dates for Inspection and Testing
  - 5.7 Rejection
  - 5.8 Cost for Inspection and Testing
  - 5.9 Independent Inspection
  - 5.10 Examination of Work Before Covering Up
  - 5.11 Uncovering and Making Openings
  - 5.12 Removal of Improper Work or Products

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**6. COMMENCEMENT,  
COMPLETION, CONTRACT TIME  
AND DELAYS**

- 6.1 Commencement of Work
- 6.2 Possession of Site and Access to Site
- 6.3 Contract Time
- 6.4 Extension of Contract Time
- 6.5 Contractor to Provide Notification and Details
- 6.6 Interim Determination of Extension of Time
- 6.7 Rate of Progress
- 6.8 Substantial Performance of the Work
- 6.9 Substantial Performance of Part or Parts of Work
- 6.10 Total Performance of the Work
- 6.11 Warranty Performance of the Work
- 6.12 Acceleration
- 6.13 Damages for Delay

**7. WARRANTY**

- 7.1 Warranty Period
- 7.2 Completion of Outstanding Work
- 7.3 Remedying Defects
- 7.4 Contractor's Failure to Carry Out Instructions
- 7.5 Contractor to Search

**8. CHANGES AND VARIATIONS**

- 8.1 Changes in the Work
- 8.2 Instructions for Changes in the Work
- 8.3 Valuation of Changes in the Work
- 8.4 Impact of Changes in the Work
- 8.5 Quantity Variations

**9. CHANGES IN COST AND  
REGULATORY REQUIREMENTS**

- 9.1 Increase or Decrease in Cost
- 9.2 Changes in Regulatory Requirements

**10. CLAIMS**

- 10.1 Notice of Claims
- 10.2 Contemporary Records
- 10.3 Substantiation of Claims
- 10.4 Payment of Claims
- 10.5 Obligations to and Claims of Third Parties
- 10.6 Claims Against Owner Only

**11. RELEASE FROM PERFORMANCE**

- 11.1 Frustration
- 11.2 Removal of Construction Equipment on Termination
- 11.3 Payment if Contract Terminated

**12. SUSPENSION AND TERMINATION  
BY OWNER**

- 12.1 Suspension of Work
- 12.2 Owner's Determination Following Suspension
- 12.3 Suspension Lasting More Than 91 Days
- 12.4 Termination of Contract

**13. DEFAULT OF CONTRACTOR**

- 13.1 Default
- 13.2 Valuation at Date of Termination
- 13.3 Payment After Termination
- 13.4 Assignment of Benefit of Agreement

**14. DEFAULT OF OWNER**

- 14.1 Failure of Owner to Pay
- 14.2 Removal of Construction Equipment
- 14.3 Payment on Termination
- 14.4 Contractor May Suspend Work
- 14.5 Resumption of Work



**15. SETTLEMENT OF DISPUTES**

- 15.1 Disputes
- 15.2 Notice of Dispute
- 15.3 Negotiated Settlement
- 15.4 Mediation
- 15.5 Arbitration

**1. OWNER AND OWNER'S REPRESENTATIVE**

**1.1 OWNER'S DUTIES AND AUTHORITY**

- .1 The Owner shall carry out the duties and exercise the authority specified in the Contract.

**1.2 OWNER'S REPRESENTATIVE**

- .1 The Owner shall appoint a representative who shall, unless the Contractor is expressly advised otherwise by the Owner, have full authority to act on behalf of and bind the Owner under the Contract.

**1.3 APPOINTMENT OF ASSISTANTS**

- .1 The Owner's Representative may appoint any number of persons to assist him in carrying out his duties. He shall notify the Contractor of the names, duties and scope of authority of such persons.
- .2 The failure of any assistants appointed pursuant to clause 1.3.1 to disapprove any work shall not prejudice the authority of the Owner to disapprove such work and to give instructions for the rectification thereof.

**1.4 INSTRUCTIONS IN WRITING**

- .1 The Contractor shall take instructions only from the Owner or any assistants appointed pursuant to clause 1.3. Instructions given by the Owner shall be in writing, provided that if the Owner considers it necessary to give any instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Owner, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this clause. Provided that if the Contractor, within 7 days, confirms in writing to the Owner any oral instruction of the Owner and such confirmation is not contradicted in writing within 7 days by the Owner, it shall be deemed to be an instruction of the Owner.

**1.5 OWNER INTERPRETER OF CONTRACT**

- .1 The Owner in the first instance shall be the interpreter of the Contract and the judge of the Contractor's performance.

**1.6 OWNER'S DETERMINATIONS**

- .1 When the Owner is required to exercise his discretion by giving his decision, opinion or consent, or expressing his satisfaction or approval, or determining value, or otherwise taking action which may affect the rights and obligations of the Contractor he shall exercise such discretion within the terms of the Contract after due consultation with the Contractor and shall promptly notify the Contractor of such decision, opinion, consent, approval or determination.

**1.7 OWNER'S REVIEW**

- .1 Any review, comment, consent, acceptance or approval, or lack thereof, by the Owner, shall not relieve the Contractor of any of its responsibilities or liabilities under the Contract.

**2. ASSIGNMENT, SUBCONTRACTING AND NOMINATION**

**2.1 ASSIGNMENT**

- .1 The Contractor shall not assign the Contract, either in whole or in part, without the previous written consent of the Owner, which consent, notwithstanding other provisions of the Contract, shall be at the Owner's sole discretion.
- .2 The Owner shall not be bound by any assignment by the Contractor of any monies payable or to become payable to the Contractor under the Contract, without the written consent of the Owner, which consent:
  - .1 will not be given for a general assignment of book debts, but
  - .2 may, at the Owner's sole discretion, be given for a specific assignment of all or part of monies payable to the Contractor under the Contract, subject however, in all cases, to the provisions of the Financial Administration Act (Alberta).

**2.2 SUBCONTRACTING**

- .1 The Contractor:
  - .1 shall not sublet the Contract as a whole,
  - .2 shall not subcontract any part of the Work without the Owner's prior consent, which shall not be unreasonably withheld,
  - .3 shall provide such details of any Subcontractor he wishes to engage as the Owner may require,
  - .4 shall contract with those Subcontractors proposed by him and accepted by the Owner and such Subcontractors shall not be changed without the Owner's prior consent.
- .2 The Owner may, for reasonable cause, object to the use of a proposed Subcontractor and require the Contractor to contract with another Subcontractor.
- .3 If the Owner requires a change from a proposed Subcontractor, the Contract Price shall be adjusted by any difference in cost and markup occasioned by such required change, except where such change is required due to the Contractor's default or negligence, in which case there shall be no change in the Contract Price.
- .4 The Owner may, upon reasonable request and at his discretion, provide to a Subcontractor information as to the percentage or quantity of the Subcontractor's work for which payment has been approved.

- .5 Nothing contained in the Contract shall create a contractual relationship between a Subcontractor and the Owner and subcontracting part of the Work shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any Subcontractor, his agents, servants or workers as fully as if they were his own.
- .6 The Contractor shall enter into contracts or written agreements with his Subcontractors to require them to perform their work in accordance with the Contract, and the Contractor shall incorporate the terms and conditions of the Contract Documents, to the extent that they apply, into all subcontracts.

**2.3 NOMINATED SUBCONTRACTORS AND SUPPLIERS**

- .1 A nominated Subcontractor or nominated Supplier means a person, firm or corporation with whom the Contract requires the Contractor to enter into a contract for the performance of a subcontract or the supply of things related to the Work.
- .2 Nothing contained in the Contract shall create a contractual relationship between the Owner and a nominated Subcontractor or nominated Supplier and such nomination shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any nominated Subcontractor or nominated Supplier, his agents, servants or workers as fully as if they were his own.

**3. DOCUMENTS**

**3.1 PROPERTY AND USE OF CONTRACT DOCUMENTS**

- .1 The Contract Documents are the sole property of the Owner and unless it is necessary for the purposes of the Contract, the Contract Documents shall not, without the consent of the Owner, be used by or communicated to a third party by the Contractor.

**3.2 REPORTING OF CONFLICTS, ERRORS AND DISCREPANCIES**

- .1 If the Contractor finds a conflict, error or discrepancy in the Contract Documents, the Contractor shall so report to the Owner in writing at once and, before proceeding or continuing with the Work affected thereby, shall obtain a written interpretation or clarification from the Owner; however, the Contractor shall not be liable to the Owner for failure to report any conflict, error or discrepancy in the Contract Documents unless the Contractor had actual knowledge thereof or should reasonably have known thereof.
- .2 The Contractor shall obtain from the Owner any dimensions required but not indicated in figures in the Contract Documents nor calculable from figures in the Contract Documents. Scaling of Drawings, for any purpose, shall be at the Contractor's risk.

**3.3 DISRUPTION OF PROGRESS**

- .1 The Contractor shall notify the Owner when planning or execution of the Work is likely to be delayed or disrupted unless any further document or instruction required of the Owner under the Contract is issued by the Owner within a reasonable time. The notice shall include details of the document or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.
- .2 If, by reason of any failure or inability of the Owner to issue, within a reasonable time, any document or instruction for which notice has been given by the Contractor in accordance with clause 3.3.1, the Contractor suffers delay or incurs costs then the Owner shall determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount of such costs, which shall be added to the Contract Price.
- .3 If the failure or inability of the Owner to issue any documents or instruction is caused in whole or in part by the failure of the Contractor to submit documents, which he is required to submit under the Contract, the Owner shall take such failure by the Contractor into account when making his determination pursuant to clause 3.3.2.

**3.4 ADDITIONAL INSTRUCTIONS**

- .1 The Owner shall have authority to issue to the Contractor, from time to time, such Additional Instructions as may be necessary for the proper performance of the Work. The Contractor shall carry out and be bound by such Additional Instructions.

**3.5 FORMS**

- .1 Forms to be used pursuant to the Contract or as otherwise may be required for the administration of the Contract shall be as prescribed or approved by the Owner.

**4. GENERAL OBLIGATIONS**

**4.1 CONTRACTOR'S RESPONSIBILITIES:**

- .1 The Contractor shall, with due care and diligence, design, to the extent provided for by the Contract, execute and complete the Work and remedy any defects therein in accordance with the provisions of the Contract. This shall include the provision of superintendence, labour, Products, Construction Equipment, Temporary Work and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects. The Contractor shall comply with and adhere strictly to the Owner's instructions on any matter, whether mentioned in the Contract or not, concerning the Work.

**4.2 CONTRACT SECURITY**

- .1 The Contractor shall, if required by the Bid Documents, provide either or both contract performance security or security for payment of claims for labour and material.
- .2 Surety bonds shall be issued by a duly incorporated surety company authorized to transact business of suretyship in the Province of Alberta.
- .3 The Owner may, for reasonable cause, object to use of the surety company proposed by the Contractor, and may require the Contractor to provide a surety bond issued by another surety company acceptable to the Owner, with no change in Contract Price.

**4.3 SITE OPERATIONS AND METHODS OF CONSTRUCTION**

- .1 The Contractor shall be fully responsible for the adequacy, stability and safety of all Site operations and methods of construction.
- .2 The Contractor shall submit at such times and in such detail as the Owner may require such information pertaining to the methods of construction (including Temporary Work and the use of Construction Equipment) which the Contractor proposes to use and such calculations of stresses, strains and deflections that will arise, in the Permanent Work or any part thereof, from the use of such methods during execution of the Work.
- .3 The Owner shall, on request from the Contractor, provide to the Contractor such design criteria relevant to the Permanent Work or any Temporary Work designed by the Owner as may be necessary to enable the Contractor to comply with clause 4.3.2.
- .4 For the purposes of this clause, "method of construction" means a method, means, technique, sequence or procedure of construction.

**4.4 DIFFERING PHYSICAL CONDITIONS OR OBSTRUCTIONS**

- .1 If, during the execution of the Work, the Contractor encounters physical obstructions or physical conditions, including sub-surface obstructions or conditions, other than weather conditions or conditions due to weather conditions, on the Site, which, in his opinion, differ substantially from those indicated in the Contract and which were not reasonably foreseeable, the Contractor shall as soon as possible give notice thereof to the Owner. On receipt of such notice, the Owner shall, if in his opinion such obstructions or conditions differ substantially from those indicated in the Contract Documents and could not have been reasonably foreseen, determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount of any costs, valued in accordance with clause 8.3, which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price.

- .2 A determination by the Owner pursuant to clause 4.4.1 shall take account of:
  - .1 the time of the Contractor's notice to the Owner of a differing physical condition or obstruction,
  - .2 any instruction which the Owner may have issued to the Contractor in connection therewith, and
  - .3 any proper and reasonable measures acceptable to the Owner, which the Contractor may have taken in the absence of specific instructions from the Owner.

#### **4.5 CLIMATIC AND WEATHER CONDITIONS**

- .1 The relevant climatological records and related information published by the Canadian Climate Centre of Environment Canada, for one or more locations in the vicinity of the Site, shall be used as a basis for any evaluations and determinations concerning climate and weather.

#### **4.6 CONTRACTOR'S SUPERINTENDENCE**

- .1 The Contractor shall provide all necessary superintendence during the execution of the Work and as long thereafter as the Owner may consider necessary for the proper fulfilling of the Contractor's obligations. The Contractor, or a competent and authorized representative approved of by the Owner, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Work. Such authorized representative shall receive, on behalf of the Contractor, instructions from the Owner.
- .2 If approval of the Contractor's representative is withdrawn by the Owner, the Contractor shall, as soon as is practicable, after receiving notice of such withdrawal, remove the representative from the Work and shall not employ him again on the Work in any capacity and shall replace him by another representative approved by the Owner.

#### **4.7 CONTRACTOR'S EMPLOYEES**

- .1 The Contractor shall provide on the Site in connection with the execution and completion of the Work and the remedying of any defects therein:
  - .1 technical assistants who are skilled and experienced in their respective trades and such foremen and others as are competent to give proper superintendence of the Work, and
  - .2 labour as is necessary for the proper and timely fulfilling of the Contractor's obligations.

#### **4.8 OWNER MAY OBJECT**

- .1 The Owner may object to and require the Contractor to remove forthwith from the Site any person who, in the opinion of the Owner, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence is otherwise considered by the Owner to be undesirable, and such person shall not be allowed on the Site without the consent of the Owner.

**4.9 SAFETY, SECURITY AND PROTECTION OF THE ENVIRONMENT**

- .1 The Contractor shall, throughout the execution of the Work and the remedying of any defects therein:
  - .1 have full regard for the health and safety of all persons upon the Site and keep the Site and the Work, to the extent that they are under his control, in an orderly state appropriate to the avoidance of danger to such persons, and
  - .2 provide and maintain at his own cost all temporary facilities and controls when and where necessary or required by the Owner or by any duly constituted authority, for the protection of the Work or for the safety and convenience of the public or others, and
  - .3 take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or any other causes arising as a consequence of his methods of operation.
- .2 The Contractor shall appoint a person at the Site who shall manage an accident prevention program. This person shall be Contractor's superintendent unless another person is appointed and approved by the Owner.

**4.10 OWNER'S RESPONSIBILITIES FOR SAFETY**

- .1 If under clause 4.18 the Owner carries out work on the Site with his own workers he shall, in respect of such work and subject to clause 4.9:
  - .1 have full regard to the safety of all persons upon the Site, and
  - .2 keep the Site in an orderly state appropriate to the avoidance of danger to such persons.
- .2 If under clause 4.18 the Owner contracts with Other Contractors on the Site he shall require them to have the same regard for safety and avoidance of danger.

**4.11 CARE OF WORK**

- .1 The Contractor shall take full responsibility for the care of the Work from the date of commencement of Work at the Site until the date of issue of the Certificate of Substantial Performance of the Work, when the responsibility for such care shall pass to the Owner, provided that:
  - .1 except where otherwise specified in the Contract, if the Owner accepts a Certificate of Substantial Performance for part of the Permanent Work the Contractor shall cease to be liable for the care of that part from the date of issue of such certificate, then the responsibility for the care of that part shall pass to the Owner, and
  - .2 the Contractor shall take full responsibility for the care of any outstanding Work which he undertakes to finish during the warranty period until such outstanding Work has been completed.



**4.12 RESPONSIBILITY TO RECTIFY LOSS OR DAMAGE**

- .1 If there is any loss or damage to the Work, or any part thereof, or to Products for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, the Contractor shall, at his own cost, rectify such loss or damage so that the Work conforms with the provisions of the Contract to the satisfaction of the Owner. The Contractor shall also be liable for any loss or damage to the Work occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under the warranty provisions of the Contract.

**4.13 HOLD HARMLESS AGREEMENT:**

- .1 The Contractor shall hold harmless the Owner from any and all third party claims, demands, or actions for which the Contractor is legally responsible, including those arising out of negligence, willful harm, or crimes by the Contractor or the Contractor's employees or agents. This hold harmless shall survive the Contract.

**4.14 REGULATORY REQUIREMENTS**

- .1 The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of:
  - .1 any Regulatory Requirements, and
  - .2 the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Work, and the Contractor shall keep the Owner indemnified against all penalties and liability of every kind for breach of any such provisions.
- .2 The Owner shall be responsible for obtaining any planning, zoning or other similar permission required for the Project to proceed.
- .3 Without limiting the Contractor's obligations under clause 4.14.1, the Contractor shall:
  - .1 comply with all requirements of and pay all fees in connection with the Workers' Compensation Act (Alberta),
  - .2 comply with the Occupational Health and Safety Act (Alberta) and all safety requirements as contained in the regulations thereto,
  - .3 ensure that wages, hours of work and other conditions of employment of all persons employed by the Contractor in the performance of any work required by the Contract are in compliance with the requirements of the Employment Standards Code (Alberta), the Labour Relations Code (Alberta) and any other applicable law, rule, regulation or order, and
  - .4 pay all fees and charges levied by a municipal authority in respect of applicable permits and licences.

**4.15 ARTIFACTS AND FOSSILS**

- .1 Coins, fossils, artifacts, structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Owner and the Contractor, be deemed to be the property of the Owner. The Contractor shall take reasonable precautions to prevent his workers or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, inform the Owner of such discovery and carry out the Owner's instructions for dealing with same. If, by reason of such instructions, the Contractor suffers delay or incurs costs then the Owner shall determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount of such costs, which shall be added to the Contract Price.

**4.16 PATENT RIGHTS**

- .1 The Contractor shall indemnify the Owner from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Product, Construction Equipment, Temporary Work or other thing used for or in connection with or for incorporation in the Work and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or specification provided by the Owner.

**4.17 ROYALTIES**

- .1 Except as otherwise provided in the Contract, the Contractor shall be liable for all tonnage and other royalties, rent and other payments or compensation, if any, for obtaining stone, sand, gravel, clay or other materials required for the Work.
- .2 The Contractor shall be liable for all payments or other compensation, if any, levied in relation to the dumping of all or part of any waste materials.

**4.18 OTHER CONTRACTORS**

- .1 The Contractor shall, in accordance with the requirements of the Owner, afford all reasonable opportunities for carrying out their work to:
  - .1 any Other Contractors of the Owner and their workers,
  - .2 the workers of the Owner, and
  - .3 the workers of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Owner may enter into in connection with or ancillary to the Work.

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- .2 Pursuant to clause 4.18.1, and except as may be provided in the Contract, the Contractor shall, on the request of the Owner:
  - .1 make available to any person referred to in clause 4.18.1, any roads or ways for the maintenance of which the Contractor is responsible, or
  - .2 permit the use, by any such persons, of Temporary Work or Construction Equipment on the Site, or
  - .3 provide any other service for any such person, the Owner shall determine an addition to the Contract Price in accordance with clause 8.3.

#### **4.19 PERMANENT WORK DESIGNED BY CONTRACTOR**

- .1 Where the Contract provides that part of the Permanent Work shall be designed by the Contractor, he shall submit to the Owner, for review:
  - .1 such drawings, specifications, calculations and other information as is necessary for the Owner's review, and
  - .2 operation and maintenance manuals, as applicable, together with drawings of the Permanent Work as completed, in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble and adjust the Permanent Work incorporating that design, and such design and any alterations thereto shall be performed by a qualified design professional licensed to practice in Alberta.
- .2 The Contractor shall not commence any work to which the information referred to in clause 4.19.1 relates unless such information has been reviewed by the Owner, and the Contractor shall not thereafter alter such design without the Owner's review.

#### **4.20 RECORDS AND AUDIT**

- .1 With respect to Cost Plus Work, the Contractor shall:
  - .1 keep accurate records of estimated and actual costs, payments made and time spent;
  - .2 keep record copies of bids, quotations, contracts, correspondence, invoices, receipts and vouchers related thereto;
  - .3 make such records available for inspection and audit by the Owner for a period of at least 2 years after the date of Total Performance of the Work;
  - .4 provide the Owner with copies and extracts therefrom when requested by the Owner; and
  - .5 afford facilities for audit and inspection by the Owner at mutually agreeable times and places.
- .2 The Contractor shall cause Subcontractors and other persons directly or indirectly controlled by or affiliated with the Contractor and persons directly or indirectly having control of the Contractor to comply with clause 4.20.1 as if they were the Contractor.

**4.21 RECORD OF LABOUR AND CONSTRUCTION EQUIPMENT**

- .1 The Contractor shall, if required by the Owner, deliver to the Owner a record in detail, in such form and at such intervals as the Owner may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Construction Equipment as the Owner may require.

**4.22 CUSTOMS**

- .1 With respect to the importation and re-export of Construction Equipment, Temporary Work, Products and other things required for the Work, the Contractor shall:
- .1 be liable for all applicable customs, import duties, taxes and brokerage fees, and
  - .2 be responsible for obtaining clearance through Customs. If requested by the Contractor, the Owner may assist in obtaining such clearance.

**4.23 URGENT REMEDIAL WORK**

- .1 If, due to any accident, or failure, or other event occurring to, in, or in connection with the Work, or any part thereof, either during the execution of the Work, or during the warranty period, any remedial or other work is, in the opinion of the Owner, urgently necessary for the safety of the Work, persons or property and the Contractor is unable or unwilling at once to do such work, the Owner may employ other persons or contract with other firms or corporations to carry out such work as the Owner may consider necessary.
- .2 If the work or repair done by the Owner pursuant to clause 4.23.1 is work which, in the opinion of the Owner, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall be determined by the Owner and shall be recoverable from the Contractor by the Owner.

**5. QUALITY OF PRODUCTS AND WORK**

**5.1 PRODUCTS AND WORKMANSHIP**

- .1 Products and workmanship shall be:
- .1 of the respective kinds described in the Contract, and
  - .2 subjected from time to time to such tests as the Owner may require at the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.
- .2 The Contractor shall:
- .1 at his cost provide all things necessary for examining, measuring, and testing Products including labour, electricity, fuels, stores, apparatus and instruments, and

- .2 supply samples of materials, before incorporation in the Work, for testing as may be selected and required by the Owner.

**5.2 COST OF SAMPLES**

- .1 All samples shall be supplied by the Contractor at his own cost if the supply thereof is provided for in the Contract.

**5.3 COST OF TESTS PROVIDED FOR**

- .1 The cost of making any test shall be borne by the Contractor if such test is:
  - .2 specified in the Contract to be performed by the Contractor, or
  - .3 in cases of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill, specified in the Contract in sufficient detail to enable the Contractor to price or allow for the same in his Bid.

**5.4 COST OF TESTS NOT PROVIDED FOR**

- .1 If the Owner requires any test which is not provided for in the Contract and such test shows the Products or workmanship not to be in accordance with the Contract, then the cost of such test shall be borne by the Contractor, but in any other case clause 5.4.2 shall apply.
  - .2 Where, pursuant to clause 5.4.1, this clause applies, the Owner shall determine:
    - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
    - .2 the amount of any costs incurred by the Contractor, which shall be added to the Contract Price.

**5.5 INSPECTION AND TESTING**

- .1 The Owner shall at reasonable times have access to the Site and to all workshops and places where Products are being manufactured, fabricated or prepared for the Work and the Contractor shall afford every facility for, and every assistance in, obtaining the right to such access.
- .2 The Owner shall be entitled, during manufacture, fabrication or preparation to inspect and test the Products to be supplied under the Contract. If Products are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Owner to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.

**5.6 DATES FOR INSPECTION AND TESTING**

- .1 The Contractor shall agree with the Owner on the time and place for the inspection or testing of any Products as provided in the Contract. The Owner shall give the Contractor not less than 48 hours notice of his intention to carry out the inspection or to attend the tests. If the Owner does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Owner, proceed with the tests. The Contractor shall forthwith forward to the Owner certified copies of the test results.

**5.7 REJECTION**

- .1 If, at the time and place agreed in accordance with clause 5.6, Products are not ready for inspection or testing or if, as a result of the inspection or testing referred to in clause 5.5, the Owner determines that the Products are defective or otherwise not in accordance with the Contract, he may reject the Products and shall notify the Contractor thereof immediately. The notice shall state the Owner's objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected Products comply with the Contract. If the Owner so requests, inspection and testing of rejected Products shall be made or repeated under the same terms and conditions.

**5.8 COST FOR INSPECTION AND TESTING**

- .1 All costs incurred by the Owner because of rescheduling, or undue delay of inspection and testing, and for which the Contractor is responsible, shall be determined by the Owner and shall be recoverable from the Contractor by the Owner.

**5.9 INDEPENDENT INSPECTION**

- .1 Inspection and testing of Products to be carried out by the Owner may be delegated to an independent agency. Any such delegation shall be effected in accordance with clause 1.3 and for this purpose such independent agency shall be considered as an assistant of the Owner.

**5.10 EXAMINATION OF WORK BEFORE COVERING UP**

- .1 The Contractor shall afford full opportunity for the Owner to examine and measure any part of the Work which is about to be covered up or put out of view and to examine exposed or excavated surfaces before any part of the Work is placed thereon. The Contractor shall give notice to the Owner whenever any such part of the Work or exposed or excavated surface is or are ready or about to be ready for examination and the Owner shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Work or of examining such surfaces.

**5.11 UNCOVERING AND MAKING OPENINGS**

- .1 The Contractor shall uncover any part of the Work or make openings in or through the same as the Owner may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of clause 5.9 and is found to be executed in accordance with the Contract, the Owner shall determine the amount of the Contractor's costs in respect of such uncovering, making openings in or through, reinstating and making good, which shall be added to the Contract Price. In any other case all costs shall be borne by the Contractor.

**5.12 REMOVAL OF IMPROPER WORK OR PRODUCTS**

- .1 The Owner shall have authority to issue instructions for:
  - .1 the removal from the Site, within such time or times as may be specified in the instruction, of any Products which, in the opinion of the Owner, are not in accordance with the Contract,
  - .2 the substitution of proper and suitable Products, and
  - .3 the removal and proper re-execution, notwithstanding any previous test thereof or progress payment therefore, of any work which is not in accordance with the Contract.
- .2 In case of default by the Contractor in carrying out instructions pursuant to clause 5.12.1 within the time specified therein or, if none, within a reasonable time, the Owner may employ other persons or contract with other firms or corporations to carry out the same, and all costs consequent thereon or incidental thereto shall be determined by the Owner and shall be recoverable from the Contractor by the Owner.

**6. COMMENCEMENT, COMPLETION, CONTRACT TIME AND DELAYS**

**6.1 COMMENCEMENT OF WORK**

- .1 The Contractor shall commence the Work as soon as is reasonably possible in accordance with the instructions contained in the Letter of Acceptance and other provisions of the Contract. Thereafter, the Contractor shall proceed with the Work without delay.

**6.2 POSSESSION OF AND ACCESS TO SITE**

- .1 If the Contractor suffers delay or incurs costs from failure of the Owner to give possession of the Site or part thereof in accordance with the provisions of the Contract, the Owner shall determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount of such costs, which shall be added to the Contract Price.

- .2 The Contractor shall bear all costs and charges for special or temporary rights-of-way required by him in connection with the Work. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Work.

### **6.3 CONTRACT TIME**

- .1 The Contractor shall achieve Substantial Performance of the Work as a whole within the Contract Time.
- .2 When the Contractor is required to achieve Substantial Performance of part or parts of the Work prior to achieving Substantial Performance of the Work as a whole, the Contractor shall achieve Substantial Performance of such part or parts of the Work within the time or times specified and such time or times shall be considered to be the Contract Time or Times for such part or parts.

### **6.4 EXTENSION OF CONTRACT TIME**

- .1 In the event of:
  - .1 a change in the Work made under clause 8.1, or
  - .2 any cause of delay referred to in the Contract, or
  - .3 abnormally adverse weather conditions, abnormal weather being defined as temperature, precipitation, humidity or wind that is outside of plus or minus one standard deviation from the mean, for the time period in question, determined pursuant to clause 4.5, or
  - .4 any delay, impediment or prevention by the Owner, or
  - .5 other special circumstances which may occur, other than through a default of or breach of Contract by the Contractor or for which he is responsible, being such as to affect an activity on the critical path of the Contractor's schedule, the Owner shall determine the extension of the Contract Time for the whole or part of the Work, to which the Contractor may be entitled.

### **6.5 CONTRACTOR TO PROVIDE NOTIFICATION AND DETAILS**

- .1 The Owner shall not be bound to make any determination pursuant to clause 6.4 unless the Contractor has:
  - .1 within 7 days after such event has first arisen notified the Owner, and
  - .2 within 14 days, or such other reasonable time as may be agreed by the Owner after such notification, submitted to the Owner details of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.



**6.6 INTERIM DETERMINATION OF EXTENSION OF TIME**

- .1 Where an event has a continuing effect such that it is not practicable for the Contractor to submit details within the period of 14 days referred to in clause 6.5.1.2, he may claim for an extension of time provided that he has submitted to the Owner interim details at intervals of not more than 14 days and final details within 14 days of the end of the effects resulting from the event. On receipt of such interim details, the Owner may make an interim determination of extension of time and, on receipt of the final details, the Owner shall review all the circumstances and may determine an overall extension of time in regard to the event. No final review shall result in a decrease of any extension of time already determined by the Owner. The Owner may determine an extension of the Contract Time notwithstanding that the Contract Time may have passed without being extended.

**6.7 RATE OF PROGRESS**

- .1 If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Work or any part is at any time, in the opinion of the Owner, too slow to comply with the Contract Time, the Owner may notify the Contractor who shall immediately take such steps as are necessary, subject to the consent of the Owner, to expedite progress so as to comply with the Contract Time. The Contractor shall not be entitled to any additional payment for taking such steps. If any steps, taken by the Contractor in meeting his obligations under this clause, involve the Owner in additional costs, such costs shall be determined by the Owner and shall be recoverable from the Contractor by the Owner.

**6.8 SUBSTANTIAL PERFORMANCE OF THE WORK**

- .1 When the whole of the Work has been substantially performed and any pre-requisites to Substantial Performance of the Work prescribed by the Contract have been met, the Contractor may so submit to the Owner a Certificate of Substantial Performance, accompanied by a written undertaking to finish without delay any outstanding work during the warranty period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Owner to accept or reject the Certificate of Substantial Performance.
- .2 The Owner shall, within 21 days after the date of receipt of the certificate referred to in clause 6.8.1, either issue to the Contractor, a letter, stating the date on which, in his opinion, the Work was substantially performed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which, in the Owner's opinion, is required to be done by the Contractor before the acceptance of such certificate. The Owner shall also notify the Contractor of any defects in the Work affecting substantial performance that may appear after such instructions and before completion of the Work specified therein. The Contractor shall be entitled to receive such notification within 21 days after completion, to the satisfaction of the Owner, of the Work so specified and remedying all defects so notified. The Owner may specify the date for Total Performance of the Work in such notice.

**6.9 SUBSTANTIAL PERFORMANCE OF PART OR PARTS OF WORK**

- .1 In accordance with the procedure set out in clause 6.8, the Contractor may submit a Certificate of Substantial Performance to the Owner in respect of any substantial part of the Permanent Work which has been substantially completed and which has been or will be occupied or used by the Owner or an Other Contractor prior to Substantial Performance of the Work as a whole, whether or not such prior occupation or use is provided for in the Contract.

**6.10 TOTAL PERFORMANCE OF THE WORK**

- .1 When the whole of the Work has been totally performed and any pre-requisites to Total Performance of the Work prescribed by the Contract have been met, the Contractor may so submit written notice to the Owner. Such notice shall be deemed to be a request by the Contractor for the Owner to issue a Certificate of Total Performance of the Work.
- .2 The Owner shall, in accordance with the procedure set out in clause 6.8.2, either issue a Certificate of Total Performance of the Work or give instructions.

**6.11 WARRANTY PERFORMANCE OF THE WORK**

- .1 The Work of the Contract shall only be considered as completed when a Certificate of Warranty Performance of the Work has been signed by the Owner and delivered to the Contractor, stating the date on which the Contractor has completed his obligations to execute and complete the Work and remedy any defects therein to the Owner's satisfaction. The Certificate of Warranty Performance of the Work shall be given by the Owner within 28 days after the expiration of the warranty period, or, if different warranty periods are applicable to different parts of the Permanent Work, the expiration of the latest such period, or as soon thereafter as any Work instructed, pursuant to clause 7, has been completed to the satisfaction of the Owner.

**6.12 ACCELERATION**

- .1 If the Owner wishes to reduce the Contract Time for the Work or any part thereof, he shall issue to the Contractor a notice thereof and an instruction requiring the Contractor to submit to him within the period specified in the instruction:
  - .1 the Contractor's priced proposals for reducing the Contract Time, together with any consequential modifications to the construction schedule, or
  - .2 the Contractor's explanation why he is unable to reduce the Contract Time.
- .2 If the Owner accepts the Contractor's proposals submitted pursuant to clause 6.12.1.1, including amendments thereto agreed by both parties, the Owner shall issue instructions to the Contractor modifying the Contract accordingly. Such instructions shall include:
  - .1 the revised Contract Time or Times,
  - .2 the modifications to the construction schedule,
  - .3 the revised Contract Price, and
  - .4 any other relevant modifications to the Contract.

- .3 The Contractor may at any time submit to the Owner proposals to reduce the Contract Time for the Work or part thereof. The Owner shall consider such proposals and if he accepts them he shall take action as in clause 6.12.2.

## **7. WARRANTY**

### **7.1 WARRANTY PERIOD**

- .1 In the Contract the term "warranty period" shall mean a period of one (1) year, or such longer period as may be provided elsewhere in the Contract, calculated from:
  - .1 the date of Substantial Performance of the Work, certified by the Owner in accordance with clause 6.8, or
  - .2 in the event of more than one certificate having been issued by the Owner under clause 6.9, the respective dates so certified, or
  - .3 in the case of outstanding work to be completed after the date or dates of Substantial Performance referred to in clauses 7.1.1.1 and 7.1.1.2, the date upon which such work is certified as complete by the Owner, and in relation to the warranty period the term "the Work" shall be construed accordingly.

### **7.2 COMPLETION OF OUTSTANDING WORK**

- .1 The Contractor shall complete work outstanding at the date of Substantial Performance of the Work within the time specified by the Owner in the Certificate of Substantial Performance of the Work.

### **7.3 REMEDYING DEFECTS**

- .1 The Contractor shall, during or as soon as practicable after the expiration of the warranty period, remedy any defects in the Work and execute any work of modification or reconstruction related thereto, as the Owner may, during the warranty period or within 14 days after its expiration instruct the Contractor to do.
- .2 Work referred to in clause 7.3.1 shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the Owner, due to:
  - .1 defects in Products or workmanship, or defects in design for which the Contractor is responsible,
  - .2 the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Owner, such necessity is due to any other cause, he may determine an addition to the Contract Price in accordance with clause 8.

**7.4 CONTRACTOR'S FAILURE TO CARRY OUT INSTRUCTIONS**

- .1 If the Contractor defaults in carrying out instructions issued pursuant to clause 7.2 or 7.3, the Owner may employ other persons or contract with other firms or corporations to carry out the same. If such work is work, which, in the opinion of the Owner, the Contractor was liable to do at his own cost, then all costs consequent thereon or incidental thereto shall be determined by the Owner and shall be recoverable from the Contractor by the Owner.

**7.5 CONTRACTOR TO SEARCH**

- .1 If any defect in the Work appears at any time prior to the end of the warranty period, the Owner may instruct the Contractor to search for the cause thereof. If such defect is one for which the Contractor is liable, the cost of the work carried out in searching shall be borne by the Contractor and he shall in such case remedy such defect at his own cost in accordance with the provisions of clauses 7.3 and 7.4. If such defect is one for which the Contractor is not liable under the Contract, the Owner shall determine the amount of the costs of such search incurred by the Contractor, which shall be added to the Contract Price.

**8. CHANGES AND VARIATIONS**

**8.1 CHANGES IN THE WORK**

- .1 Consistent with the Work, the Owner may make changes in the Work or any part thereof, and he shall have the right to instruct the Contractor to make such changes and the Contractor shall make such changes, which may include:
  - .1 increasing or decreasing the quantity of any work included in the Contract,
  - .2 omitting any work, but not if the omitted work is to be carried out by the Owner or by an Other Contractor except by reason of the Contractor's default or negligence,
  - .3 changing the character or quality or kind of any work,
  - .4 changing the levels, lines, position and dimensions of any part of the Work,
  - .5 executing additional work of any kind necessary for the completion of the Work,
  - .6 changing any specified sequence or timing of construction of any part of the Work.
- .2 No such change shall invalidate the Contract, but the effect, if any, of such changes on the Contract Price shall be valued in accordance with clause 8.3 and any extension of the Contract Time shall be determined in accordance with clause 6.4. Where an instruction to change the Work is necessitated by default or negligence of the Contractor or for which he is responsible, any cost and time attributable to such default or negligence shall be borne by the Contractor.

## 8.2 INSTRUCTIONS FOR CHANGES IN THE WORK

- .1 The Contractor shall not make any changes in the Work without a written instruction from the Owner.
- .2 No instruction shall be required for:
  - .1 an increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this clause, but is the result of quantities exceeding or being less than those stated in the Schedule of Prices, and
  - .2 a change or adjustment in lines, levels, grades or elevations when such change or adjustment is already provided for in the Contract.

## 8.3 VALUATION OF CHANGES IN THE WORK

- .1 Changes referred to in clause 8.1 and any changes to the Contract Price which are required to be determined in accordance with this clause (for the purposes of this clause referred to as "changed work"), shall be valued, at the Owner's option:
  - .1 at the rates and prices set out in the Contract if, in the opinion of the Owner, these are applicable, or
  - .2 if the rates and prices set out in the Contract are not applicable to the changed work, at rates and prices deduced or extrapolated from such rates and prices, or
  - .3 by acceptance by the Owner of rates and prices submitted by the Contractor or other rates and prices as may be agreed by negotiation, or
  - .4 by acceptance by the Owner of a lump sum quotation submitted by the Contractor or other lump sum as may be agreed by negotiation, or
  - .5 as Cost Plus Work in accordance with the provisions of Section 00630 - Payment Conditions.
- .2 If there is disagreement on the value of changed work, the Owner shall fix such rates or prices as are, in his opinion, appropriate and shall notify the Contractor accordingly. Until such time as rates or prices are agreed or fixed, the Owner shall determine provisional rates or prices to enable on-account payments to be made in accordance with the payment conditions of the Contract.

## 8.4 IMPACT OF CHANGES IN THE WORK

- .1 If in the opinion of the Owner or the Contractor the nature or amount of any changed work relative to the nature or amount of the whole of the Work or to any part thereof, is such that the rate or price contained in the Contract for any item of the Work is, by reason of such changed work, rendered inappropriate or inapplicable, then, after due consultation by the Owner with the Contractor, a suitable rate or price may be agreed upon between the Owner and the Contractor.

- .2 If there is disagreement on the rates or prices referred to in clause 8.4.1 the Owner shall fix such rate or price as is, in his opinion, appropriate and shall notify the Contractor. Until such time as rates or prices are agreed or fixed, the Owner shall determine provisional rates or prices to enable on-account payments to be made in accordance with the payment conditions of the Contract.

## **8.5 QUANTITY VARIATIONS**

- .1 The quantities set out in the Schedule of Prices are approximate only and no claim shall be made by the Contractor against the Owner on account of any excess or deficiencies absolute or relative, in the same.
- .2 The price or prices provided in the Contract whether stipulated sum or unit price or both shall be accepted by the Contractor, as full compensation for everything furnished and done by the Contractor under the Contract, including all Work required but not included in the items herein mentioned, and also for all loss or damages arising out of the nature of the Work or the action of the weather, elements, or any unforeseen obstruction or difficulty encountered in the prosecution of the work, and for all risks of every description connected with the Work, and for all expenses incurred by or in the consequence of any delay or suspension or discontinuance of the work as herein specified, and for well and faithfully completing the Work as provided in the Contract.

## **9. CHANGES IN COST AND REGULATORY REQUIREMENTS**

### **9.1 INCREASE OR DECREASE IN COST**

- .1 Subject to clause 9.2, the Contract Price shall not be subject to any adjustment in respect of rise or fall in the cost of labour, Products or any other matters affecting the cost of execution of the Contract.

### **9.2 CHANGES IN REGULATORY REQUIREMENTS**

- .1 If, after the latest date for submission of Bids for the Contract, there is a change to any Regulatory Requirement, or a new Regulatory Requirement is introduced, which causes additional or reduced cost to the Contractor in the execution of the Contract, such additional or reduced cost shall be determined by the Owner and shall be added to or deducted from the Contract Price.
- .2 When a Regulatory Requirement is changed or introduced during the period of time referred to in clause 9.2.1 but public notice thereof has been given by the applicable authority before the commencement of such period of time, the change or introduction shall be deemed to have occurred before the commencement of such period of time.

**10. CLAIMS**

**10.1 NOTICE OF CLAIMS**

- .1 If the Contractor intends to claim any additional payment he shall give notice of his intention to the Owner within 7 days after the event giving rise to the claim has first arisen.
- .2 Upon the occurrence of the event referred to in clause 10.1.1 the Contractor shall take all reasonable measures required to mitigate any loss or damage, which may be incurred as a result of such event.

**10.2 CONTEMPORARY RECORDS**

- .1 Upon the occurrence of the event referred to in clause 10.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make, including records of time and cost relating to labour, products, construction equipment and other resources used in the work. The Contractor shall permit the Owner to inspect all records kept pursuant to this clause and shall supply him with copies thereof as and when the Owner so instructs.

**10.3 SUBSTANTIATION OF CLAIMS**

- .1 Within 14 days, or such other reasonable time as may be agreed by the Owner, of giving notice under clause 10.1, the Contractor shall send to the Owner an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Owner may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Owner, the Contractor shall send a final account within 14 days after the end of the effects resulting from the event.

**10.4 PAYMENT OF CLAIMS**

- .1 The Contractor shall be entitled to have included in any progress payment such amount in respect of any claims as the Owner may consider due to the Contractor. If information is insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such information may substantiate to the satisfaction of the Owner.

**10.5 OBLIGATIONS TO AND CLAIMS OF THIRD PARTIES**

- .1 The Contractor shall, with respect to lawful obligations of and lawful claims against the Contractor or any Subcontractor arising from the Contract:
  - .1 discharge such obligations of and satisfy such claims against the Contractor, and
  - .2 ensure the discharge of such obligations of and the satisfaction of such claims against Subcontractors.

- .2 The Contractor shall, when requested by the Owner, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in Clause 10.5.1.
- .3 If a third party sends written notice to the Owner of an undischarged obligation or unsatisfied claim referred to in Clause 10.5.1, the Owner may, 30 days after giving written notice to the Contractor, and surety where applicable:
  - .1 pay any amount that is due and payable to the Contractor pursuant to the Contract directly to the obligees of and the claimants against the Contractor or the Subcontractor, and
  - .2 where security for payment of claims has been provided in the form of a security deposit, the Owner may deduct such amount from the security deposit, or
  - .3 where a security deposit has not been provided or insufficient monies are available in the security deposit, the Owner may deduct such amount, or portion thereof, from the amount payable to the Contractor under the Contract.
- .4 Clause 10.5.3 shall apply only when written notice of the obligation or claim is sent to Owner as set out in the Builders Lien Act.

## **10.6 CLAIMS AGAINST OWNER ONLY**

- .1 Any claims, demands or actions by the Contractor, arising out of alleged errors, omissions or misrepresentations in the Contract Documents or arising out of acts or omissions of the Owner's Representative or his assistants during the execution of the Work, shall be made only to or against the Owner. The Contractor waives any right to commence or carry on such claims, demands or actions against any person or party other than the Owner.

## **11. RELEASE FROM PERFORMANCE**

### **11.1 FRUSTRATION**

- .1 If any circumstance outside the control of both the Owner and the Contractor arises after the award of the Contract which renders it impossible or unlawful for either party to fulfill his contractual obligations, then the Owner or the Contractor may terminate the Contract by giving notice to the other party and, upon such notice, the Contract shall, except as to the rights of the parties under this clause and to the operation of clause 15, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

### **11.2 REMOVAL OF CONSTRUCTION EQUIPMENT ON TERMINATION**

- .1 If the Contract is terminated pursuant to clause 11.1, the Contractor shall remove from the Site all Construction Equipment.



### **11.3 PAYMENT IF CONTRACT TERMINATED**

- .1 If the Contract is terminated pursuant to clause 11.1, the Contractor shall be paid by the Owner, insofar as such amounts or items have not already been covered by payments on account made to the Contractor, for all Work executed prior to the date of termination at the rates and prices provided in the Contract and in addition:
  - .1 the cost of Products reasonably ordered for the Work which have been delivered in acceptable condition to the Contractor or of which the Contractor is liable to accept delivery, such Products becoming the property of the Owner upon such payments being made by him,
  - .2 the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Work insofar as such expenditure has not been covered by any other payments referred to in this clause,
  - .3 such proportion of the cost as may be reasonable, taking into account payments made or to be made for work executed, for removal of Construction Equipment under clause 11.2. provided that against any payment due from the Owner under this clause, the Owner shall be credited with any amounts which, at the date of termination, were recoverable by the Owner from the Contractor.
- .2 Any amount payable under this clause shall be determined by the Owner.

## **12. SUSPENSION AND TERMINATION BY OWNER**

### **12.1 SUSPENSION OF WORK**

- .1 The Contractor shall, on the instructions of the Owner, suspend the progress of the Work or any part thereof for such time and in such manner as the Owner may consider necessary and shall, during such suspension, properly protect and secure the Work or such part thereof so far as is necessary in the opinion of the Owner. Clause 12.2 shall apply unless such suspension is:
  - .1 otherwise provided for in the Contract, or
  - .2 necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible, or
  - .3 necessary by reason of normal weather conditions on the Site, or
  - .4 necessary for the proper execution of the Work or for the safety of the Work or any part thereof, except to the extent that such necessity arises from any act or default by the Owner, in which case such suspension shall be at the Contractor's expense.

### **12.2 OWNER'S DETERMINATION FOLLOWING SUSPENSION**

- .1 Where, pursuant to clause 12.1, this clause applies the Owner shall determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension.

**12.3           SUSPENSION LASTING MORE THAN 91 DAYS**

- .1       If the progress of the Work or any part thereof is suspended on the written instructions of the Owner and if permission to resume work is not given by the Owner within a period of 91 days after the date of suspension then, unless such suspension is the Contractor's responsibility pursuant to clauses 12.1.1.1 to 12.1.1.4, the Contractor may give notice to the Owner requesting permission, within 28 days from the receipt thereof, to proceed with the Work or that part thereof in regard to which progress is suspended. If, within such time, such permission is not granted, the Contractor may elect to treat the suspension, where it affects only part of the Work, as an omission of such part under clause 8.1 by giving a further notice to the Owner to that effect, or, where it affects the whole of the Work, treat the suspension as an event of default by the Owner and terminate the Contract in accordance with the provisions of clause 14, in which case the provisions of clauses 14.2 and 14.3 shall apply.

**12.4           TERMINATION OF CONTRACT**

- .1       The Owner may terminate the Contract at any time by giving a notice of termination to the Contractor. When such a notice is received by the Contractor he shall, subject to the provisions of such notice, forthwith cease all operations in performance of the Contract.
- .2       If the Owner terminates the Contract pursuant to clause 12.4.1 the Owner shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Clause 14.

**13.            DEFAULT OF CONTRACTOR**

**13.1           DEFAULT**

- .1       If the Contractor:
  - .1       is deemed by law unable to pay his debts as they fall due, or becomes insolvent, or
  - .2       enters into voluntary or involuntary bankruptcy, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or
  - .3       if any act is done or event occurs with respect to the Contractor or his assets which, under any applicable law, has a similar effect to any of the foregoing, or if he
  - .4       has contravened clause 2.1, or
  - .5       has repudiated the Contract, then the Owner may, upon written notice, enter upon the Site and the Work and immediately terminate the Contractor's right to continue with the Work.
- .2       If the Owner determines, that, in his opinion, the Contractor without reasonable excuse:
  - .1       has failed to commence and proceed with the Work or any part thereof in accordance the provisions of the Contract, or

- .2 has failed to comply with a notice issued pursuant to clause 6.7 or an instruction issued pursuant to clause 6.12 within 14 days after receiving it, or
  - .3 despite previous warning from the Owner, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the Contract, or
  - .4 has contravened clause 2.2, or
  - .5 has failed to attain Substantial Performance of the Work or part or parts of the Work within the Contract Time or Times pursuant to clause 6.3, then the Owner may, after giving 14 days notice to the Contractor, and unless the Contractor has within such period remedied the default, enter upon the Site and the Work and terminate the Contractor's right to continue with the Work in whole or in part.
- .3 If the Owner terminates the Contractor's right to continue with the Work, in whole or in part, pursuant to clause 13.1.1 or clause 13.1.2, such termination shall not release the Contractor from any of his obligations or liabilities under the Contract, and shall not affect the rights and authorities conferred on the Owner by the Contract, and the Owner may complete the Work or part thereof, or may contract with any Other Contractor to complete the Work or part thereof. The Owner or such Other Contractor may use for such completion so much of the Construction Equipment, Temporary Work and Products as he or they may think proper.

### **13.2 VALUATION AT DATE OF TERMINATION**

- .1 The Owner shall, as soon as practicable after any entry and termination by the Owner pursuant to clause 13.1, determine:
  - .1 what amount (if any) had, at the time of such entry and termination, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and
  - .2 the value of any unused or partially used Products, any Construction Equipment and any Temporary Work.

### **13.3 PAYMENT AFTER TERMINATION**

- .1 If the Owner terminates the Contractor's right to continue with the Work in whole or in part under clause 13.1, he shall not be liable to pay to the Contractor any further amount in respect of the Contract until the expiration of the warranty period and thereafter until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Owner have been determined. The Contractor shall then be entitled to receive only such sum (if any) as the Owner may determine would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Owner the amount of such excess and it shall be deemed a debt due by the Contractor to the Owner and shall be recoverable accordingly.

**13.4 ASSIGNMENT OF BENEFIT OF AGREEMENT**

- .1 The Contractor shall, if so instructed by the Owner within 14 days of the entry and termination referred to in clause 13.1, assign to the Owner the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the Contract, which the Contractor may have entered into.

**14. DEFAULT OF OWNER**

**14.1 FAILURE OF OWNER TO PAY**

- .1 If the Owner fails to pay to the Contractor any amount due under the Contract within 28 days after the expiry of the time stated in the Payment Conditions within which payment is to be made, the Contractor may terminate the Contract by giving notice to the Owner. Such termination shall take effect 14 days after the giving of such notice unless payment is received within such period.

**14.2 REMOVAL OF CONSTRUCTION EQUIPMENT**

- .1 Upon the termination of the Contract referred to in clause 14.1, the Contractor shall remove promptly from the Site all Construction Equipment.

**14.3 PAYMENT ON TERMINATION**

- .1 In the event of termination pursuant to clause 14.1 the Owner shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of clause 11, but, in addition to the payments specified in clause 11.3, the Owner shall pay to the Contractor the amount of any loss or damage, including reasonable profit, to the Contractor directly arising out of or in connection with or by consequence of such termination.

**14.4 CONTRACTOR MAY SUSPEND WORK**

- .1 As an alternative to termination under clause 14.1 but without prejudice to the Contractor's entitlement to terminate under clause 14.1, the Contractor may, after giving 14 days' prior notice to the Owner, suspend work or reduce the rate of work.
- .2 If the Contractor suspends or reduces the rate of work pursuant to clause 14.4.1 and thereby suffers delay or incurs cost the Owner shall determine:
  - .1 any extension of time to which the Contractor is entitled under clause 6.4, and
  - .2 the amount of such costs, which shall be added to the Contract Price.

**14.5 RESUMPTION OF WORK**

- .1 When the Contractor suspends work or reduces the rate of work pursuant to clause 14.4.1 and the Owner subsequently pays the amount due, the Contractor's entitlement under clause 14.1 shall, if notice of termination has not been given, lapse and the Contractor shall resume normal working as soon as is reasonably possible.

**15. SETTLEMENT OF DISPUTES**

**15.1 DISPUTES**

- .1 If a dispute of any kind arises between the Owner and the Contractor in connection with, or arising out of, the Contract or the execution of the Work, whether during the execution of the Work or after its completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Owner, the matter in dispute shall be settled in accordance with the provisions of this clause 15.
- .2 Unless the Contract has already been repudiated or terminated, the Contractor shall, during the course of any dispute settlement, and without prejudice to any claim the Contractor may have:
  - .1 proceed with the Work without delay, and
  - .2 comply with any instructions issued by the Owner with respect thereto, unless and until such instructions are revised, as hereinafter provided, in a negotiated settlement or an arbitral or judicial award.

**15.2 NOTICE OF DISPUTE**

- .1 A dispute shall be deemed to arise when the Owner or the Contractor serves on the other party a written notice of dispute stating the nature of the dispute. No notice of dispute shall be served by either party unless all other applicable provisions of the Contract have been invoked.

**15.3 NEGOTIATED SETTLEMENT**

- .1 The Owner and the Contractor shall make bona fide efforts to settle any dispute arising between them by negotiations, in accordance with this clause 15.3, and provide timely disclosure of all relevant facts, information and documents to such negotiations.
- .2 Within 14 days after the serving of a notice of dispute by one party on the other pursuant to clause 15.2, the parties shall commence negotiations for the purposes of settling the dispute. Such settlement process may include, if both parties agree, the use of mediation.
- .3 If, after 28 days, or such longer period as the parties and the mediator, if any, may agree, after the commencement of negotiations pursuant to clause 15.3.2, the parties have not settled the dispute, it shall be referred to arbitration, unless the parties mutually agree otherwise.

**15.4            MEDIATION**

- .1        If, in their efforts to reach a negotiated settlement, the parties agree to use mediation pursuant to clause 15.3.2, such mediation shall be conducted by a single mediator acceptable to both parties and under terms-of-reference established by both parties and the mediator. The parties shall share equally the cost of mediation.

**15.5            ARBITRATION**

- .1        A reference to arbitration pursuant to clause 15.3.3 shall be effected by either party serving on the other party a notice to refer the dispute to arbitration and such dispute shall be referred to a single arbitrator agreed for that purpose or, in default of agreement within a reasonable time, appointed at the request of the Owner or the Contractor by the Alberta Arbitration and Mediation Society.
- .2        A reference to arbitration under this clause shall be a reference to which the Arbitration Act (Alberta) applies and any award pursuant thereto shall bind the parties, except as otherwise provided by the Act.

**END OF SECTION**

**1. SUPPLEMENTARY CONDITIONS**

- .1 These Supplementary Conditions provide information relative to specific items not covered in other sections.

**2. WARRANTY**

- .1 The Warranty Period for all work is One (1) Year, except for roads, lanes, sidewalks, valve and manhole adjustments, for which the Warranty Period is Two (2) Years.
- .2 Thirty to sixty days prior to the end of the Warranty Period the Contractor shall apply to the Owner for acceptance of the Warranty Performance of the Work. The Owner will review the work and advise the Contractor of any defects that require remedy under the Contract. The Owner will issue a certificate of Warranty Performance of the Work, after all defects have been remedied.
- .3 No extra payment will be made for these required maintenance items.

**3. INCIDENTAL ITEMS**

- .1 The following items are incidental to the contract and no separate payment will be made for this work:
  - .1 All submittals.
  - .2 All Road Restoration beyond the Limits of Work, which have been damaged or disturbed by the Work.
  - .3 All Site Restoration beyond the Limits of Work, which have been damaged or disturbed by the Work.
  - .4 Locating, protecting, and reconnecting where necessary all existing utilities (underground and overhead) and service connections, existing trees, fences, buildings, etc.
  - .5 Working in proximity to and crossing of utilities including Alberta One-Call notification, third party locations and exposure as required.
  - .6 Public notification program.
  - .7 Road/lane closure and traffic control, providing access to existing residences, businesses or facilities as required or to provide nearby alternate parking.
  - .8 Cleaning and delivery of salvaged material removed during construction to the Owner's yard.
  - .9 Proof rolling.

- .10 Dust control.
- .11 Thrust Blocking.
- .12 Care of Water.
- .13 Removal and replacement of guardrail, fencing, signs, etc., necessary to complete the work.
- .14 Wheel cutting of asphalt.
- .15 Co-ordination of solid waste (garbage) collection with the Owner and the Town Public Works Department.

**4. IMPORT FILL REQUIREMENTS**

- .1 All import fill material to be sourced from one common site. Material must be approved by the Owner's Representative, prior to the commencement of any import fill work.

**5. DISPOSAL OF WASTE MATERIAL**

- .1 All materials having a salvage value shall be excavated and removed in such a manner that no damage shall be done to the material. Such material shall be removed, cleaned and stored at a location within the work area. At the completion of the project all salvage items shall be transferred to the Owner's Public Works yard for storage. There will be no separate payment for salvaging or transferring to storage of these items.
- .2 Unless indicated otherwise, non-salvageable materials will be excavated, transported and disposed of at the nearest sanitary landfill site. Burying of non-salvageable materials will not be allowed under any circumstances.
- .3 There will be no separate payment for Disposal of Waste Materials. The cost of Disposal of Waste Materials including the cost of materials, labour, equipment supply, excavation, handling, hauling, and disposal, shall be included in the prices bid in the Tender Form.

**6. EXISTING UTILITIES**

- .1 There may be existing utilities (gas, telephone, power, storm sewer, sanitary sewer, water mains, etc.) in the location of the contract work. Due care and attention is required in safeguarding these utilities.
- .2 Locate all buried utilities which will be affected by construction. Exposing and crossing of the utility lines to be in accordance with the requirements of the utility Owner.



- .3 Contractor to notify the Taber Irrigation District at least 48 hours in advance, prior to any interruption to, or operation required of, utilities.
- .4 No separate payment will be made for this work, unless specifically noted otherwise within the Contract Documents.

**7. SITE CONDITIONS**

- .1 A Geotechnical report for the site has been included as part of the Information Documents Section 00300. The Engineer offers no interpretation of the information provided. It is the responsibility of the Contractor to determine how the construction will proceed and to provide all necessary equipment and labour for such construction. Any unforeseen delays or costs as a result of the underground or aboveground site conditions are the responsibility of the Contractor. Should the Contractor deem it necessary to consult qualified geotechnical personnel or to have such personnel on site during the execution of this Contract, it is the Contractor's responsibility to coordinate and pay for these services.

**8. FIRE ALARM VERIFICATION**

- .1 A verification of the fire alarm system is required before the building can be occupied. An allowance for hiring of the consultant to complete the verification is to be included as part of the Extra Work Allowances.

**9. EXISTING PROPERTY PURCHASE**

- .1 This contract is subject to the completed purchase of the existing building and the property identified in the site boundaries, including the parking lot which is to be used by the contractor during the project.

**END OF SECTION**

**1. GENERAL**

**1.1 WORK OF THIS CONTRACT**

.1 The main items of Work of this Contract include the following:

**1. Emergency Services Building**

- a) Strip and pad footings
- b) Interior slab-on-grade
- c) Structural steel building complete inclusive of office and equipment bays
- d) Mechanical
- e) Electrical
- f) Finishing

**2. Site Upgrades**

- a) Waste Excavation
- b) Imported Fill Material
- c) Paved parking lot and concrete aprons and sidewalks
- d) Utilities
- e) Site Grading and Landscaping

**3. Renovations & Modifications to Existing Building**

- a) Selective Demolition
- b) Electrical
- c) Mechanical
- d) Finishing

.2 The Site of the Work of this Contract is located in the Town of Taber, Alberta.

**1.2 CONTRACT TIME**

.1 The Contract will commence on the date on which the Letter of Acceptance is issued, subject to the completion of the purchase of the existing building and property.

.2 Upon receipt of the Letter of Acceptance, promptly, and without undue delay, commence work at the Site.

.3 Attain Substantial Performance of the Work by July 10<sup>th</sup>, 2020.

.4 Attain Total Performance of the Work by August 8<sup>th</sup>, 2020.

**1.3 PERMANENT SERVICE LINES AND CONNECTIONS**

.1 Much of the fire water lines and other services going to the building and the hydrants will be installed under another contract. It will be the responsibility of this contract to coordinate the connection locations of the services and carry the piping to the building and hydrants as noted on the drawings.

- .2 As per Section 1.3.1 above, services requiring coordination under this contract are as follows:
  - .1 Water
  - .2 Sanitary
  - .3 Power
  - .4 Gas
  - .5 Telephone
  - .6 Stormwater

**1.4 USE OF THE SITE**

- .1 The Site Limits are specified in the Contract Documents. This includes the parking lot area that has been allocated for use by the Contractor.
- .2 Approximate locations of existing utility lines within the Site that are known to the Owner are specified in the Contract Documents.
- .3 Site Limits to allow for construction access are specified in the Contract Documents.
- .4 Assume responsibility for the care and protection of the existing work.
- .5 All work done in the existing Post Office or other occupied spaces will be required to be completed after working hours.
- .6 The gym in the basement of the existing building is to remain open for use by its users. Patrons will be required to use the western stairwell to access the gym.

**1.5 PUBLIC ROADS**

- .1 Determine the condition and availability of public roads, clearances, restrictions, bridge load limits, bond requirements, conditions of use, and other limitations that may affect ingress to and egress from the Site.
- .2 The section of 49 Ave that runs between the project site and the parking lot staging area may be closed for the initial portion of the project, until the building is enclosed. Contractor to provide a schedule for road closure to the town.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 MEASUREMENT SYSTEM**

- .1 This section specifies the measurement rules that will generally be used for payment purposes unless otherwise specified in the Contract Documents. In case of conflict between the method of measurement specified in this section and the requirements specified in Section 01280 – Measurement Schedule, the latter will govern.
- .2 Work will be measured in the International System of Units (SI) in accordance with CAN/CSA–Z234.1–89 Canadian Metric Practice Guide.
- .3 When used in the Contract, the following abbreviations and symbols have the meaning assigned to them.

<b>Abbreviation/Symbol</b>	<b>Meaning</b>
µm	micrometre or micron
mm	millimetre
m	metre
mm <sup>2</sup> or mm2	square millimetre
m <sup>2</sup> or m2	square metre
ha	hectare
kPa	kilopascal
MPa	megapascal
m <sup>3</sup> or m3	cubic metre
L	litre
L.S.	lump sum
g	gram
kg	kilogram
N	newton
kN	kilonewton
t	tonne
no.	number (quantity)
min	minute (time)
h	hour
d	day
wk	week
%	percent
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
\$	Canadian dollars
°	degree (angle)
°C	degree Celsius

**1.2 METHOD OF MEASUREMENT**

.1 Unless otherwise indicated in the Contract Documents:

- .1 earthwork materials will be measured net in place after compaction, with no allowance for bulking, shrinkage, compression, foundation settlement, or waste;
- .2 products will be measured net, with no allowance for waste;
- .3 dimensions used in calculating quantities will be rounded to the nearest unit of dimension as follows:

<b>Quantity</b>	<b>Dimension</b>
Volume of earth	centimetre
Volume of concrete	millimetre
Length of pipe	centimetre
Area of land	decimetre

- .4 the survey station grid system adopted will be at 10 linear metres spacing on curves and 20 linear metres spacing on tangent sections for measuring earthwork quantities, respectively;
  - .5 contours may be based on aerial photograph interpretation and are approximate only. Actual ground elevations and location co-ordinates will be determined in the field during the course of the Work for measurement purposes; and
  - .6 measurement and payment will not be made for work carried out beyond measurement and payment lines and limits specified in the Contract Documents.
- .2 When boundaries between different items of Work are not specified in the Contract Documents, such boundaries will be established by the Owner.

.3 Mass:

- .1 Mass will be measured by weigh scale or by estimated or theoretical mass taken from reference documents, as specified.
- .2 Mass will be measured to 3 decimal places.

.4 Length:

- .1 Length will be measured at the item centreline or mean chord.
- .2 Items to be measured by linear dimension will be measured parallel to the base or foundation upon which such items are placed.
- .3 Items to be measured by station will be measured horizontal to the base or foundation upon which such items are placed.

- .4 Centre line for pipes, ducts, culverts, and similar items will be the line equidistant between inside faces of pipe walls.
- .5 Area:
  - .1 For rectangular and regular shaped objects, area will be measured using mean length and width or radius.
  - .2 For irregular objects, area will be measured by the sum of squares, triangles, and circles, etc., as selected by the Owner.
- .6 Volume:
  - .1 Unless otherwise indicated, volume will be measured using mean length, width, and height or thickness.
  - .2 Excavation and fill volumes will be computed using a digital terrain modelling computer software program.
- .7 Time:
  - .1 Construction Equipment to be paid for on a time basis will be measured in hours of actual working time, and necessary travelling time, when under its own power to the nearest tenth thereof.
  - .2 Hauling equipment to be paid for on a time basis will be measured in hours of actual working time to the nearest tenth thereof.
- .8 Number of items will be measured on a per item basis.
- .9 Lump Sum items will not be measured for payment.
- .10 When standard manufactured items are identified by their physical characteristics, such characteristics will be considered as nominal. Unless more stringently controlled by specified tolerances, manufacturing tolerances established by the industry involved will be accepted.
- .11 Overhaul:
  - .1 Haul Distance will be the shortest distance, calculated as the difference between stations along the design centreline of the canal, between the centre of volume of the material in-place before excavation and the centre of volume of this material at its final point of deposition.
  - .2 Overhaul Distance means the Haul Distance minus the specified Freehaul Distance.

- .3 The Haul Distance is not the actual distance along the haul route used by the Contractor. The actual haul distance used by the Contractor will not be measured for payment
  
- .12 Borrow Overhaul:
  - .1 Borrow Haul Distance will be calculated by adding the sums of:
    - .1 the shortest perpendicular distance between the centre of volume of the material in-place before Borrow Excavation and the intersection point with the design centreline upon entering the project works, and
    - .2 the shortest distance between the intersection point as referenced above, and the centre of volume of this material at its final point of deposition, calculated as the difference between stations along the design centreline.
  - .2 Borrow Overhaul Distance means the Borrow Haul Distance minus the specified Freehaul Distance.
  - .3 The Borrow Haul Distance is not the actual distance along the haul route used by the Contractor. The actual haul distance used by the Contractor will not be measured for payment.

**1.3 MEASUREMENT COMPUTATION**

- .1 Formulae and computer programs used for measurement computation will be as specified or, when not specified, as selected by the Owner.

**1.4 MEASUREMENT OF WORK**

- .1 Unless otherwise specified, the Owner will measure the Work for the purpose of determining payment to the Contractor.
- .2 The Owner will request the Contractor to attend with the Owner in making measurements.
- .3 If the Contractor does not attend pursuant to Paragraph 1.4.2, measurements made or approved by the Owner will be considered to be the correct measurement for such part of the Work.
- .4 The Owner will prepare survey records and drawings for payment purposes as the Work progresses. The Owner will request the Contractor to attend, within 14 days, to examine and verify such records and drawings. If the Contractor does not attend to examine and verify such records and drawings, they will be considered to be correct.

- .5 If, after attending pursuant to Paragraph 1.4.2 or 1.4.4, the Contractor disagrees with such measurements or records or drawings, they will nevertheless be considered correct until the Contractor notifies the Owner of the aspects in which they are considered incorrect. On receipt of such notice, the Owner will review the measurements or records or drawings and either confirm or vary them.

## **1.5 QUANTITIES**

- .1 Unless otherwise indicated, quantities specified in the Schedule of Prices for Unit Price Work are estimated quantities and will not be considered as actual quantities of Work to be performed. Subject to the Contract terms, unit prices stated in the Schedule of Prices will be applied to actual quantities of Work performed as measured in accordance with the Contract Documents.
- .2 When it is stated that the Contractor will be paid only for the quantity specified for an item of Work, such quantity will be considered as a fixed quantity and the Contractor will be paid for the quantity specified, regardless of the actual quantity performed. If a change in the Work directed by the Owner results in a change in a fixed quantity, the quantity will be adjusted in accordance with the Contract Documents and payment will be made for the adjusted quantity.

## **1.6 SCALES**

- .1 Unless otherwise indicated, provide weigh scales, certified by Industry Canada, for measurement purposes.
- .2 Provide scales that are accurate to within 0.5% of correct mass throughout the range of use. Spring balances will not be permitted.
- .3 Prior to use and at anytime requested by the Owner, provide the services of a qualified independent person, acceptable to the Owner, for the testing and servicing of weigh scales. Perform baseline tests and record results. Service and adjust weigh scales to meet requirements of Industry Canada and the Contract Documents. Submit a final report of weigh scale tests, services, and adjustments.
- .4 Scales indicating more than true mass will not be permitted to operate and material measured subsequent to the last previous correct accuracy test will be reduced by the percentage of error in excess of 0.5%.
- .5 Scales indicating less than true mass will be adjusted and no additional payment will be made for materials previously scaled and recorded.

## **1.7 SCHEDULE OF PRICES**

- .1 The Schedule of Prices is divided into items for purposes of measurement and payment of Work. Price each item in accordance with the methods of measurement specified in the Contract.



- .2 Item names in the Schedule of Prices identify the work covered by the respective item, but do not define the size or nature of the unit.
- .3 Read item names in the Schedule of Prices as part of the item scope, measurement, and payment requirements to which they apply in the Measurement Schedule.
- .4 For each price specified in the Schedule of Prices include all costs and charges required to perform the Work including overhead charges and profit, and all costs of all related Work for which payment is not specified elsewhere.
- .5 Subject to the provisions of the Contract Documents, the total amount of the Schedule of Prices shall cover all of the Contractor's obligations under the Contract and all matters and things necessary for performance of the Work in accordance with the Contract Documents.
- .6 Payment will be made only for items specified in the Schedule of Prices. Costs and charges not directly provided for in the Schedule of Prices will be deemed to be included therein.
- .7 Work or material included in any one item will not also be measured for payment under another item. No item will be paid for more than once.
- .8 Omissions or errors in any item including quantities in the Schedule of Prices will not invalidate the Contract nor release the Contractor from any of his obligations or liabilities under the Contract.

**1.8 LUMP SUM ITEMS**

- .1 Breakdown of Lump Sum Items
  - .1 If requested, submit to the Owner a breakdown of each Lump Sum item included in the Schedule of Prices, within 21 days after the commencement date of the Contract.
  - .2 Provide sufficient details as required by the Owner to identify the principal components of the Work and to permit ready valuation of Work performed.
- .2 Lump Sum Items Paid in Accordance with a Schedule
  - .1 For Mobilization and Demobilization, Existing and Temporary Roads, and Care of Water, where payment of the respective Lump Sum amount will be made in accordance with a schedule as specified in Section 01280 – Measurement Schedule, the measurement of the completed Work by the Owner will include the amount of any work completed for Mobilization and Demobilization, Existing and Temporary Roads, and Care of Water.

**1.9 SCHEDULE OF PRICES – DIVIDED BID ITEMS**

- .1 Where Divided Bid items are included in the Schedule of Prices or the Measurement Schedule, such items shall be excluded from the provisions for variations specified in the General Conditions.
- .2 Include in the Unit Price for the first quantity of the divided item:
  - .1 costs and profit for each unit of first quantity, and
  - .2 Contractor's fixed costs for the total quantity of the divided item specified in the Schedule of Prices plus additional quantities as specified in 1.9.4 Contractor's fixed costs shall include fixed costs for labour, Products, Construction Equipment, Temporary Work and overhead.
- .3 Include in the Unit Price for the quantity of Work over the first quantity, hereinafter called the 'second quantity', cost and profit for each unit of Work, excluding fixed costs included in 1.9.2.2.
- .4 Where the actual total quantity of the Divided Bid item is less than 120% of the estimated total quantity specified in the Schedule of Prices, the Unit Prices bid for the second quantity shall apply to all quantities in excess of the first quantity.
- .5 Where the actual total quantity of the Divided Bid item is more than 120% of the estimated total quantity of the Divided Bid Item, the Contractor's fixed costs per unit of Work shall be calculated by the Owner as follows:

$$\text{Fixed costs per Unit of work} = ((\text{FQUP} - \text{SQUP}) \times \text{FQ}) / \text{TQ}$$

Where:

- FQUP – First Quantity Unit Price bid
- SQUP – Second Quantity Unit Price bid
- FQ – First Quantity in the Schedule of Prices
- TQ – Total Quantity in the Schedule of Prices

Payment for the actual quantity which exceeds 120% of the total quantity in the Schedule of Prices shall be based on the Unit Price bid for the second quantity plus the fixed costs calculated by the Owner.

- .6 The Unit Price for the second quantity of Work shall not exceed the Unit Price for the first quantity. Where a Unit Price for the second quantity of Work is greater in amount than the Unit Price for the first quantity, the Unit price and its extension will be corrected by the Owner to the Unit Price of the first quantity. Accordingly, the Bid will be evaluated and the Work will be paid for at the Unit Price of the first quantity. Contractor shall be bound to such corrected amounts.

2. **PRODUCTS** – **NOT USED**

3. **EXECUTION** – **NOT USED**

**END OF SECTION**

**1. GENERAL**

- .1 Requirements specified in this Section apply to the scope and measurement of work for purposes of determining payment under the Contract.

**2. MEASUREMENT SCHEDULE**

**2.1 SCHEDULE A: MAIN ADDITION**

**.1 Strip and Pad Footings**

- .1 Scope: Excavation, forming and pouring of foundations, backfill.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.2 Interior and Exterior Slab-on-Grade**

- .1 Scope: Forming, pouring, and finishing of slab on grade.
- .3 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.3 Structural Steel Building**

- .1 Scope: Supply and Construction of steel building as per structural and architectural drawings and specifications.
- .3 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.4 Mechanical**

- .1 Scope: Supply and install of plumbing and HVAC equipment, piping, ducting, etc for the new building as per the mechanical drawings and specifications. Includes work identified in the existing basement. Includes sprinkling of the entire building, including existing portion.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.5 Electrical**

- .1 Scope: Supply and install of electrical equipment, conduit, wiring, lighting, etc for the new building as per the electrical drawings and specifications. Includes work identified in the existing basement. Includes fire alarm for the entire building, including existing portion.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.6 Finishing**

- .1 Scope: Finishing of the new building as per the project drawings and specifications.
- .3 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**2.2 SCHEDULE B: SITE UPGRADES**

**.1 Waste Excavation**

- .1 Scope: Provision of all equipment, material and labor required for waste excavation, complete. The work includes excavating; loading, hauling, and disposal of unsuitable waste excavation material; clean-up; and all related work for which payment is not included elsewhere.
- .2 Measurement: Will be on a per cubic metre basis of waste excavation, determined by surveys and volume calculations.
- .3 Payment: Will be at the unit price bid therefor in the Schedule of Prices.
  - .1 No separate payment will be made for unnecessary excavation or excavation work performed beyond established lines or grades unless otherwise authorized by the Owners Representative.
  - .2 No separate payment will be made for waste excavation created by or as a result of the supply and installation of: pipe, granular bedding and haunching material, manholes and catch basins.
  - .3 No separate payment will be made for damages or for unstable soil conditions caused by surface drainage after the commencement of construction and during maintenance period.

**.2 Imported Fill Material**

- .1 Scope: Provision of all equipment, material and labour required for the supply and installation of suitable imported material, complete. The work includes loading, hauling, testing, moisture conditioning, placing, spreading, grading, shaping and compaction; and all related work for which payment is not included elsewhere.
- .2 Measurement: Will be on a per cubic metre basis of placed and compacted suitable material, determined by surveys and volume calculations.
- .3 Payment: Will be at the unit price bid therefor in the Schedule of Prices.

**.3 Concrete/Paving**

- .1 Scope: Removal and Installation of site hardscaping, such as concrete and pavement.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.4 Utilities**

- .1 Scope: Demolition and Installation of site utilities, including excavation, installation, backfilling, etc.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.5 Site Grading and Landscaping**

- .1 Scope: Final grading of the site, removal and replacement of top soil, grass, etc.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**2.3 SCHEDULE C: RENOVATION TO EXISTING BUILDING**

**.1 Selective Demolition – Item 1**

- .1 Scope: Selective demolition of partition walls, millwork, interior finishes, etc. within the existing portion of the building, as identified in the architectural, mechanical, and electrical drawings and specifications.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.2 Mechanical – Item 2**

- .1 Scope: Supply and install of plumbing and HVAC equipment, piping, ducting, etc for the existing building as per the mechanical drawings and specifications. Does not include the work identified in the existing basement. Sprinkling is included in schedule A.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.3 Electrical – Item 3**

- .1 Scope: Supply and install of electrical equipment, conduit, wiring, lighting, etc for the existing building as per the electrical drawings and specifications. Does not include the work identified in the existing basement. Fire alarm is included in schedule A.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**.4 Finishing – Item 4**

- .1 Scope: Finishing of the existing building as per the project drawings and specifications.
- .2 Payment: Will be made as a lump sum payment not exceeding the original amount bid for this item.

**2.4 SCHEDULE D: EXTRA WORK ALLOWANCES**

**.1 Extra Work Allowances**

- .1 Scope: Includes unforeseen work for which payment is not included elsewhere. Unforeseen work shall be approved by Owner. Also includes the required fire alarm verification. Allow for \$1500.00 per phase.
- .2 Measurement: Shall be made by the Owner after assessment of the nature of the unforeseen work. Method of measurement, extent of work and the limit of work shall be agreed to prior to commencing the unforeseen work.
- .3 Payment: Shall be made by an approved change order describing the unforeseen work and setting out the method of payment (ie. lump sum, unit price and/or force account). Payment amount shall be taken from the Extra Work Allowance provided for in the Contract.

**END OF SECTION**

**1. GENERAL**

**1.1 CO-ORDINATION**

- .1 Co-ordinate all construction activities to provide efficient and orderly construction of each and every part of the Work.
- .2 Where construction of one part of the Work is dependent on construction of other parts, schedule and co-ordinate construction activities in the sequence needed to obtain the best results.
- .3 Where availability of space is limited, co-ordinate construction of different parts of the Work to provide maximum accessibility for maintenance, service, and repair.
- .4 Make adequate provisions to accommodate Work scheduled for later construction by Other Contractors or by the Owner's own forces.

**1.2 COMMUNICATION EQUIPMENT**

- .1 Provide suitable computer equipment and software at the Contractor's office specified in this section for exchange of electronic data by e-mail of the following types of documents:
  - .1 Letters and Memos Microsoft® Word
  - .2 Document Readers Adobe Acrobat® Reader
  - .3 Schedules Microsoft® Project
  - .4 Drawings AutoCAD®
  - .5 Communication Microsoft® Outlook

**1.3 COMMUNICATION METHODS**

- .1 Communications will be sufficiently given by any one of the following methods:
  - .1 Delivered personally to the Contractor, the Contractor's representative, or left at the Contractor's address as specified in this section.
  - .2 Mailed at any post office to the Contractor's address as specified in this section.
  - .3 Couriered to the Contractor's address as specified in this section.
  - .4 Transmitted by facsimile to the Contractor's facsimile number as specified in this section.
  - .5 Transmitted by Internet to the Contractor's e-mail address as specified in this section.



**1.4 CONTRACT ADMINISTRATION**

- .1 Co-ordinate scheduling and timing of administrative procedures with other construction activities to avoid delays and provide orderly progress of the Work. Administrative procedures include the following:
  - .1 Preparation and monitoring of schedules.
  - .2 Co-ordination of construction and removal of temporary facilities.
  - .3 Co-ordination, review, and processing of submittals.
  - .4 Participation in project meetings.
  - .5 Following Contract acceptance procedures.
  - .6 Preparation of change order proposals.

**1.5 CONTRACTOR'S ADDRESS FOR CORRESPONDENCE**

- .1 Submit the name, address, telephone number, facsimile number, and e-mail address to be used for correspondence with the Contractor within 10 days of the date of commencement of the Contract. Update whenever information changes during the Contract.

**1.6 OWNER'S ADDRESS FOR CORRESPONDENCE**

- .1 The Owner will provide to the Contractor the name, address, telephone number, facsimile number, and e-mail address to be used for correspondence with the Owner within 10 days of the date of commencement of the Contract. This information will be updated as required during the Contract.

**1.7 CONTRACTOR'S REPRESENTATIVES AND SITE MANAGEMENT**

- .1 Submit an organization chart showing the names, positions, telephone numbers, and responsibilities and levels of authority for the Contractor's representatives and site management organization, within 10 days of the date of commencement of the Contract, and update whenever information changes during the Contract.

**1.8            OWNER'S REPRESENTATIVES AND ASSISTANTS**

- .1        The Owner will provide to the Contractor an organization chart showing the names, positions, telephone numbers, and responsibilities and levels of authority for the Owner's Representative and assistants, within 10 days of the date of commencement of the Contract, and will update whenever information changes during the Contract.

**2.            PRODUCTS                    –            NOT USED**

**3.            EXECUTION                        –            NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 ADMINISTRATIVE RESPONSIBILITIES**

- .1 The Owner will be responsible for administrative requirements for the following Contract meetings:
  - .1 Pre–construction
  - .2 Construction Progress
- .2 The Contractor shall be responsible for administrative requirements for the following Contract meetings:
  - .1 Workplace Orientation
  - .2 Safety
- .3 The Owner or the Contractor may request additional meetings related to installation of equipment, commissioning progress, warranty, dispute resolution, environmental issues. Unless otherwise specifically requested by the Contractor, the Owner will be responsible for administrative duties related to these meetings. The agenda for these meetings may be combined with that of the construction progress meetings.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 The administrative requirements for Contract meetings include the following:
  - .1 Scheduling and administering the Contract meetings throughout the progress of the Work.
  - .2 Preparing the agenda for the meetings.
  - .3 Distributing to the relevant attendees written notice of each meeting and the proposed agenda at least 3 days in advance of the meeting date.
  - .4 Presiding at the meetings.
  - .5 Recording the minutes including attendance, significant proceedings and decisions, and action required by the parties.
  - .6 Reproducing and distributing copies of the minutes within 7 days after each meeting to the meeting participants and affected parties not in attendance.
- .2 Representatives of the Contractor, Subcontractors, and Suppliers shall attend meetings as necessary and be authorized to act on behalf of the party each represents.

**1.3 PRE-CONSTRUCTION MEETING**

- .1 Frequency: Within 15 days after award of the Contract and prior to commencement of activities at the Site.
- .2 Purpose: To review personnel assignments, responsibilities, schedules, submissions, and administrative and procedural requirements.
- .3 Attendees:
  - .1 Contractor's representatives: senior management, site superintendent, major Subcontractors, and others as necessary.
  - .2 Owner's representatives: as determined by the Owner.
- .4 Agenda may include the following:
  - .1 Appointment of representatives of participants in the Work.
  - .2 Schedule of the Work and progress scheduling.
  - .3 Schedule of submittals.
  - .4 Requirements for temporary facilities, site signage, offices, storage sheds, utilities, and fences.
  - .5 Schedule of equipment delivery.
  - .6 Site safety and security.
  - .7 Contemplated changes, change orders, approvals required, costing and mark-up percentages permitted, time extensions, overtime, and administrative requirements.
  - .8 Products and materials provided by the Owner.
  - .9 Record documents.
  - .10 Maintenance manuals.
  - .11 Takeover procedures, acceptance, and warranties.
  - .12 Monthly progress claims, administrative procedures, and holdbacks.
  - .13 Inspection and testing.
  - .14 Insurance and transcripts of policies.
  - .15 Environmental management principles.
  - .16 Mobilization to the Site.

**1.4 CONSTRUCTION PROGRESS MEETINGS**

- .1 Frequency: Bi-weekly during the course of the Work.
- .2 Purpose: To monitor construction progress, to identify problems and actions required for their solution, and to expedite the Work.
- .3 Attendees:
  - .1 Contractor's representatives: site superintendent and, when so requested by the Owner, Subcontractors, Suppliers, and other parties involved in the Work.
  - .2 Owner's representatives: as determined by the Owner.
- .4 Agenda may include the following:
  - .1 Review and approval of minutes of the previous meeting.
  - .2 Review of the Work progress since the previous meeting.
  - .3 Field observations, problems, and conflicts.
  - .4 Problems that impede the construction schedule.
  - .5 Off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain the Contract schedule.
  - .7 Revisions to the construction schedule.
  - .8 Progress and schedule for the succeeding work period.
  - .9 Submittal schedules.
  - .10 Adherence to quality standards.
  - .11 Contemplated changes effect on the construction schedule and Contract Time.
  - .12 Contentious items of the Work.
  - .13 Contract closeout issues.
  - .14 Safety and security issues.
  - .15 Environmental issues.
  - .16 Other business.

**1.5 WORKPLACE ORIENTATION MEETINGS**

- .1 Frequency: As required for all new workers prior to commencement of Work on the Site.
- .2 Purpose: To familiarize new workers with site conditions, rules, regulations, safety, and security requirements.
- .3 Attendees: All new Contractor and Owner personnel scheduled to work on the Site.
- .4 Agenda may include the following:
  - .1 Project description including areas of work and other concurrent construction contracts.
  - .2 Hazardous areas including open excavations, construction equipment traffic, blasting, and chemical or explosive storage, etc.
  - .3 Safety equipment to be worn by workers, including areas with special requirements.
  - .4 Traffic routes on the Site.
  - .5 Evacuation procedures.
  - .6 First aid procedures.
  - .7 Excavation or work permit procedures.
  - .8 WHMIS (Workplace Hazardous Materials Information System) requirements for handling and storage of chemicals.
  - .9 Fire safety rules and regulations.
  - .10 Rules and regulations regarding wildlife, environmental concerns, drugs, alcohol, etc.

**1.6 SAFETY MEETINGS**

- .1 Frequency: Weekly during the course of the Work for each area of work.
- .2 Purpose: To review safety concerns and implement preventive safety measures.
- .3 Attendees: Contractor's and Owner's personnel for each area of work.

- .4 Agenda may include the following:
  - .1 Review and discussion of safety concerns, accidents, and “near misses.”
  - .2 Remedial or preventive actions to be taken.

2. **PRODUCTS** – **NOT USED**

3. **EXECUTION** – **NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 DEFINITIONS**

- .1 “Administrative Submittals” means data presented for review to ensure administrative requirements of the Contract are met.
- .2 “Shop Drawings” means technical data specifically prepared for work of this Contract including drawings, diagrams, schedules, templates, patterns, and similar information not in standard printed form.
- .3 “Product Data” means standard printed information describing materials, products, equipment, and systems not specifically prepared for work of this Contract. Product Data consisting of manufacturers’ standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations, and descriptive data will be accepted in lieu of Shop Drawings provided that:
  - .1 information not applicable to the work of this Contract is deleted; and
  - .2 standard information is supplemented with information specifically applicable to the Work of this Contract.
- .4 “Samples” means cuts or containers of materials or partial sections of manufactured or fabricated components that are physically identical to products proposed for use.
- .5 “Field Samples” means volumes of materials as specified, which are physically representative of the materials proposed for use.

**1.2 SCHEDULE OF SUBMITTALS**

- .1 Submittals required for the Contract are specified in each section of the Contract Documents.
- .2 Submittals required by this section are appended to this section.

**1.3 SUBMITTAL PREPARATION**

- .1 Determine and verify:
  - .1 Field measurements.
  - .2 Field construction criteria.
  - .3 Catalogue numbers and similar data.
  - .4 Compliance with the Contract Documents.
- .2 Co-ordinate each submittal with requirements of the Work and the Contract Documents.



- .3 Notify the Owner, in writing, on the submittal and at the time of submission, of any deviations from the requirements of the Contract Documents.

#### **1.4 SUBMITTAL REQUIREMENTS**

- .1 Make submittals within the times required by the Contract Documents and sufficiently in advance of the date that reviewed submittals will be required, and in such sequence as to cause no delay in the Work.
- .2 Make submittals in the form specified or in a form considered as an industry standard.
- .3 Provide a transmittal letter with each submittal containing:
  - .1 Date.
  - .2 Project Name.
  - .3 Contract Name.
  - .4 Tender Number.
  - .5 Contractor's name and address.
  - .6 Number of each Shop Drawing, Product Data, and Sample submitted.
  - .7 Other pertinent data.
- .4 Include in the submittals:
  - .1 Date and revision dates.
  - .2 Project Name.
  - .3 Contract Name.
  - .4 Tender Number.
  - .5 Name of:
    - .1 Contractor.
    - .2 Subcontractor.
    - .3 Supplier.
    - .4 Manufacturer.

.5 Name of detailer when details are not prepared by the Contractor, Subcontractor, or Supplier.

.6 The Contractor's stamp, signed, certifying its review of the submittal, verification of field measurements, and compliance with the Contract Documents, or that deviations, if incorporated, will be compatible with other elements of the Work.

**1.5 REVIEW OF SUBMITTALS**

.1 The Owner will review each submittal within 10 working days of receipt of the submittal unless specified otherwise in the Contract Documents.

.2 Make corrections or changes to reviewed submittals and resubmit as specified for the initial submission.

.3 Until a reviewed submittal is received, do not proceed with the Work related to the submittal.

.4 The Owner's review of any submittal does not relieve the Contractor from responsibility for errors and omissions, nor deviations from the requirements of the Contract Documents.

**1.6 CASH FLOW FORECAST**

.1 Submit to Owner for review, 15 days before submission of first application for payment, a forecast of approximate progress payments for the duration of the Contract.

.2 Submit revised cash flow forecasts of progress payments as the Work progresses and as requested by Owner.

**1.7 LIST OF SUPPLIERS**

.1 Submit a list of suppliers to Owner for review 15 days prior to commencement of activities at the Site.

.2 Submit revised list of suppliers as the work progresses and as requested by the Owner.

**1.8 LIST OF CONSTRUCTION EQUIPMENT**

.1 Submit a list of construction equipment to Owner for review 15 days prior to commencement of activities at the Site.

.2 Submit revised list of construction equipment as the work progresses and as requested by the Owner.

**1.9 SCHEDULE OF WORKERS**

- .1 Not applicable.

**1.10 SITE MANAGEMENT PERSONNEL**

- .1 Submit a list of site management personnel to Owner for review 15 days prior to commencement of activities at the Site.
- .2 Submit revised site management personnel as the work progresses and as requested by the Owner.

**1.11 MANPOWER SCHEDULES**

- .1 Not applicable.

**1.12 LOCAL LABOUR, GOODS AND SERVICES**

- .1 Not applicable.

**1.13 METHOD STATEMENT**

- .1 Not applicable.

**1.14 PRODUCTS LIST**

- .1 Not applicable.

**1.15 FIELD REPORTS**

- .1 Not applicable.

**1.16 PHOTOGRAPHS**

- .1 Not applicable.

**1.17 CONSTRUCTION NOTIFICATIONS - PUBLIC**

- .1 Seven days prior to construction, notify all affected businesses, institutions, facilities and residents informing them in writing of the nature of the work to be performed, how long the inconvenience will last, who to contact in the event of damages to the home, business or property, and what to do for access and alternative parking arrangements. The Contractor shall submit the proposed notification to the Owners Representative for review before issuance.

**1.18 GUARANTEES**

- .1 The Contractor shall issue a written and signed document in the name of the Owner by way of a maintenance bond certifying the work shall remain in place and free from any workmanship defects for a period of one (1) year starting from the date of final completion of work.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

- .1 Submit for review, shop drawings, product data and samples called for by the Contract Documents and for such other items as the Engineer may reasonably request.
- .2 Until submittal is reviewed, do not proceed with work involving the relevant product.

**2. SHOP DRAWINGS**

- .1 Shop drawings means technical data specially prepared for work of this Contract; including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.
- .2 Present shop drawings in a clear and thorough manner to appropriately illustrate the work.
- .3 Identify field dimensions on drawings.
- .4 Identify shop drawings by appropriate references to sheet, detail, schedule or room numbers.
- .5 Maximum drawing size: 860 x 1120 mm.
- .6 Leave a clear space of 100 mm x 75 mm on each sheet of shop drawings for placement of Engineer's review stamp.
- .7 Submit one set of PDF files for each required shop drawing.

**3. PRODUCT DATA**

- .1 Product data means standard printed information describing materials, products, equipment and systems; not specially prepared for work of this Contract, other than the designation of selections.
- .2 Clearly mark product data to identify products.
- .3 Manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and descriptive data will be accepted in lieu of shop drawings provided that:
  - .1 information not applicable to work of this Contract is deleted, and
  - .2 standard information is supplemented with information specifically applicable to the work of this Contract.

- .4 Submit clear reproducible information in PDF format.

**4. SAMPLES**

- .1 Samples means cuts or containers of materials or partial sections of manufactured or fabricated components which are physically identical to products proposed for use and which establish minimum standards by which the work will be judged.
- .2 Label samples as to origin and intended use in the Work.

**5. SUBMITTAL PREPARATION**

- .1 Review, date and sign, shop drawings, product data and samples, prior to submission.
- .2 Determine and verify:
  - .1 Field measurements.
  - .2 Field construction criteria.
  - .3 Catalogue numbers and similar data.
  - .4 Conformance with Contract Documents.
- .3 Coordinate each submittal with requirements of work and Contract documents. Individual drawings will not be reviewed until all related shop drawing and product data are available.
- .4 Notify Engineer, in writing, on the submittal and at the time of submission, of deviations from requirements of Contract Documents.

**6. SUBMISSION REQUIREMENTS**

- .1 Make submittals sufficiently in advance of date that reviewed submittals will be required and in such sequence as to cause no delay in the Work.
- .2 Accompany submittals with transmittal letter, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.

- .4 Number of each shop drawing, product data and sample submitted.
- .5 Other pertinent data.
- .3 Submittals shall include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name of:
    - .1 Contractor.
    - .2 Subcontractor.
    - .3 Supplier.
    - .4 Manufacturer.
    - .5 Name of detailer when details not prepared by Contractor, sub-contractor, or supplier.
  - .4 Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements, and compliance with Contract Documents.
- .4 Make corrections or changes to rejected submittals and resubmit, as specified for initial submission.

**7. RESPONSIBILITY FOR ERRORS, OMISSIONS AND DEVIATIONS**

- .1 Engineer's review of submittals does not relieve Contractor from responsibility for errors and omissions, nor deviations from requirements of the Contract Documents.

**8. REPRODUCTION OF SUBMITTALS**

- .1 After final review, Engineer will reproduce at his expense, the number of copies he requires, and return reviewed reproducible documents in PDF format. Contractor shall reproduce at his expense the number of copies required for performance of the Work.

**END OF SECTION**

**1. GENERAL**

**1.1 REGULATORY RESPONSIBILITY**

- .1 Conform to Regulatory Requirements and pay all fees and give all notices required by them.
- .2 Obtain approvals necessary for the Work and the Contract from the regulatory agencies having jurisdiction, except those approvals obtained by the Owner as identified in this section.
- .3 The Owner will obtain the approvals necessary for the Project that involve agreement between the Owner and the regulatory agency having jurisdiction.

**1.2 VARIATIONS BETWEEN THE CONTRACT DOCUMENTS AND THE REGULATORY REQUIREMENTS**

- .1 If the Contract Documents are at variance with Regulatory Requirements, notify the Owner in writing, requesting direction, immediately after such variance becomes known.
- .2 The Owner may make Changes in the Work due to Regulatory Requirements, and such changes will be authorized by Change Order and valued in accordance with Section 00725 - General Conditions, Article 8.3 – Valuation of Changes in the Work.
- .3 If the Contractor fails to notify the Owner in writing and obtain the Owner's direction related to variations in Regulatory Requirements and performs work knowing it to be contrary to Regulatory Requirements, the Contractor accepts responsibility for correcting violations thereof, and bears the costs, expenses, and damages attributable to the Contractor's failure to comply with the provisions of such Regulatory Requirements.

**1.3 CONTRACT DOCUMENTS**

- .1 Contractor shall not be responsible for verifying that Contract Documents comply with regulatory requirements. If Contract Documents are at variance therewith, or changes which require modification to Contract Documents are made to regulatory requirements, by authorities having jurisdiction, subsequent to date of tender closing, Contractor shall notify Engineer in writing, requesting direction, immediately such variance or change becomes known to him. Engineer may make changes required to Contract Documents and any resulting change in Contract Price or Contract Time will be made in accordance with the General Conditions of Contract.
- .2 If Contractor fails to notify Engineer in writing and obtain Engineer's direction as required in paragraph 1.3.1 and performs work knowing it to be contrary to regulatory requirements, Contractor shall be responsible for and shall correct violations thereof and shall bear costs, expenses and damages attributable to his failure to comply with provisions of such regulatory requirements.



**1.4 ALBERTA BUILDING CODE**

- .1 Conform to and perform work in accordance with the Alberta Building Code, except as otherwise indicated in Contract Documents.

**1.5 PERMITS**

- .1 Development Permit: Owner will apply for, obtain, and pay for development permit if required.
- .2 Building Permit: Owner will apply for, obtain, and pay for development permit if required.

- .1 Display the building permit and such other permits in a conspicuous location at the Place of the Work.

.3 Occupancy Permits:

- .1 Where required by authority having jurisdiction, apply for, obtain, and pay for occupancy permits, including partial occupancy permits.
- .2 Where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits, Engineer will issue appropriate instructions to correct the Work.
- .3 Turn occupancy permits over to Engineer.

**2. PRODUCTS - NOT USED**

**3. EXECUTION - NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 WORK SITE SAFETY – THIS CONTRACTOR IS “PRIME CONTRACTOR”**

- .1 For the purposes of the *Occupational Health and Safety Act* (Alberta), and for the duration of the Work of this Contract:
  - .1 be the “prime contractor” for the “work site”; and
  - .2 do everything that is reasonably practicable to establish and maintain a system or process that complies with the Act and its regulations, and as required to provide for the health and safety of all persons at the “work site.”
- .2 Direct all Subcontractors, Sub-subcontractors, Other Contractors, employers, workers, and any other persons at the “work site” on safety related matters, to the extent required to fulfil “prime contractor” responsibilities pursuant to the Act, regardless of:
  - .1 whether or not any contractual relationship exists between the Contractor and any of these entities; and
  - .2 whether or not such entities have been specifically identified in this Contract.

**1.2 CERTIFICATE OF RECOGNITION (COR)**

- .1 Maintain a valid COR for the duration of the Work of this Contract.

**1.3 SAFETY REQUIREMENTS**

- .1 Establish and maintain a system or process to provide for the safety for all persons at the Site during the Contract Time, including:
  - .1 the development and implementation of satisfactory safety plans for all aspects of work and the co-ordination of all plans;
  - .2 the establishment of a safety committee; and
  - .3 conducting safety meetings and workplace orientation meetings.
- .2 Communicate and co-operate on safety matters with the Owner and Occupational Health and Safety.
- .3 Comply with federal, provincial, and municipal legislation, including the Workplace Hazardous Materials Information System.
- .4 Rectify unsafe conditions, and be responsible for all related costs and delays.
- .5 Advise the Owner as soon as possible of all accidents.

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- .6 Investigate any accident that causes injury, and complete accident forms and prepare accident reports.
- .7 Provide and maintain a first aid room and equipment as required by the Occupational Health and Safety Regulations.
- .8 Maintain first aid supplies, space, and trained personnel on Site as required by the Occupational Health and Safety Regulations.
- .9 Have at least one qualified first aider on Site for each work shift.

**1.4 SUBMITTALS**

- .1 Provide the following submittals.
- .2 The Certificate of Recognition (COR) prior to commencing Work at the Site.
- .3 The name of the person responsible for supervision of the Contractor's safety plan at the Site prior to commencing Work at the Site.
- .4 The names of workers qualified as first aiders prior to commencing Work at the Site including monthly updates.
- .5 At the end of each month, a list of accidents including lost time injuries incurred for the month, and a cumulative summary of all accidents and total lost time including a comparison with the total work time since the start of the Contract.
- .6 Completed accident forms and reports as soon as possible.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 QUALITY CONTROL**

- .1 Establish and maintain an effective quality control system including quality control procedures and testing to ensure compliance with the requirements of the Contract Documents.
- .2 Conduct tests incorporated in the quality control system and as required in the Specifications.
- .3 Engage qualified personnel, professional engineers, and independent CSA certified materials engineering and testing companies to carry out designs and to perform tests when required by the Specifications.

**1.2 QUALITY ASSURANCE**

- .1 The Owner will perform quality assurance testing and inspection as the Owner deems appropriate.
- .2 Co-operate with the Owner and provide assistance required by the Owner for testing, inspection, and sampling; provide access including off-Site locations; and provide equipment and labour to obtain samples.
- .3 If the quality assurance testing identifies quality deficiencies, the extent of removal and replacement of potentially deficient materials will be at the discretion of the Owner and will include, at least, all related materials placed after the Owner's previous quality assurance testing indicated acceptable quality.
- .4 If the quality assurance testing identifies ongoing quality deficiencies, submit to the Owner in writing, proposed revisions to the quality control procedures and testing that will prevent quality deficiencies. Continue the work only when the proposed quality control revisions have been reviewed with no exceptions taken by the Owner and implemented by the Contractor.

**1.3 TESTING BY CONTRACTOR**

- .1 Contractor shall furnish to Engineer, upon request, test results from testing performed by Contractor.

**1.4 TESTING BY OWNER**

- .1 Owner reserves the right to employ services of independent testing agencies to establish if work complies with Contract Documents. Owner will appoint and pay for services of such testing agency.

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- .2 Where tests or inspections, by Owner appointed testing agency, indicate work is not in accordance with the Contract Documents, additional tests or inspections, as Owner may require, to verify acceptability of corrected work, shall be paid for by Contractor.

**1.5 REFERENCE STANDARDS**

- .1 Within the text of these specifications, reference may be made to the following standards:
- .1 ANSI - American National Standards Institute
  - .2 ASTM - American Society for Testing and Materials
  - .3 CGSB - Canadian General Standards Board
  - .4 CSA - Canadian Standards Association
  - .5 CAN 2- National Standard of Canada (published by CGSB)
  - .6 FM - Factory Mutual Engineering Corporation
  - .7 ULC - Underwriters Laboratories of Canada
  - .8 CAN 3 – National Standard of Canada (publish by CSA)
- .2 The testing of materials may be requested by the Owner, to prove conformance with Standards, and shall be paid for by the Contractor.
- .3 The referenced standard and any amendments in force on the day of receipt of tenders shall be applicable to the work during the duration of the Contract.

**2. PRODUCTS - NOT USED**

**3. EXECUTION - NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 EXISTING UTILITIES**

.1 Contractor's General Responsibilities

- .1 The approximate existence of service lines known to the Owner are indicated in the Contract Documents. Confirm the number, type, location and elevation of all existing service lines. Contact the appropriate Utility to locate all lines, conduits, and other such structures. Notify the Owner if any service lines have been omitted from or are incorrectly specified in the Contract Documents.
- .2 Identify, stake, and flag all existing service line locations and elevations. Maintain staking and flagging.
- .3 Notify the appropriate Utility prior to carrying out operations in the vicinity of the service lines. Comply with the requirements of, and co-operate fully with, each Utility for the location and protection of the service lines during the Work.
- .4 Be responsible to the Utility for any claims resulting from damage to the service lines as a result of the Contractor's construction operations.
- .5 Promptly notify the Utility and the Owner in the event of any damage or interruption to any services caused by the Contractor's construction operations. Co-operate with the Utility in the restoration of service as promptly as possible and bear all costs arising from the damage or interruption.
- .6 Excavation adjacent to power poles may require the poles to be supported. Contact the Owner of the power poles to determine if pole supporting is required for the construction methodology employed. Support power poles as necessary to complete the work.
- .7 At no time interfere with the operations of existing utilities.
- .8 Notify the utility owner at least 48 hours in advance of any interruption required for purposes of the work of an affected utility.
- .9 Co-ordinate extended utility shut-downs for evenings or weekends.
- .10 Co-ordinate the timing of the connections with the affected Owner of the specific utilities as required for the construction works.
- .11 Do not operate any existing water main valves and hydrants.
- .12 Only the utility owner's personnel shall operate the utility.
- .13 Advise the proper authorities and Fire Departments of hydrants which will be out of commission, so that alternate fire protection can be provided for.

- .14 Install a non-shrink grout plug at each end of any abandoned pipe that is not removed during construction.
- .15 Meet Occupational Health and Safety (OH&S) regulations and requirements for all work associated with asbestos cement water materials.
- .2 Utility Crossings
  - .1 The shallow Utility Owner(s) shall complete all relocation, modification, and repair work as highlighted in the drawings. The costs of shallow utility relocations, modifications, and repairs undertaken by the shallow Utility Owner(s) and shown on the drawings shall be borne by the Owner. All other shallow utility relocations, modifications, and repairs shall be borne by the Contractor.
  - .2 Co-ordinate all relocation, modification and repair work with the construction schedule and assist the utility Owner where needed. No separate payment will be made for this work.
- .3 Hydro Excavation
  - .1 Hydro excavation shall be used to locate and expose existing utilities to be crossed by the underground utility works.
  - .2 The hydro excavation work includes locates; hydro excavation; measuring and recording of the hydro excavation information; securing and protecting the locate holes; and sand backfill.
  - .3 No separate payment will be made for relocating of existing utilities that were previously hydro excavated and measured for payment.
  - .4 No separate payment will be made for hydro excavating of shallow utilities related to roadwork unless approved by the Owners representative.
  - .5 Provide monthly written statements to the Owners representative for the hydro excavation hours for review and approval. Keep a running total of approved hydro excavation hours to date and shall provide that information to the Owners representative upon request.

**1.2 TEMPORARY UTILITIES**

- .1 Provide the specified temporary utilities and as otherwise required in order to execute the Work expeditiously. Remove the temporary utilities from the Site upon completion of the Work unless specified otherwise.
- .2 Co-ordinate and pay for all required temporary utility work.

- .3 Temporary Power and Light
  - .1 Provide power for the Owner's Site office, as applicable.
  - .2 Arrange for connection with the appropriate Utility. Pay all costs for installation, maintenance, power consumption, and removal.
  - .3 Provide and maintain sufficient temporary power for all construction equipment required to carry out the Work.
  - .4 Provide and maintain adequate lighting to safely perform the Work. Provide white light for night construction. Avoid light pollution off the Site.
  - .5 Where failure of the normal lighting system would endanger workers, provide an emergency lighting system capable of producing sufficient dependable illumination to enable the workers to:
    - .1 leave the worksite;
    - .2 initiate emergency shut-down procedures; or
    - .3 restore normal lighting.
- .4 Temporary Heating and Ventilation
  - .1 Provide temporary heating for the Owner's Site office (as applicable) including maintenance and fuel consumption during the period of construction up to the date of Substantial Performance. Design the heating system for a temperature differential of 60°C and to be capable of maintaining a minimum temperature of 16°C.
  - .2 Provide temporary heating for construction as specified in the Contract Documents.
- .5 Temporary Water Supply
  - .1 Provide a continuous supply of potable water for the Owner's Site office, as applicable.
  - .2 Provide a continuous supply of potable water to affected residence, institutions and businesses as required in order to execute the work expeditiously. Remove the temporary utilities from the site upon completion of the work unless specified otherwise.
  - .3 Pay all costs of providing the temporary works and the potable water used for construction purposes.
  - .4 Provide and maintain appropriate temporary fire protection equipment during the performance of the work as required.



- .6 Temporary Sanitation Facilities
  - .1 Provide and maintain temporary sanitary facilities on site for work as required by legislation.
  - .2 Provide sanitation facilities for the Owner's Site office, as applicable.
  - .3 Arrange and pay all costs for installation, maintenance, and removal.
  - .4 Re-establish sanitary services to affected residences, institutions and businesses as required to execute the work as quickly as possible.
- .7 Temporary Natural Gas or Propane Supply
  - .1 Provide a continuous supply of natural gas or propane for the Owner's Site office, as applicable.
  - .2 Arrange for connection with the appropriate Utility and pay all costs for installation, maintenance, and removal.
  - .3 Pay for utility charges.

**1.3 CROSSING AGREEMENTS**

- .1 Owner has made application for all required utility crossing agreements. Do not commence work on the utility crossings portion of the project until the Owner has obtained the agreements.
- .2 Meet the requirements of the applicable crossing agreements when undertaking all utility crossing work.
- .3 A copy of the crossing agreement will be provided to the Contractor once issued.
- .4 The Owner's representative and the Owner offer no interpretation of the crossing agreements. It is the responsibility of the Contractor to determine how to utilize the information provided to determine how the proposed work will be installed; and to provide all necessary equipment and labour for such installation. Any unforeseen delays or costs as a result of the crossings are the responsibility of the Contractor.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

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**1. GENERAL**

- .1 Provide and maintain temporary buildings required to perform the Work.
- .2 Locate temporary buildings within the parking lot specified south of 49 Ave.

**1.2 SITE OFFICE**

- .1 Provide a separate building for the Owner's Site office adjacent to the Contractor's Site office in accordance with the following:
  - .1 Provide Owner's Site Office with a minimum floor area of 38 m<sup>2</sup> consisting of at least two rooms.
  - .2 Furnish the Owner's Site office with two office desks, three layout tables for plans, two filing cabinets, ten chairs, shelves, waste baskets, etc.
  - .3 Provide uniquely keyed locks with three keys for each entrance.
  - .4 Arrange and pay for weekly janitorial services for each building.
  - .5 Provide temporary utilities as specified in Section 01510 - Existing and Temporary Utilities.
  - .6 Maintain Owner's Site Office on site during the period between the start of construction and the date of Substantial Performance.

**1.3 FIRE PROTECTION**

- .1 Provide and maintain appropriate temporary fire protection equipment during the performance of the Work as required by Regulatory Requirements.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 REFERENCES**

- .1 Reference are made to standards as listed in the Specifications.
  - .1 Conform to these standards, in whole or in part, as required in the Specifications.
  - .2 Conform to the latest date of issue of the standards in effect on the date of the submission of bids, except where another date or issue is specified.

**1.2 SUBMITTALS**

- .1 Provide the following submittals.
- .2 When requested by the Owner, a complete description of the procedures for installing the product.
- .3 When requested by the Owner, appropriate design calculations for the products to be installed.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Inspect each shipment of products and timely replace any missing or damaged items.
- .2 Handle and store products in a manner to prevent damage, alteration, deterioration, and soiling, and in accordance with the manufacturer's written instructions when applicable.
- .3 Store packaged or bundled products in original and undamaged condition with the manufacturer's seal and label intact. Do not remove products from packaging or bundling until required in the Work.
- .4 Store products subject to damage from weather in weatherproof enclosures.

**2. PRODUCTS**

**2.1 PRODUCT QUALITY**

- .1 Provide products that conform to the Contract Documents, are new, not damaged or defective, and of the best quality (compatible with the Specifications) for the purpose intended. If requested by the Owner, furnish evidence as to the type, source, and quality of products provided.
- .2 Defective products, whenever identified prior to the completion of the Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility from the Contractor, but provides a precaution against oversight or error.

- .3 Unless otherwise indicated in the Contract Documents, maintain uniformity of manufacture for any particular or like items.
- .4 Do not place permanent labels, trademarks, or nameplates on products in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**2.2 PRODUCT AVAILABILITY**

- .1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are foreseeable, notify the Owner's Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In the event of failure to notify the Owner's Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Owner's Representative reserves the right to substitute more readily available Products of similar character, at no increase in Contract Price.

**3. EXECUTION**

**3.1 PRODUCT CONTROL**

- .1 Maintain an inventory of all products delivered to the Site and placed in temporary storage.
- .2 Record the use of products during the course of construction.
- .3 When requested by the Owner, provide inventory records for verification of quantities.

**3.2 TRANSPORTATION, STORAGE, HANDLING AND PROTECTION**

- .1 Pay costs of transportation of products required in the performance of Work.
- .2 Handle and store products in a manner to prevent damage, alteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .3 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and label intact. Do not remove from packaging or bundling until required in the Work.
- .4 Store products subject to damage from weather in weatherproof enclosures.
- .5 Store cementitious products clear of earth or concrete floors, and away from structures or undrained depressions.
- .6 Store and handle miscellaneous steel products and reinforcing steel by methods such that materials are not contaminated by mud, soil, dust or other debris.

- .7 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .8 Stockpile sand, gravel or processed granular materials on a well drained prepared pad with low exposure to dust accumulation.
- .9 Store sheet materials and lumber in flat, solid supports and keep clear of ground. Slope to shed moisture.
- .10 Remove and replace damaged products at own expense and to the satisfaction of the Owner.

**3.3 INSTALLATION STANDARDS**

- .1 Unless otherwise specified in the Contract Documents, install products in accordance with the manufacturer's instructions. Do not rely on labels or enclosures provided with the products. Obtain written instructions directly from the manufacturers.
- .2 Notify the Owner, in writing, of conflicts between the Contract Documents and the manufacturer's instruction, so that the Owner may establish a course of action.

**3.4 REMEDIAL WORK**

- .1 Repair or replace the parts or portions of the Work identified by the Owner as defective or unacceptable.
- .2 Retain specialists familiar with the products affected to perform remedial work in a manner that neither damages nor endangers any portion of the Work.

**END OF SECTION**

**1. GENERAL**

**1.1 DEFINITIONS**

- .1 “Proprietary Specification” means a specification that lists one or more proprietary names of products or manufacturers and may also include descriptive language, references to standards, or lists performance requirements, or any combination thereof.
- .2 “Non–proprietary Specification” means a specification that uses descriptive language, references to standards, or lists performance requirements, or any combination thereof, but does **not** include proprietary names of products or manufacturers.
- .3 “Substitute Product” means a product not specified by proprietary name that may be acceptable in place of a product which is specified by proprietary name.
- .4 “Substitute Manufacturer” means a manufacturer not specified by proprietary name that may be acceptable in place of manufacturer which is specified by proprietary name.
- .5 “Substitution” means a Substitute Product or Substitute Manufacturer.

**1.2 PRODUCT OPTIONS**

- .1 For products specified by Non–proprietary Specification:
  - .1 select any product by any manufacturer that meets the requirements of the Contract Documents.
- .2 For products specified by Proprietary Specification:
  - .1 select any product or manufacturer named; or
  - .2 select a substitute product or manufacturer in accordance with Article 1.3.
- .3 For products specified by Proprietary Specification and accompanied by words indicating that substitutions will not be accepted:
  - .1 select any product or manufacturer named; Substitutions will not be permitted.

**1.3 SUBSTITUTIONS**

- .1 Where Substitute Products are permitted, unnamed products will be authorized by the Owner, subject to the following:
  - .1 Substitute Products shall be the same types as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitute Products shall not require revisions to the Contract Documents nor to work of Other Contractors.
- .2 Do not order or install Substitutions without the Owner’s authorization.

- .3 If, in the Owner’s opinion, a Substitution does not meet the requirements of the Contract Documents, provide a product that, in the Owner’s opinion, does meet the requirements of the Contract Documents.

**1.4 CHANGES TO AUTHORIZED PRODUCTS AND MANUFACTURERS**

- .1 Do not change products or manufacturers, authorized by the Owner for use in performance of the Work, without the Owner’s written authorization.
- .2 Submit requests to change authorized products and manufacturers to the Owner in writing, including the product data indicated in Article 1.5.

**1.5 PRODUCT DATA**

- .1 When requested by the Owner, submit complete data substantiating compliance of a product with the requirements of the Contract Documents. Include the following:
  - .1 Product identification, including the manufacturer’s name and address.
  - .2 Manufacturer’s literature providing product description, applicable reference standards, and performance and test data.
  - .3 Samples, as applicable.
  - .4 Name and address of projects where the product has been used and the date of each installation.
  - .5 For Substitutions and requests for changes to authorized products, include, in addition to the above, the following:
    - .1 Itemized comparison of the substitution with the named product(s). List significant variations.
    - .2 Availability of maintenance services and sources of replacement products and parts.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 SURVEY REFERENCE POINTS**

- .1 Primary horizontal and vertical survey reference points have been established by the Owner as specified in the Contract Documents. The Owner is responsible for the accuracy of the primary survey reference points.
- .2 Locate, confirm, and protect primary reference points prior to starting Work on the Site. Preserve permanent reference points during construction.
- .3 Make no changes to or relocations of the primary survey reference points without prior written authorization of the Owner.
- .4 Report to the Owner when a reference point is lost or damaged, or requires relocation because of the Work.
- .5 Replace damaged reference points in accordance with the original survey control.

**1.2 CONTRACTOR SURVEY WORK**

- .1 Employ qualified construction surveyors to perform survey work.
- .2 Record survey data in accordance with standard survey methods in a form acceptable to the Owner.
- .3 Establish secondary survey reference points required for laying out and staking the Work and for checking tolerances. Be solely responsible for the accuracy of the secondary survey reference points and the layout, staking, and checking of the Work.
- .4 Establish lines, grades, and elevations, and locate and lay out the Work.
- .5 Provide final grade staking of each line, grade or elevation required for the Owner's checking of the work and for measurement for payment purposes, as defined in Section 01280 – Measurement Schedule, for checking by the Owner. Maintain final grade stakes in place until the Owner has authorized their removal.
- .6 Provide such assistance as may be required by the Owner for carrying out surveys in Article 1.4.
- .7 Establish and maintain survey reference points in all work areas, including elevations and locations relative to established stationing and offset systems or otherwise required by the Owner. Provide reference points within 50 m horizontal distance and 2 m vertical distance of all locations where testing, observations of conditions, or other similar activities are undertaken by the Owner, such that the Owner can establish the location and elevations at those locations.



**1.3 GLOBAL POSITIONING SYSTEMS (GPS)**

- .1 If GPS controlled excavation and trimming equipment is utilized in conjunction with GPS final grade checking, the Owner may waive the requirement for final grade stakes if the accuracy and consistency of the final grade check can be demonstrated.
- .2 If the final grade stake requirement is waived provide a surface grade sheet in electronic and hard copy of the electronic survey data in a format acceptable to the Owner.
- .3 The surface grade sheet to include the following minimum information.
  - .1 Station.
  - .2 Offset left or right of the centerline.
  - .3 Design elevation at the grade line break point.
  - .4 Actual elevation at the grade line break point.
  - .5 Deviation of the actual elevation from the design elevation.
  - .6 Indication if deviation is within specified tolerances.

**1.4 OWNER'S SURVEY REQUIREMENTS**

- .1 The Owner may carry out surveys, as the Owner deems necessary, to check the accuracy of the Contractor's layout and stakes.
- .2 The Owner will carry out surveys for the purpose of measuring the Work for payment.

**1.5 SUBMITTALS**

- .1 Provide the following submittals.
  - .2 The name and address of the Contractor's surveyor to the Owner prior to commencing the Work at the Site.
  - .3 When requested, submit a copy of reduced notes for surveys or portions of surveys to the Owner.
  - .4 A certificate signed by the Contractor's surveyor confirming that the lines, grades, elevations, and dimensions of the completed Work are in conformance or not in conformance with the Contract Documents. Provide details of all non-conformances.
  - .5 Electronic survey data files in a format acceptable to the Owner.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

- .1 Perform final cleaning operations prior to the request for inspection for Total Performance.
- .2 Remove surplus products, tools, construction machinery, and equipment not required for the performance of the remaining Work prior to the request for inspection for Substantial Performance.
- .3 Remove waste products and debris resulting from the Work of the Contractor, and leave the Work clean and suitable for use by the Owner.
- .4 Repair, patch, and touch-up marred surfaces to match adjacent finishes.
- .5 Leave all surfaces in a neat, levelled condition.
- .6 Excavate and dispose of contaminated soils from equipment service and maintenance areas.
- .7 Excavate and dispose of excess soils including impervious, random, granular, and riprap materials.
- .8 Clean up and dispose of all foreign matter including wire, posts, logs, branches, roots, rocks, and construction debris.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 SUMMARY OF PROCESS**

- .1 A Contract acceptance process will be used to facilitate the Owner's acceptance of the Work. The process can be summarized as follows:
  - .1 Substantial Performance of the Work:
    - .1 Fulfilment of prerequisites to Substantial Performance.
    - .2 Inspection for Substantial Performance.
    - .3 Issuance of a Certificate of Substantial Performance.
  - .2 Total Performance of the Work:
    - .1 Fulfilment of prerequisites to Total Performance.
    - .2 Inspection for Total Performance.
    - .3 Issuance of a Certificate of Total Performance.
  - .3 Warranty Performance of the Work:
    - .1 Fulfilment of prerequisites to Warranty Performance.
    - .2 Inspection for Warranty Performance.
    - .3 Issuance of Certificate of Warranty Performance.

**1.2 SUBSTANTIAL PERFORMANCE OF PART OF THE PERMANENT WORK**

- .1 When utilization of part of the Permanent Work is required and Substantial Performance of part of the Permanent Work is a condition of such utilization, the applicable requirements specified in this section will apply to the part of the Permanent Work to be utilized.

**1.3 PREREQUISITES TO SUBSTANTIAL PERFORMANCE**

- .1 Prior to requesting the Owner's inspection for Substantial Performance carry out the following:
  - .1 Obtain and submit evidence of compliance with Regulatory Requirements.
  - .2 Remove from the Site temporary facilities along with construction tools, equipment, mock-ups, and similar items not required for the performance of the remaining work.

- .3 Complete the Work and have it ready for the purpose intended use.
- .4 Review the Contract Documents and inspect the Work to confirm that prerequisites to Substantial Performance have been fulfilled and that the Work is ready for inspection for Substantial Performance.
- .5 Submit product warranties and extended warranties when specified in the Contract Documents.
- .6 Make final change-over of locks and transmit keys to the Owner.
- .7 Complete installation of architectural finish items, including all mechanical and electrical covers and trims.
- .2 Complete all work items such that the Operation and Maintenance Building can be used for the purpose intended. Work that does not have to be completed to obtain Substantial Performance follows:
  - .1 Final Commissioning: wet testing of gates.
  - .2 Operation and maintenance manuals.
  - .3 Record drawings
  - .4 Final cleanup
  - .5 Removal of the Owner's site office.

#### **1.4 INSPECTION FOR SUBSTANTIAL PERFORMANCE**

- .1 Submit a written request to the Owner for inspection for Substantial Performance, certifying that prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed, corrected, or submitted.
- .2 The Owner will, within a reasonable time after receipt of the Contractor's request:
  - .1 proceed with the inspection; or
  - .2 advise the Contractor that prerequisites are not adequately fulfilled.
- .3 Results of the Owner's inspection for Substantial Performance will form the Substantial Performance Contract Deficiency List (SPC Deficiency List).

#### **1.5 SUBSTANTIAL PERFORMANCE OF THE WORK**

- .1 Following inspection, the Owner will:
  - .1 issue a Certificate of Substantial Performance of the Work stating the effective date of Substantial Performance, with a copy of the SPC Deficiency List attached; or
  - .2 advise the Contractor that prerequisites to Substantial Performance are not fulfilled and repeat the inspection for Substantial Performance as necessary.

- .2 Upon issuance of a Certificate of Substantial Performance of the Work, the Owner will assume responsibility for care, custody, and control of the Work, including responsibility for the following:
  - .1 Facility operation, including all systems and equipment.
  - .2 Maintenance.
  - .3 Security.
  - .4 Property insurance.
  - .5 Utility costs.

**1.6 PREREQUISITES TO TOTAL PERFORMANCE**

- .1 Prior to requesting the Owner's inspection for Total Performance carry out the following:
  - .1 Perform the entire Work, including the correction of all Contract Deficiencies, and except those items arising from the warranty provisions of the Contract Documents.
  - .2 Review the Contract Documents and inspect the Work to confirm that prerequisites to Total Performance have been met and that the Work is ready for inspection for Total Performance.

**1.7 INSPECTION FOR TOTAL PERFORMANCE**

- .1 Submit a written request to the Owner for inspection for Total Performance, including a copy of the Owner's most recent SPC Deficiency List, and certify that each Contract Deficiency has been corrected or otherwise resolved in a manner agreed to between the Owner and the Contractor. List known exceptions, if any, in the request.
- .2 The Owner will, within a reasonable time after receipt of the Contractor's request:
  - .1 proceed with the inspection; or
  - .2 advise the Contractor that prerequisites are not adequately fulfilled.

**1.8 TOTAL PERFORMANCE OF THE WORK**

- .1 Following the inspection, the Owner will:
  - .1 issue a Certificate of Total Performance of the Work, stating the effective date of Total Performance; or
  - .2 advise the Contractor of Contract Deficiencies that must be corrected prior to issuance of a Certificate of Total Performance of the Work.

**1.9 PREREQUISITES TO WARRANTY PERFORMANCE**

- .1 The prerequisites to Warranty Performance are:
  - .1 Total Performance of the Work;
  - .2 expiry of the warranty period; and
  - .3 correction of items arising from the warranty period required by the Contract Documents.

**1.10 INSPECTION FOR WARRANTY PERFORMANCE**

- .1 Just prior to the end of the warranty period, the Owner will conduct an inspection for Warranty Performance.

**1.11 WARRANTY PERFORMANCE OF THE WORK**

- .1 Following the inspection, the Owner will:
  - .1 issue a Certificate of Warranty Performance of the Work; or
  - .2 advise the Contractor of items that must be corrected prior to issuance of the Certificate of Warranty Performance of the Work.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 DESIGNATION OF CONTRACT RECORD DOCUMENTS**

- .1 At the commencement of the Work, the Owner will provide the following documents to be designated and retained as Contract Record Documents:
  - .1 One copy of the Specifications.
  - .2 Two complete sets of the Drawings.
  - .3 One set of all addenda issued.
- .2 Maintain one record copy of the following:
  - .1 Change Orders and other modifications to the Contract.
  - .2 Reviewed Shop Drawings, Product Data, and Samples.
  - .3 Field-test records.
  - .4 Inspection certificates.
  - .5 Manufacturers' certificates.
  - .6 Final survey data.
  - .7 Environmental Construction Operations Plan

**1.2 MAINTENANCE OF CONTRACT RECORD DOCUMENTS**

- .1 Store Contract Record Documents in the Contractor's Site office apart from documents used for construction. Provide files, racks, and secure storage.
- .2 Label each document "CONTRACT RECORD" in large, neatly printed letters.
- .3 Maintain Contract Record Documents in a clean, dry, and legible condition. Do not use these documents for construction purposes.
- .4 Keep Contract Record Documents available for inspection by the Owner. Revise the content of the documents as required prior to final submittal.
- .5 Maintain Contract Record Documents as work progresses. Record information for each area of work within 14 days after completion.

**1.3 RECORDING INFORMATION ON CONTRACT RECORD DOCUMENTS**

- .1 Record information on the Contract Record Documents provided by the Owner.
- .2 Use coloured erasable pencils to record information.
- .3 Use a different colour to record information pertaining to each major system.
- .4 Record changes and variations from the Drawings concurrently with construction progress. Do not cover any work until the required information is recorded.
- .5 Legibly mark Contract Record Drawings to record actual construction, including the following:
  - .1 Measured dimensions, depths, elevations, and horizontal co-ordinates of foundation excavations and fill surfaces, including the interfaces of fill zones.
  - .2 Measured dimensions, elevations, and horizontal co-ordinates of structure components and foundations.
  - .3 Measured depths, elevations, and horizontal co-ordinates of underground utilities and appurtenances. Reference locations to permanent surface improvements.
  - .4 Measured depths, elevations, and horizontal co-ordinates of internal utilities and appurtenances covered in construction. Reference to visible and accessible features of construction.
  - .5 Measured depths, elevations, and horizontal co-ordinates of instrumentation installed in foundations and structures.
  - .6 Field changes of dimensions and details.
  - .7 Changes to equipment layout and services.
  - .8 Details not on the original Drawings.
  - .9 References to related Shop Drawings and modifications.
- .6 Legibly mark the Specifications to record actual construction including the following:
  - .1 Manufacturer trade name and catalogue number of each product actually installed, particularly optional and substitute items.
  - .2 Changes made by addenda and Change Orders.
- .7 Maintain other documents including manufacturer's certifications, inspection certifications, field test records required by individual Specification sections.



**1.4 SUBMITTALS**

- .1 Provide the following submittals.
- .2 Prepare Contract Record Drawings at least monthly throughout the course of the Work as the information becomes available or the information is received. The Owner's representative will check the Contract Record Drawings and confirm the accuracy of the information by field notes, surveys, photographs, or other field observation methods and return the Contract Record Drawings to the Contractor after review for ongoing revisions.
- .3 Completed Contract Record Documents before or with the request for inspection for Total Performance. The owner reserves the right to withhold monies until record documents are provided.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1. GENERAL**

**1.1 DESCRIPTION OF TYPES OF OPERATION AND MAINTENANCE DATA**

- .1 The following documents are designated as Operation and Maintenance Data.
- .2 For systems designed by the Contractor, Contractor Designed System Data includes the following:
  - .1 System Design and Performance Criteria.
  - .2 System and Controls Descriptions.
  - .3 System and Controls Schematics.
  - .4 Operating Instructions.
  - .5 Equipment Data.
  - .6 Other data as required by the Owner.
- .3 Installation Instructions includes the manufacturer's printed instructions describing the recommended installation procedures, and photographs, video footage, and computer software.
- .4 Operating Instructions includes the manufacturer's printed instructions describing proper operation, and photographs, video footage, and computer software.
- .5 Equipment Identification includes the nameplate information for each piece of equipment, in a form, and with content acceptable to the Owner.
- .6 Maintenance Instructions includes the manufacturer's printed instructions describing the manufacturer's recommended maintenance and photographs, video footage, and computer software.
- .7 Spare Parts Lists includes parts lists and the manufacturer's recommended maintenance products and spare parts.
- .8 Suppliers and Contractors List includes a list of Contractor, Subcontractors, and Suppliers who supplied and installed equipment, systems, materials, or finishes, organized by the Division of Specifications and system, and company names, addresses, and telephone numbers.
- .9 Tag Directory includes a directory identifying tag number and equipment description and location.
- .10 Drawings List includes a list of Drawings.

- .11 Shop Drawings includes the final reviewed Shop Drawings.
- .12 Product Data includes the manufacturer's product data for equipment, systems, materials, and finishes, and photographs, video footage, and computer software.
- .13 Material Safety Data Sheets (MSDS) includes the MSDS for all relevant products.
- .14 Certifications includes the following:
  - .1 Copies of inspection reports prepared by authorities having jurisdiction.
  - .2 Certified copies of test reports prepared by independent testing agencies.
  - .3 Any other certificates required by the Contract Documents.
- .15 Warranties and Bonds include the Owner's copy of manufacturer's warranties, maintenance bonds, and service contracts.
- .16 Reports includes the following:
  - .1 Documentation certifying the performance of tests required by the Contract Documents and the results of those tests.
  - .2 Documentation of other material, equipment, or system related information required by the Contract Documents.

**1.2 OPERATION AND MAINTENANCE MANUAL BY THE CONTRACTOR**

- .1 Prepare the operation and maintenance manual as follows:
- .2 General organization of each volume: (Three volumes are required as a minimum)
  - .1 Include the following in each volume:
    - .1 Title page.
    - .2 Table of contents. Identify volume number where listed information is located.
    - .3 Ten percent free space for additional data.
  - .2 Present textual information, schematics and data on 21.5 X 28 cm, 75 g/m<sup>2</sup>, white bond paper.
- .3 Manual contents organization:
  - .1 For each major equipment, system, materials or finishes area, organize operation and maintenance data as follows:

- .1 Operation Division: include the following, as applicable:
  - .1 System Design Criteria.
  - .2 System and Controls Descriptions.
  - .3 System and Controls Schematics.
  - .4 Operating Instructions.
- .2 Maintenance Division: include the following, as applicable:
  - .1 Maintenance Tasks and Schedules.
  - .2 Spare Parts.
  - .3 Suppliers and Contractors.
  - .4 Tags and Directories.
- .3 Contract Document Division: include the following, as applicable:
  - .1 Drawings List.
  - .2 Shop Drawings and Product Data.
  - .3 Certifications.
  - .4 Warranties and Bonds.
  - .5 Maintenance Brochures.
  - .6 Reports.
- .4 Document Binding Methods
  - .1 Standard 21.5 X 28 cm sheets: punch sheets to fit binder.
  - .2 Sheets up to 28 X 41.5 cm: punched and neatly folded to allow use without removing from binder.
  - .3 Drawings larger than 28 X 41.5 cm: insert drawings in sturdy vinyl envelopes with reinforced binding holes, open on one side and overall folded size not exceeding 21.5 X 28 cm. Do not punch holes in drawings.

.5 Binders

- .1 Commercial quality, fabric coated, hard covers attached to spine with metal piano hinges, three post, designed to accommodate 21.5 X 28 cm paper. Maximum 100 mm thick.
- .2 Silk-screen project title and identification, in gold, on front cover and spine of binder. All binders to be forest green with gold lettering.
- .3 Covers to read as follows:

Operation and Maintenance  
Manual

Town of Taber

Emergency Services Building

{Date}

Prime Consultant: MPE Engineering Ltd.

General Contractor:

Mechanical Contractor:

Electrical Contractor:

The Spine to read as follows:

Operation and Maintenance  
Manual

Town of Taber

Emergency Services Building

{Date}

.4 Divider tabs:

- .1 Heavy-weight coloured paper, mylar laminated with tab number and title printed on tab as follows.
- .2 Main divisions: white tabs, labelled with division name, 2 bank tab length.
- .3 Sections of a main division: colour coded tabs, labelled with section name, 4 bank tab length.
- .4 Subsections: same colour tabs as the section, printed label, 8 bank tab length.

.5 Co-ordinate tab colour codes and labelling format with the Owner.

**1.3 SUBMITTALS**

.1 Provide the following submittals:

.1 One draft copy of the operation and maintenance manual prior to requesting inspection for Substantial Performance.

.2 Three copies and one digital copy of the completed operation and maintenance manual prior to requesting inspection for Total Performance.

.2 The Owner reserves the right to withhold any amount of payment up to a maximum of \$20,000 until the Contractor provides satisfactory copies of the O&M manuals.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**1415-057-00**

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**1. GENERAL**

**1.1 SOURCE OF SUPPLY**

- .1 Provide spare parts manufactured by original equipment manufacturer.
- .2 Provide maintenance materials identical to those installed.

**1.2. DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by Owner.
- .2 Deliver and store items in original factory packaging or other securely packaged form.
- .3 Identify, on carton or package, name of item, colour or part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.
- .4 Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.
- .5 Stored items shall remain in Contractor's care, custody, and control until the completion of the Work. Protect stored items against theft or damage.
- .6 Handle items as necessary, until stored in permanent locations designated by Owner's Representative.

**1.3 ACCEPTANCE**

- .1 Prior to requesting Owner's final inspection, do the following:
  - .1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.
  - .2 Verify that items listed on inventory list are in there designated storage locations.
  - .3 Inspect items to verify that they meet specified requirements and are in serviceable condition.
  - .4 Arrange for delivery of any missing items.
  - .5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.

- .6 Provide Owner with copy of inventory list indicating status of all required items.
- .2 Review inventory list with Owner's Representative during final inspection.
  
- 2. **PRODUCTS** – **NOT USED**
  
- 3. **EXECUTION** – **NOT USED**
  
- END OF SECTION**



**1. GENERAL**

**1.1 DEFINITIONS**

- .1 “Commissioning” means a series of activities including start-up and testing of equipment and systems, and instructing the Owner on operation and maintenance that bring the Work to a fully operational state. Completion of Commissioning is a prerequisite to Substantial Performance of the Work.
- .2 “Initial Commissioning” means the partial commissioning of the systems and equipment under the specified conditions except where the presence of water is required. Completion of Initial Commissioning is a prerequisite to Substantial Performance of the Work.
- .3 “Final Commissioning” means the completion of the commissioning of the systems and equipment once water is available. Completion of Final Commissioning is a prerequisite to Total Performance of the Work.

**1.2 GENERAL COMMISSIONING REQUIREMENTS**

- .1 Perform the following services during Commissioning:
  - .1 Develop a Commissioning plan outlining the activities to be conducted and the schedule for their completion.
  - .2 Provide a qualified supervisor to oversee all work.
  - .3 Comply with standards set out by the certifying association under whose standard services will be provided.
  - .4 Provide access to all equipment and services. Co-operate with the Owner.
  - .5 Provide all instrumentation, equipment, and materials required for Commissioning.
  - .6 Undertake all pre-start inspections, preparations, checks, and tests.
  - .7 Advise the Owner in writing, at least 5 days prior to performing the specified operational testing. Perform testing in the presence of the Owner, and where required, in the presence of the manufacturer’s representative.
  - .8 Conduct operational tests, record results, and note all deficiencies.
  - .9 Diagnose deficiencies, determine causes, and take corrective actions. Document each deficiency, cause, and corrective action taken.
  - .10 Repeat Commissioning activities as required to verify that deficiencies have been corrected.

- .11 Demonstrate the operation of the systems and equipment to the Owner's personnel.
- .12 Provide training for the Owner's personnel.
- .13 Complete Commissioning records.

**1.3 COMMISSIONING RECORDS**

- .1 Provide Commissioning reports including systems and equipment checklists for all commissioning activities.
- .2 Provide equipment checklists to facilitate installation and servicing of equipment. Prepare equipment checklists in a form acceptable to the Owner, and include the following:
  - .1 Name of the company and the personnel performing the inspection, including the date and time.
  - .2 Equipment manufacturer and model number.
  - .3 Equipment capacity.
  - .4 Operating voltage and grounding requirements.
  - .5 Operating amperage.
  - .6 Safety devices.
  - .7 Operating characteristics.
  - .8 Equipment operating fluids and fuel requirements.
- .3 Complete the checklist for each piece of equipment as it is inspected and checked for proper installation and servicing prior to start-up.
- .4 Provide Commissioning reports in a form acceptable to the Owner, and include the following:
  - .1 Completed equipment checklists.
  - .2 Name, address, and telephone number of the company and the names of the personnel performing the Commissioning, and the date, time, and site conditions during Commissioning.
  - .3 Equipment start-up tests and records performed by the manufacturer and the Contractor.
  - .4 Operational testing and adjusting records.

- .5 Deficiency records including diagnosis, causes, and corrective actions taken.

**1.4 CONSTRAINTS**

- .1 Additional separate cycles of commissioning by the Contractor may be necessitated at a later time on equipment and systems where Commissioning is dependent on operational or seasonal conditions.
- .2 Perform Final Commissioning for all components that depend on the availability of water in the canal.

**1.5 TRAINING**

- .1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment.
- .2 Train the Owner's personnel at the established times and location on all phases of the operation and maintenance.
- .3 Provide all instruction aids.
- .4 The Owner will provide a list of personnel to receive training, and will schedule and co-ordinate their attendance with the Contractor.

**1.6 SUBMITTALS**

- .1 Provide the following submittals.
- .2 A Commissioning plan at least 15 days prior to starting the Commissioning.
- .3 Commissioning reports no later than 10 days after the Initial and Final Commissioning is completed.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Site Clearing and Grubbing” specified herein.

**1.2 PROTECTION**

- .1 Protect trees, shrubs and other vegetation to remain in place, against unnecessary cutting, breaking and any other damage.
- .2 Protect from damage fences, roadways and other existing site improvements that are to remain.
- .3 Protect bench marks and reference points from damage.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 INSPECTION**

- .1 Inspect site and verify with the Owner’s Representative clearing and grubbing limits and items designated to remain.

**3.2 GENERAL**

- .1 Confirm clearing and grubbing procedures with Owner’s Representative.
- .2 Locate and protect underground and service utilities.
- .3 Notify utility agencies before starting site clearing and grubbing.
- .4 Remove all concrete, logs, trees, brush, stumps, roots and all objectionable material above the ground or on the ground surface.
- .5 Remove all stumps, roots and other deleterious materials to 0.3 m below the ground surface.
- .6 Remove visible rock fragments and boulders greater than 300mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .7 Temporarily stockpile material within the site until conditions are suitable for disposal.

**3.3            DISPOSAL**

- .1        Dispose of cleared and grubbed material by hauling to disposal off-site.
  
- .2        Excavate, load, transport and dispose of all materials off-site to the nearest qualified sanitary landfill site.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for the location, use and placement of “Demolition, Removal and Salvage” requirements specified herein.

**1.2 DEFINITIONS**

- .1 For the purpose of construction in this Contract, the following definitions apply:
  - .1 “Salvageable” is defined as all materials having salvage value.
  - .2 “Non-salvageable” is defined as all material having no salvage value.

**2. PRODUCTS**

- .1 Not Applicable.

**3. EXECUTION**

**3.1 INSPECTION**

- .1 Inspect site and verify with the Owner’s Representative items to be demolished, removed, and salvaged.

**3.2 SALVAGEABLE MATERIALS**

- .1 All materials having a salvage value will be excavated and removed in such a manner that no damage will be done to the material. Salvaged material will be removed, cleaned and stored at a location within the work area. At the completion of the project all salvage items will be transferred to the Owner’s facility for storage. There will be no separate payment for salvaging or transferring to storage of these items.

**3.3 DEMOLITION AND NON-SALVAGEABLE MATERIALS**

- .1 Unless indicated otherwise, demolition and non-salvageable materials will be excavated, transported and disposed of at a licensed landfill. Burying of demolition and non-salvageable materials will not be allowed under any circumstances.
- .2 Asbestos cement pipe and materials are to be handled, removed and disposed of according to OH&S regulations and guidelines and the “*Alberta Asbestos Abatement Manual*”, latest edition by Alberta Employment and Immigration.
- .3 The Contractor will bear the cost of all disposal fees.

**3.4            REMOVAL OF CONCRETE MATERIALS**

- .1      Saw cut the concrete as required for all concrete removal work and as indicated by the Owner's Representative. All cutting to be approved by Owner's Representative prior to cutting.
- .2      Re-cut concrete edges that are damaged or chipped due to the work, at no expense to the Owner.
- .3      Jack hammer, excavate, load, haul and dispose of the waste concrete materials at a licensed landfill, unless otherwise authorized by the Owner's Representative.
- .4      No separate payment will be made for saw cutting concrete, unless otherwise noted.

**3.5            REMOVAL OF ASPHALT MATERIALS**

- .1      Saw cut or wheel cut the asphalt as required for all asphalt removal work and as indicated by the Owner's Representative. All cutting to be approved by Owner's Representative prior to cutting.
- .2      Re-cut asphalt edges that are damaged or rounded due to the work, at no expense to the Owner.
- .3      Asphalt removals other than by cold milled method will be excavated, loaded, hauled and disposed of at a licensed landfill, unless otherwise authorized by the Owner's Representative.
- .4      No separate payment will be made for saw cutting or wheel cutting asphalt, unless otherwise noted.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this section in conjunction with other sections for the location, use and placement for “Care of Water” specified herein.

**1.2 SITE CONDITIONS**

- .1 Be aware that the project area is located where rapid temperature, and weather changes occur in all four seasons. Prepare the site for sudden rainfalls and quick snow melts due to Chinook winds.

**2. PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

- .1 Provide all pumps, hoses and related equipment and power sources required for “Care of Water”.
- .2 Maintain pumps in good operating condition at all times. Have at least one standby pump for each category of pump required for care of water onsite at all times.
- .3 Install a replacement pump or pumps of equal capacity before removing a pump or pumps for maintenance.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Design, construct and maintain Temporary Works, construct and maintain related Permanent Works, as required for care of water, including all necessary cofferdams, channels, flumes, drains, sandpoints, wells and sumps and other temporary diversion and protective works and furnish all materials required therefore. Furnish, install, maintain and operate all necessary pumping and other equipment, for dewatering the various parts of the work and for maintaining the foundation and other parts of the work free of water, ice and snow from whatever source.
- .2 Maintain all sumps, trenches and discharge lines to ensure proper containment and free flow of water to and from the pumps and other diversion and protective works at all times.
- .3 Obtain permits, in addition to those obtained by the Owner.
- .4 Ensure that “Care of Water” procedures do not interfere with the excavated work areas, operation of road surface drainage courses, natural watercourses, utilities or the flow of traffic.



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- .5 Repair damage to any part of the work caused by water or failure of protective works at no extra cost to the Owner.
- .6 Be responsible for additional excavation and subsequent backfill made necessary by water, snow, or ice.
- .7 Ensure procedures for “Care of Water” do not cause pollution in the area. Locate and control discharges of water to avoid causing damage to property, pollution of watercourses, nuisances on roads, or injury to the public or wildlife.
- .8 Remove or level all cofferdams, drainage ditches or other Temporary Works after having served their purpose so as not to interfere in any way with adjacent facilities or with adjacent landowners.
- .9 Make provisions for handling residual water, storm runoff and snowmelt that may enter the work area or excavations from time to time.
- .10 Make arrangements with the Owner, landowners and agencies, which may be affected by disposal of water, snow and ice. Written permission is required before any water may be disposed of through sewer of a municipality.
- .11 Remove and dispose of all water, snow and ice from the work areas in a manner not detrimental to public or private property, or any portion of the work completed or under construction.
- .12 Excavations are to be kept free of water while work is in progress.
- .13 Protect open excavations against flooding and damage due to surface runoff.
- .14 Provide the Owner’s Representative written details of the proposed dewatering and/or heave prevention measures and methods such as dikes, well points, and sheet pile cut-offs.

**3.2 CONSTRUCTION ACCESS CROSSING**

- .1 Provide construction access crossings, as required.
- .2 Design crossings to accommodate the drainage of runoff water.
- .3 Design crossings for the maximum load of the construction equipment to be used.
- .4 Do not use existing on-site public and private bridges and culvert crossings for construction equipment without prior written approval.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Stripping” specified herein.

**1.2 DEFINITIONS**

- .1 For the purpose of construction in this Contract, the following definitions apply:
- .1 “Topsoil” is defined as the uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils, normally ranging in depth from 50 mm to 450 mm, capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 “Subsoil” is defined as material that lies immediately beneath the Topsoil and extending to root depth. Subsoil may be up to 1.5 m in depth.
  - .3 “Overburden” is defined as soil material that lies between the Subsoil and the material that is designated to be utilized for construction.
  - .4 “Stripping” is defined as the excavation of Topsoil, Subsoil, and Overburden, including materials in frozen condition.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 PROTECTION OF EXISTING FACILITIES**

- .1 Locate utility lines, fencing, survey reference points, instrumentation, culverts, and all other existing facilities before commencement of Work. Protect these items from damage.

**3.2 EXCAVATION**

- .1 Do not strip any area without prior approval of the Owner.
- .2 Stay on designated haul roads and do not disturb grassed or natural areas not part of the Work. Do not drive on undisturbed areas except for the performance of stripping operation.
- .3 In stripping areas, strip topsoil to top of subsoil levels, then strip the subsoil to top of overburden levels, then strip the overburden. Avoid mixing Topsoil, Subsoil and Overburden.

- .4 Conduct the stripping operation far enough in advance of excavation to ensure that undesirable material does not become mixed with the Topsoil.
- .5 Suspend stripping operations during rain or wet ground conditions.
- .6 Suspend stripping operations during high winds greater than 80 km/hr, which may result in contamination or loss of Topsoil.
- .7 Provide proper drainage of surface water from stripped area to prevent ponding and infiltration in areas where fill is to be placed.
- .8 Use equipment with precise depth control such as a grader when stripping shallow depth topsoil.
- .9 If the stripping area soils are frozen, rip the area to a depth of 300 mm and stockpile separately.
- .10 Excavate all initial frozen material. Subsequent frost removal will not be paid.

#### **3.4 DISPOSAL OF STRIPPING MATERIAL**

- .1 The Contractor will assume ownership of the different waste stripping materials, not incorporated in the work. The Contractor is encouraged to recycle the waste material where practical. Dispose of non-recycled topsoil material at a licensed landfill, unless otherwise approved by Owner's Representative.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Topsoil Placement” specified herein.

**1.3 SOURCE TOPSOIL**

- .1 Only use imported topsoil meeting specified requirements.

**2. PRODUCTS**

**2.1 TOPSOIL MATERIALS**

- .1 Topsoil materials to be a mixture of mineral particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture to be based on the *Canadian System of Soil Classification*, to consist of 20% to 70% sand and contain 2% to 10% organic matter by weight.
  - .2 Topsoil PH value to be between 6.5 to 8.0.
  - .3 Topsoil to contain no toxic elements or growth inhibiting materials.
  - .4 Topsoil to be free from debris and stones over 50 mm diameter.
  - .5 Topsoil consistency to be friable when moist.
- .2 Major soil nutrients required for topsoil fertility to be present in following ratios:
  - .1 Nitrogen (N): 20 to 40 microgram of available N per gram of topsoil.
  - .2 Phosphorus (P): 10 to 20 micrograms of phosphate per gram of topsoil.
  - .3 Potassium (K): 80 to 120 micrograms of potash per gram of topsoil.
  - .4 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .5 Coarse vegetative material: 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

**3. EXECUTION**

**3.1 PREPARATION OF SUBGRADE**

- .1 Remove debris, roots, branches, foreign material, undesirable plants, visible stones in excess of 50 mm diameter, contaminated soil and other deleterious materials. Dispose of waste materials at a licensed landfill.
- .2 Grade areas to be reclaimed to finish subgrade. Eliminate uneven areas and low spots and ensure proper drainage.
- .3 Scarify all areas designated for topsoil placement to a depth of 150 mm, except in areas where considered impractical by the Owner's Representative. Scarify entire subgrade area once in the longitudinal direction and once in the perpendicular direction. Disc area when large clay lumps are prevalent.
- .4 Compact finished subgrade to 85% Standard Proctor Density.

**3.2 TOPSOIL PLACEMENT**

- .1 Place and spread subsoil and topsoil materials in uniform layers not exceeding 150 mm, in dry weather on dry unfrozen subgrade.
- .2 Manually spread and rake topsoil around structures, trees, fences or other obstructions.
- .3 Spread topsoil to obtain minimum depth after settlement of:
  - 100 mm for sodded areas

**3.3 FINISH GRADING**

- .1 Remove all stones in excess of 50 mm diameter, soil lumps, roots, grass, weeds, construction materials, debris and foreign non-organic materials that may surface after preparation. Dispose of waste materials at a licensed.
- .2 Thoroughly cultivate topsoil to minimum depth of 100 mm by rototilling or hand methods where compaction has occurred and to break all soil lumps.
- .3 Float until surface is smooth. Cut smooth falls to catch basin rims, finish flush.
- .4 Fine grade to eliminate rough or low areas and to ensure positive drainage on slopes and away from buildings, sidewalks and other structures. Maintain levels, profiles and contours of subgrade.
- .5 Leave surface smooth, uniform and sufficiently firm to prevent settlement or sinkage pockets when watered. Finished surface to be even and free from irregular surface changes.

- .6 Rake, chain drag and lightly roll topsoil areas, remove all ridges and fill all depressions. On larger areas, use hydraulic power box rake or similar mechanical equipment to: remove soil lumps, rocks and debris; fill and level low areas; and correct other grading deficiencies in preparation of seed or sod bed.
- .7 When topsoil will abut existing turf, cut turf to form a straight joint with the new seeded or sodded areas.
- .8 Where topsoil will be receiving sod, leave final grade 15 mm below finish grade of adjacent pavement, edging, curbs and crown of adjacent turf area.
- .9 Do not cover catch basins, manholes, valve covers, irrigation boxes or any other surface accesses.
- .10 Use water trucks and sprinklers to control all airborne dust caused by topsoil placement and grading operations when necessary.
- .11 Immediately clean up any soil or debris spilled onto roadway, walks and mulched areas.

**3.6 TOLERANCES**

- .1 The finished topsoil surface to be even, uniformly shaped and compacted to within  $\pm 15$  mm of design grade, but not uniformly high or low, while maintaining surface drainage.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for requirements for “Earthwork and Granular Material Testing” specified herein.
- .2 Read this Section in conjunction with requirements for testing specified in General Conditions Section 00725.

**1.2 TESTING**

- .1 Contractor is responsible for performance testing in performance of the Work.
- .2 The Owner’s Representative will perform quality assurance testing and related functions.
- .3 The Owner’s Representative will perform quality assurance testing according to the testing standards listed in the Contract Documents as selected by the Owner.
- .4 Provide samples requested by Owner’s Representative for testing.
- .5 Co-operate with the Owner’s Representative in site sampling for testing.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 FILL MATERIAL TESTING**

- .1 Fill materials may be tested, before and after placement, for conformance with specified requirements and to confirm suitability for intended uses.
- .2 Acceptance of fill material will be made only after the material has been dumped, spread and compacted in place. Owner may reject fill material in the borrow areas, in the stockpiles, in the transporting vehicle or in place. Cooperate with the Owner to ensure only acceptable fill material will be placed in the Work.
- .3 If requested by the Owner’s Representative, provide 1 m<sup>3</sup> of each type of imported granular fill material for testing purposes.

**3.2 COMPACTION AND MOISTURE CONTENT TESTING**

- .1 Compaction and moisture content testing will be performed during fill material placement operations to ensure that specified requirements are met.

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- .2 The frequency of compaction and moisture content testing will be determined by the Owner.

**3.3 GRAVEL TESTING**

- .1 The Owner's Representative may carry out testing of the gravel material while it is being processed.

**END OF SECTION**



**1. GENERAL**

**1.1 INTENT**

- .1 Read this section in conjunction with other sections for location, use and placement of “Excavation” specified herein.

**1.2 DEFINITIONS**

- .1 “Common Excavation” is defined as all excavation, hauling, placement and compaction of materials within the project work area excluding materials classified under topsoil stripping, rock excavation, borrow excavation or other specified excavation operations as shown in the Contract Documents or as designated by the Owner’s Representative.
- .2 “Borrow Excavation” is defined as all imported excavation from borrow areas excluding materials classified under topsoil stripping, excavation of frozen material or other specified excavation operations as shown in the Contract Documents or as designated by the Owner’s Representative.
- .3 “Waste Excavation” is defined as all excavation, hauling, and placement of materials, within the project work area and at designated waste areas, that are not suitable for use or are surplus to requirements for the completion of the project work excluding materials classified under topsoil stripping, rock excavation or other specified excavation operations as shown in the Contract Documents or as designated by the Owner’s Representative.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 PREPARATION**

- .1 Notify Owner’s Representative at least 2 days prior to beginning excavating operations.
- .2 Prior to commencing excavation:
  - .1 Contact all appropriate utility companies and establish exact location and current status of all utilities, voltage of underground and overhead power lines and pressure of natural gas lines.
  - .2 Notify Owner if any utility lines have been omitted from or incorrectly indicated in the Contract Documents.

**3.2 PROTECTION OF EXISTING FACILITIES**

- .1 Locate utility lines, fencing, survey reference points, instrumentation, culverts, and all other existing facilities before commencement of Work. Protect these items from damage.

**3.3 UNAUTHORIZED EXCAVATION**

- .1 Unauthorized excavation is any excavation beyond lines, elevations and dimensions indicated in the Contract Documents without specific authorization by the Owner.
- .2 Fill unauthorized excavation to lines, elevations and dimensions indicated, as directed by the Owner's Representative.
- .3 Unauthorized excavation and remedial work will be at Contractor's expense.

**3.4 EXCAVATION LINES**

- .1 Excavate to the lines, grades and elevations indicated in the Contract Documents or as determined by the Owner's Representative
- .2 The Owner's Representative will determine if unsuitable bearing materials are encountered at indicated foundation elevations. Carry excavation deeper to remove unsuitable bearing materials and replace excavated material with suitable materials.
- .3 The Owner's Representative will determine if bearing conditions are fulfilled at elevations above those indicated in the Contract Documents. Adjust excavation elevations to accommodate raised foundation level.

**3.5 SHORING AND BRACING**

- .1 If required to provide safe working conditions and to prevent cave-ins and loose soil from falling into excavations, protect excavations by temporary shoring, bracing, or other suitable methods.
- .2 Where the excavation is made to accommodate structures, remove sufficient material to allow for the proper placing and bracing of forms.
- .3 No extra payment will be made for supplying, placing, maintaining and removing sheeting, bracing, shoring, or other means of temporary support.

**3.6 EXCAVATION**

- .1 Strip Topsoil and Subsoil in accordance with Section 02200 and stockpile in the designated areas.
- .2 Remove and dispose of all water, snow and surface ice prior to excavation.

- .3 Schedule and coordinate the work such that excavations are trimmed to grade prior to becoming frozen.
- .4 Excavate to the required lines, grades and elevations.
- .5 Immediately notify the Owner's Representative of unsuitable organic soils or other unsuitable or unstable materials encountered during excavation and remove unsuitable materials to the depth and extent directed.
- .6 Prevent loss of soil and sloughing of slopes if springs or seepage are encountered within excavation.
- .7 Remove boulders, loose bedrock, soil blocks and other fragments that may slide or roll into excavated areas, which, in the opinion of the Owner's Representative or the Contractor, are unsafe or appear to endanger persons, work or property. The fact that such removal may enlarge an excavation beyond the required excavation lines will not relieve the Contractor from the necessity of doing such scaling and removal.

**3.7 COBBLES AND BOULDERS**

- .1 No separate payment will be made for removal, handling, transporting and/or disposing of cobbles and boulders.

**3.8 DISPOSAL OF EXCAVATED MATERIAL**

- .1 General
  - .1 Obtain prior approval by Owner for stockpile areas. Strip topsoil from stockpile areas except do not strip topsoil stockpile areas.
  - .2 If stockpiling is required, stockpile materials meeting the classifications of different zones in separate stockpiles.
  - .3 Prepare stockpile sites and construct stockpiles taking every precaution necessary to prevent segregation of particle sizes and contamination with other materials.
  - .4 Finish the surfaces in stockpiles to safe, stable lines and slopes 3H:1V or flatter or as directed by the Owner's Representative and leave the surfaces in a neat and workmanlike manner.
  - .5 Maintain stockpiles in a condition acceptable to Owner.
  - .6 Do not block drainage courses with stockpiled material.
  - .7 Space all stockpiles at least three metres from adjacent material stockpiles with a different classification.
  - .8 Remove all stockpiled materials from stockpiles and incorporate into the Work of the Contract.

- .2 Suitable Materials
  - .1 Load, haul and place, suitable materials from common and borrow excavations where placement of compacted and tamped fills are designated.
- .3 Unsuitable Materials
  - .1 Load, haul and place unsuitable waste excavation materials in designated waste fills and waste sites. If no waste fills or waste sites are designated, dispose of material off site in an area located by the Contractor and approved by the Owner's Representative.
  - .2 Load, haul and place unsuitable materials from borrow excavations in borrow areas, after the removal of all suitable materials. Costs associated with replacement of unsuitable materials in borrow areas to be included in unit rate for borrow excavation.
- .4 Excavated Material Disposal Sites
  - .1 The Contractor will assume ownership of the different excavated materials, not incorporated into the work. The Contractor is encouraged to recycle this waste material where practical. The Contractor will dispose of non-recycled waste material at a licensed landfill.

**3.9 TOLERANCE**

- .1 Excavate all surfaces to within + 20 mm and - 20 mm of the lines, grades and elevations shown in the Contract Documents.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Compacted Earth Fill” specified herein.

**1.2 TYPES OF FILL**

- .1 Compacted Fill.

**1.3 DEFINITIONS**

- .1 “Suitable Material” is defined as material obtained from common or borrow excavations, free of organic or frozen materials, that is suitable for construction.
- .2 “Unsuitable Material” is defined as organic or frozen material from common or borrow excavations, that is not suitable for construction.
- .3 “Compacted Fill” or “Tamped Fill” is defined as suitable material obtained from common or borrow excavations, free of organic, wet or frozen materials, and placed on site, road or construction.
- .4 “Waste Fill” is defined as organic or frozen material from common or borrow excavation that is not suitable for site, road, embankment, liner or structural construction.

**2. PRODUCTS**

**2.1 FILL MATERIALS**

- .1 Compacted and tamped fill material is fine grained materials having a minimum of 50% passing the 0.075 mm sieve size and classified as a low to medium plastic clay based on the unified classification system as modified by PFRA.
- .2 Remove tree roots, sod or other organic materials.
- .3 Do not use frozen material in the fill.
- .4 Remove cobbles and rock fragments having maximum dimensions greater *than* 100 mm.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Do not proceed with fill placement until the Owner has inspected and approved foundation areas designated for fill placement.

- .2 Scarify the foundation to obtain a suitable bond with the earthfill immediately prior to placing the first layer of earthfill.
- .3 Construct earthfills to the lines, grades and elevations shown in the Contract Documents.
- .4 Suspend all earthwork operations at any time when satisfactory work cannot be conducted on account of rain, floods, cold weather or other unsatisfactory conditions.

### **3.2 DENSITY CONTROL**

- .1 Compacted Fill material to be compacted to a dry density equal to or greater than 98% of the maximum dry density obtained in the Standard Proctor Compaction Test performed in accordance with ASTM D698.

### **3.3 MOISTURE CONTROL**

- .1 Maintain moisture content for Compacted Fill materials within -2% to +2% of optimum moisture content as determined by ASTM D698 test procedures.
- .2 When the moisture content in the fill material is lower than that specified for placement, add water and mix with the material to achieve uniform moisture content in the material to conform to the requirements.
- .3 When the moisture content in the fill material is higher than that specified for placement, dry the material by scarifying, disking, mixing and harrowing to achieve uniform moisture content in the material to conform to the requirements.
- .4 Moisture content control on waste fill will not be required.
- .5 Do not apply water to fill material in a manner that causes segregation or the finer materials to be washed out.
- .6 Water added to fill material for moisture control purposes will be free of deleterious materials.

### **3.4 PLACEMENT AND COMPACTION**

- .1 Drain and clean all earth foundations of loose, thawed, frozen, soft, or other deleterious material including ice, snow and organic materials and topsoil.
- .2 Work the surface to obtain a suitable bond with the earth fill immediately prior to placing the first layer. Scarify the top 150 mm of the surface and compact to 95% of the maximum dry density obtained in the Standard Proctor Compaction Test performed in accordance with ASTM D698.
- .3 When the surface of the prepared foundations or the compacted fill material is too dry or too smooth to bond properly with the layer of fill material to be placed thereon, moisten the surface and work with a disc, scarifier, or other equipment, to provide a satisfactory bonding surface before the succeeding layer of fill material is placed.

- .4 When the surface of the prepared foundations or the compacted fill material is too wet for proper compaction, remove it and allow it to dry, or work it with a harrow, disc or other equipment to reduce the moisture content to the required amount; then compact the fill material before the succeeding layer of fill material is placed thereon.
- .5 Maintain slopes at less than 1V:1H for earth foundations on which fill is to be placed.
- .6 Place compacted fill material in continuous horizontal layers not exceeding 150 mm in thickness when compacted. Spread, blend, disc, blade, smooth and compact each lift to provide a homogeneous fill without stratification. Commence placement of fill at the lowest elevation of foundation. Use sheepfoot type compaction equipment.
- .7 Place waste fill materials in continuous horizontal lifts not exceeding 300 mm in thickness such that there will be no voids or bridging of material. Spread and compact each lift by complete coverage of tracked equipment. Blade the compacted waste fill embankment to a smooth, uniform, free-draining shape.
- .8 Join new fill to existing slopes by terracing or excavating into slopes to remove all dried and loose material.
- .9 Schedule fill placement operations such that the foundation areas or previously compacted earthfill does not freeze and that compacted earthfill is not placed on frozen subgrade. Remove and replace any such frozen layers of compacted earthfill at no cost to the Owner.
- .10 Scarify each lift of fill to a minimum depth of 70 mm following compaction, using a disc or other Owner approved equipment to ensure complete bond between that lift and the overlying lift.
- .11 Reroute construction traffic or increase fill thickness over soft foundations in areas where fill surface starts rutting. If rutting has occurred, scarify, regrade and moisture condition the fill surface prior to placement of overlying fill.
- .12 Re-compact or remove any portion of the fill, which has suffered a reduction in density due to frost, rain or any other reason before placing succeeding layers. Protect compacted fill material and foundations prepared for the fill from freezing.
- .13 Remove any non-conforming materials, which accumulate on the surface of any layer, or prepared foundation before any material is placed for the succeeding layer.
- .14 Maintain adequate grading during construction to protect the work from surface drainage damage.

### **3.5 COMPACTION EQUIPMENT**

- .1 Supply necessary compaction equipment capable of meeting the specified compaction requirements.

- .2 Hauling equipment is not acceptable for compaction.
- .3 The Owner's Representative reserves the right to order the discontinuation of any compaction equipment that does not produce the specified compaction requirements or causes excessive breakage around structures or is not capable of compacting the fill material to the required density in a reasonable time.

**3.6 TOLERANCE**

- .1 Make changes in grade natural. Blend slopes into level areas.
- .2 Compact all surfaces to within -50 mm and + 50 mm from the lines, grades and elevations shown in the Contract Documents.

**3.7 COMPACTION SCHEDULE**

Location <sup>(1)</sup>	Maximum Loose Lift Thickness (mm)	Moisture Content Limits <sup>(2)</sup>	Density Limits <sup>(3)</sup>
General Engineered Fill	200	Optimum to +2%	≥98% SPMDD

- <sup>(1)</sup> Requirements for "General" location as described in paragraphs 3.2, 3.3 and 3.4 apply unless otherwise noted in this schedule or directed by the Owner.
- <sup>(2)</sup> Moisture content range above (+) or below (-) Optimum Moisture Content (ASTM D698).
- <sup>(3)</sup> Density relative to indicated reference value, Standard Proctor Maximum Dry Density (SPMDD), as determined by test method ASTM D698.

**END OF SECTION**



**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use, and placement of “Granular Materials” specified herein.
- .2 This Section is intended to be used as a reference Section; it is not a "section of work". All materials specified in Part 2, Products, may not necessarily be required.

**2. PRODUCTS**

**2.1 MATERIAL QUALITY**

- .1 Use only clean, sound, hard, durable particles, free from silt, clay, soft shale, flaky particles, topsoil, organic matter and other detrimental material.
- .2 Ensure granular materials are not gap graded and have a smooth gradation curve with no excess or deficiency of any particular grain size within the required range.
- .3 Where blending is required, thoroughly mix the granular materials in such a manner that a homogeneous material of the specified gradation is achieved prior to placing of the material into the work or stockpiles.
- .4 “Gravel” in general means a mixture of natural gravel, crushed gravel or crushed stone, and natural or crushed sand, meeting the gradation limits specified below for each type.
- .5 “Crushed Gravel” means angular shaped particles of crushed gravel or stone, washed, meeting the gradation limits specified. Ensure minimum of 50% by weight, of material retained on 5 mm sieve has at least one face resulting from fracture.

**2.2 GRANULAR MATERIALS**

- .1 Granular materials to meet gradation limits specified below for each type:

Granular Material Type	Sieve Size	% Passing By Weight
Zone 1 – A well graded sand, typically used as a fine filter beneath structure concrete slabs and small embankment toe drains:	10 mm	100
	2 mm	65 – 95
	1.25 mm	42 – 86
	0.16 mm	2 – 19
	0.08 mm	0 – 5
Zone 2 – A well graded gravel typically used as a course filter in conjunction with Zone 1 fine filter:	40 mm	100
	20 mm	45 – 90
	5 mm	10 – 40
	2 mm	0 – 10
Zone 3 – A combined coarse – fine	40 mm	100

<b>Granular Material Type</b>	<b>Sieve Size</b>	<b>% Passing By Weight</b>
filter material typically used as a bedding material for concrete slabs, pipe and similar structures:	20 mm	50 – 95
	5 mm	25 – 65
	0.530 mm	6 – 29
	0.315 mm	2 – 20
	0.08 mm	0 – 10
Zone 4 – A well graded gravel material typically used as a bedding material:	20 mm	100
	10 mm	20 – 60
	5 mm	5 – 30
	2 mm	2 – 10
Zone 5 – A well graded sand and gravel material typically used as bedding under riprap or as a granular backfill:	150 mm	100
	100 mm	70 – 100
	40 mm	35 – 80
	5 mm	10 – 35
	2 mm	0 – 10
Zone 6 – Road Gravel – A well graded crushed gravel material typically used for road surfaces or as a bedding material with a 50% or greater (2 face) fracture by weight.	25 mm	100
	20 mm	85 – 100
	10 mm	35 – 75
	5 mm	15 – 55
	1.25 mm	0 – 30
	0.08 mm	0 – 12
Zone 7 – Wash Rock – typically used when specified as bedding material in extremely wet or unstable conditions:	20 mm	100
	10 mm	35 – 95
	5 mm	5 – 25
	2 mm	0 – 10
Zone 8 – Armour Gravel – A processed gravel typically used as a bank armouring material:	200 mm	100
	100 mm	60 – 85
	30 mm	20 – 45
	10 mm	0 – 15
	5 mm	0 – 5
Zone 9 – Bedding and Haunching Material – A well graded crushed angular gravel material (Percent fractures by weight will be 50% or greater):	20 mm	100
	10 mm	20 – 60
	5 mm	5 – 30
	2 mm	2 – 10

**2.3 ASPHALT AGGREGATE**

- .1 For asphalt aggregates refer to Section 02744.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Drain, clean and maintain foundation and subgrades free from debris, snow, ice, water, topsoil or any loose objectionable material. Do not proceed with granular material placement, until the Owners Representative has inspected and approved the foundations and subgrade areas.
- .2 Place granular materials to the lines, grades and elevations specified in the Contract Documents.
- .3 Suspend all granular material placement at any time when satisfactory work cannot be conducted due to rain, floods, snow or other unsatisfactory conditions.
- .4 Select temporary stockpile sites that minimize potential for contamination with underlying soils.
- .5 Stockpile material in a manner that minimizes segregation.
- .6 Replace stockpiled material that becomes contaminated, damaged, or lost at no cost to the Owner.
- .7 Refer to other Sections for location, use, and placement of Granular Materials specified herein.

**3.2 PLACEMENT**

- .1 Granular Bedding Or Granular Backfill Materials:
  - .1 Place granular material in layers not exceeding 150 mm in thickness when compacted, to the lines, grades and elevations shown in the Contract Documents. Compact to a minimum density of 95% Standard Proctor Density. Compact each layer before placing the succeeding layer. Ensure the granular material are installed within - 3% and + 3% of optimum moisture content, unless indicated elsewhere in the Contract Documents.
  - .2 If any granular bedding material is too dry to allow adequate compaction, apply water into the material until uniform distribution of moisture is obtained. Control water application accurately in amounts so that free water will not appear on surface during or subsequent to rolling or tamping.

- .3 If the material is too wet, dry and spread material in thin lifts on subgrade and permit to dry until the moisture content is reduced to the specified moisture content.
- .4 Provide tamping with hand operated mechanical tampers such as vibratory plate tampers, jumping jacks or walk-along double drum rollers. Do not use large compaction equipment in tamped backfill zones.

**3.3 TOLERANCES**

- .1 Granular Bedding or Granular Backfill Materials
  - .1 Place granular materials within -20 mm and +20 mm of design grades, but not uniformly high or low.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location and requirement of “Subgrade Preparation” specified herein.

**2. DEFINITIONS**

- .1 “Scarification” is defined as loosing or breaking up of surface of soils with a disk, cultivator, shanks, or ripper teeth to a depth of 150 mm unless specified otherwise in the Contract Documents.

**3. PRODUCTS**

- .1 Not Applicable.

**4. EXECUTION**

**4.1 SUBGRADE PREPARATION**

- .1 Subgrade preparation includes the following work:
  - .1 Place, scarify, moisture condition, shape and compact the upper 300 mm of subgrade earth materials to 98% Standard Proctor Density, moisture conditioned to within optimum moisture content to +2% of optimum moisture content and to design subgrade elevation.
  - .2 When the moisture content in the subgrade material is lower than that specified, add water and mixed with the material to achieve uniform moisture content in the material to conform to the requirements.
  - .3 When the moisture content in the subgrade material is higher than that specified, dry the material by scarifying, disking, mixing and harrowing to achieve uniform moisture content in the material that conforms to the requirements.
  - .4 Remove and dispose of unsuitable materials as authorized by the Owner’s Representative. Replace with an approved suitable material and compact as specified herein.
  - .5 Maintain the subgrade to the specified section, grades and condition required for filter fabric and/or granular material placement. Provide interim drainage to prevent damage to the work and unstable conditions due to high moisture contents. No separate payment will be made for these items.

- .6 The subgrade will pass density and proof rolling requirements prior to the placement of filter fabric and/or granular materials.

**4.2 TOLERANCES**

- .1 Shape and compact subgrade to the required cross-section and grade to within - 10 mm and + 10 mm of design elevations but not uniformly high or low, and maintain surface drainage as required to protect the work.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use, and placement of “Base Granular Materials” specified herein.

**2. PRODUCTS**

**2.1 GRANULAR BASE MATERIAL**

- .1 Granular base material will consist of sound, hard, durable, well graded crushed gravel, sand, and fine soil particles as specified.
- .2 Granular base material will not contain clay, loam, roots, plants or other deleterious materials. The materials to be well graded from coarse to fine within the gradation limits specified, and will not be subject to extreme variation between the lower and upper limits of the gradation envelope specified.

**2.2 GRADATION**

- .1 Gradation to be within the following limits when tested to ASTM C-136-82 and ASTM C117-80, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.
- .2 Base Granular Material

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
25 mm	100%
16 mm	73 - 94%
10 mm	56 - 80%
5 mm	40 - 66%
1.25 mm	24 - 45%
0.315 mm	13 - 27%
0.160 mm	9 - 19%
0.080 mm	4 - 10%

The percent fractures by weight (2 faces) will be 60 % or greater.

**3. EXECUTION**

**3.1 PLACEMENT OF BASE MATERIAL**

- .1 Process, handle and transport aggregates to avoid segregation, contamination and degradation.

- .2 Do not place granular materials on snow, ice or frozen surfaces. Place base granular material on prepared subgrade, geotextile fabric, and/or sub-base granular materials.
- .3 Do not place the base material until the subgrade or sub-base materials have been inspected, surveyed, proof rolled, tested and approved by the Owner's Representative.
- .4 Place the base material uniformly on the approved sub-base material to compacted depths specified. Do not place the base materials in layers exceeding 150 mm compacted depth. Shape each layer to a smooth contour and compact to the specified density before placing the next layer. Areas that become segregated during spreading will be removed and replaced at the Contractor's expense. Compact the final layer of the base material to proper grade and cross-section.
- .5 Maintain the base material to the specified section, grade and condition required for the placement of other materials or as required by the Owner's Representative. Provide interim drainage to prevent damages to the work or the causing of unstable conditions due to high moisture contents.

### **3.2            **COMPACTION OF BASE MATERIAL****

- .1 Granular base materials to be compacted by rolling with a pneumatic tired roller, vibratory smooth drum roller or other approved equipment.
- .2 During compaction, add water by an applicator in such quantities that the moisture content will be maintained at the optimum level as determined by Standard Proctor test. If the moisture content exceeds the optimum moisture content, aerate the material by mechanical means or cease work temporarily until the material has dried sufficiently to reach the optimum moisture content.
- .3 Compact base materials to 100% of Standard Proctor Density within optimum moisture content and + 2% of optimum moisture content.

### **3.3            **TOLERANCES****

- .1 The final surface to be even and uniformly shaped and compacted within a tolerance of -10 mm to +10 mm of established grade but not uniformly low or high, while maintaining surface drainage.

**END OF SECTION**



**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Proof Rolling” specified herein.
- .2 This Section is intended to be used as a reference Section. Provide proof rolling equipment and perform the Proof Rolling as required. Proof Rolling work is considered incidental to the Contract.

**2. PRODUCTS**

**2.1 PROOF ROLLING EQUIPMENT**

- .1 Perform proof rolling using a heavily loaded tandem truck with a vehicle weight of at least 10 tonnes (22,000 lbs.) per axle and a minimum tire pressure of 550 kPa (80 psi).
- .2 Owner’s Representative may authorize use of other acceptable proof rolling equipment.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Proof roll at level in grade indicated. If alternative proof rolling equipment is authorized, Owner’s Representative will determine level of proof rolling.
- .2 Where proof rolling reveals areas of defective subgrade, Owner’s Representative will determine limits of unsuitable subgrade excavation and specify replacement material.

**3.2 SUBGRADE PROOF ROLLING**

- .1 Perform subgrade proof rolling on a daily basis prior to the placement of geotextile fabric, sub-base granular material, and base granular material immediately after the subgrade material has been shaped, graded and compacted to the specified density and moisture content. The loaded vehicle to be driven slowly (walking pace) in a systematic pattern so that each successive pass is next to or partially overlaps the previous pass. Where the area to be tested is large enough, successive passes will be conducted at right angles across the previous passes. While the test is being performed, the Owner’s Representative will observe the surface for deflections, cracking or rutting.
- .2 Once the subgrade proof roll is complete and deficient areas have been sub cut and repaired, the Contractor is now responsible for the condition of the road. Any further road failures in the future due to weather or any other conditions will be the responsibility of the Contractor to repair at his cost.

**3.3 BASE PROOF ROLLING**

- .1 Perform base proof rolling immediately prior to the placement of asphalt and after the base material has been placed, shaped, graded and compacted to the specified density and moisture content. The loaded vehicle to be driven slowly (walking pace) in a systematic pattern so that each successive pass is next to or partially overlaps the previous pass. Where the area to be tested is large enough, successive passes will be conducted at right angles across the previous passes. While the test is being performed, the Owner's Representative will observe the surface for deflections, cracking or rutting.

**3.4 TOLERANCES**

- .1 Where an area of subgrade material deflects, then rebounds more than 10 mm, the area will be deemed as failing the proof roll test. The failed areas identified by the Owner's Representative will be repaired to a passing condition and re-tested by proof roll method again at no cost to the Owner.
- .2 Where an area of sub-base granular material deflects, then rebounds more than 10 mm, the area will be deemed as failing the proof roll test. The failed areas identified by the Owner's Representative will be repaired to a passing condition and re-tested by proof roll method again at no cost to the Owner.
- .3 Where an area of base granular material deflects, then rebounds more than 5 mm, the area will be deemed as failing the proof roll test. The failed areas identified by the Owner's Representative will be repaired to a passing condition and re-tested by proof roll method again at no cost to the Owner.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

**1.3 INTENT**

- .1 Read this Section in conjunction with other sections for location, use and placement of building and structure excavation specified herein.

**1.4 SECTION INCLUDES**

- .1 This Section includes requirements for excavating for buildings and structures inside perimeter of each building or structure, and within a nominal distance outside perimeter of each building or structure, as required for foundation and other substructure construction.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 EXCAVATION**

- .1 Excavate to elevations and dimensions indicated on Drawings within a tolerance of  $\pm 25$  mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for inspection.
- .2 In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- .3 Protect bottom of excavations and soil around and beneath footings from frost.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 INTENT**

- .1 Read this Section in conjunction with other sections for the location, use and placement of building and structure backfilling specified herein.

**1.3 SECTION INCLUDES**

- .1 This Section includes requirements for:
  - .1 Backfilling, filling, and compaction inside perimeter of each building or structure and outside perimeter of each building or structure, adjacent to foundations.
  - .2 Granular base construction, above subgrade, for floor slabs supported on grade, within perimeter of building or structure.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Refer to Section 02250 and 02265 for material product specifications.

**3. EXECUTION**

**3.1 PLACEMENT AND COMPACTION OF FILL MATERIALS**

- .1 Backfill excavations and fill to required subgrade elevations using fill materials specified in Backfilling and Filling Schedule.
- .2 Place fill materials in layers not exceeding loose thickness specified in Backfilling and Filling Schedule.
- .3 Moisture condition each layer of fill to within the Optimum Moisture Content range specified in Backfilling and Filling Schedule

- .4 Compact each layer of fill to the minimum percentages of Standard Proctor Density and within moisture content range specified in Backfilling and Filling Schedule.
- .5 Ensure that adequate permanent or temporary horizontal bracing is in place prior to backfilling against walls.
- .6 Take care to prevent damage to or displacement of waterproofing, insulation, weeping tile installation, pipe, conduit and other work.

**3.2 WASHED BASE MATERIAL**

- .1 Directly under floor slabs supported on grade, provide a minimum of 150mm of washed base material
- .2 Washed base material will consist of sound, hard, durable, crushed gravel, and sand with no fine soil particles as specified.
- .3 Washed base material will not contain clay, loam, roots, plants or other deleterious materials. The materials to be well graded from coarse to fine within the gradation limits specified, and will not be subject to extreme variation between the lower and upper limits of the gradation envelope specified.
- .4 Gradation:
  - .1 Gradation to be within the following limits when tested to ASTM C-136-82 and ASTM C117-80, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

- .2 Washed Base Material

Sieve Size	Percent Passing by Weight
25 mm	100%
16 mm	73 - 94%
10 mm	56 - 80%
5 mm	0 - 66%
1.25 mm	0%
0.315 mm	0%
0.160 mm	0%
0.080 mm	0%

The percent fractures by weight (2 faces) will be 60 % or greater.

**3.3 GRANULAR SUB-BASE MATERIAL**

- .1 Granular sub-base material will consist of sound, hard, durable, well graded pit-run or crushed gravel or sand as specified.

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.2 Granular sub-base material will not contain clay, loam, roots, plants or other deleterious materials. The materials are to be well graded from coarse to fine within the gradation limits specified, and will not be subject to extreme variation between the lower and upper limits of the gradation envelope specified.

3. Gradation:

.1 Gradation to be within the following limits when tested to ASTM C-136-82 and ASTM C117-80, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.2 Sub-Base Granular Material

Sieve Size	Percent Passing by Weight
75 mm	100%
25 mm	65 - 100%
10 mm	40 - 100%
5 mm	30 - 90%
2.5 mm	25 - 65%
0.63 mm	15 - 35%
0.16 mm	5 - 15%
0.08 mm	3 - 10%

The percent crushed particle (1 face plus 5 000 sieve fraction) will be 25% or greater.

### 3.4 GRANULAR BASE CONSTRUCTION UNDER SLABS

.1 Directly under floor slabs supported on grade, provide a minimum of 150 mm compacted layer of 20 mm crushed gravel. See drawings for additional granular base requirements

### 3.5 BACKFILLING AND FILLING SCHEDULE

Location	Fill Material	Max. Lift Thickness	Minimum Compaction	Moisture Content
Ambulance and Truck Bay Slabs-on-grade	400 mm Granular Base Engineered Fill	150 mm 150 mm	98 % 98%	Within $\pm$ 2% of optimum moisture content
Office Areas	200 mm Granular Base Engineered Fill	150 mm 150 mm	98 % 98%	Within $\pm$ 2% of optimum moisture content

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Exterior Aprons	300 mm Granular Base Engineered Fill	150 mm 150 mm	98 % 98%	Within $\pm$ 2% of optimum moisture content
Against exterior side of foundations and under landscaped areas	Suitable Native Material	150 mm	95 %	Within $\pm$ 2% of optimum moisture content

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**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Trench Excavating and Backfilling” specified herein.
- .2 This Section is intended to be used as a reference section for excavating, backfilling of trenching required for installation of underground services which may include pipes, fittings, valves, manholes, vaults, catch basins, ducts, duct banks, conduits, cable, wire, etc.

**2. PRODUCTS**

**2.1 FILL MATERIALS**

**.1 General**

- .1 Do not use frozen fill materials.
- .2 Remove cobble, stones and rock fragments have maximum dimension greater than 75 mm from fill material or other object other objects which could be detrimental to the pipe or the embedment materials.

**.2 Native Backfill Material**

- .1 Native backfill containing no debris; tree roots, sod or other organic materials.

**.3 Granular Materials**

Refer to Section 02265.

**.4 Non-shrink Backfill**

Non-shrink Backfill is a very weak mixture of Portland Cement or Lime/Fly Ash, concrete aggregates and water that resists settlement when placed in a utility trenches and is capable of being readily excavated.

- .1 Compressive Strength – 0.2 to 0.5 Mpa with a maximum 56 day strength of 0.5 Mpa.
- .2 Aggregate consisting of washed sand conforming to the requirement of C.S.A. Standard CAN#-A23.1-M77. Aggregate gradation to be within the following limits:



<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
10 mm	100%
5 mm	95 - 100%
2.5 mm	80 - 100%
1.25 mm	50 - 100%
0.630 mm	25 - 65%
0.315 mm	10 - 35%
0.160 mm	2 - 15%
0.080 mm	0 - 10%

- .3 Minimum slump - 75 mm. Maximum slump - 125mm.
- .4 Calcium chloride admixture may be used. Air entrainment admixture may be used to improve workability.
- .5 Cold Weather Requirements: Non shrink backfill delivered in cold weather will conform to the requirement specified in Section 18 of C.S.A Standard CAN3-A23.1-M77.

## .5 Concrete

Concrete mix will satisfy the requirements of Exposure Classification C-2 of Table 1 in the latest revision of CAN/CSA A23, and will be in accordance with the following minimum requirements unless shown in the Contract Documents:

- 28 day compressive strength – 20 MPa
- Maximum nominal size of coarse aggregate – 25 mm
- Slump – maximum 75 mm
- Air Content – 4% to 7%
- Maximum water cementing materials ratio – 0.45
- Portland Cement – Type 50 or HS, Sulfate Resistant
- Minimum cement content – 300 kg/m<sup>3</sup>
- Fly Ash Content – 20% max.

## 2.2 RIGID FROST SHIELD

- .1 Rigid frost shield material to be extruded polystyrene insulation 50 mm thick with a minimum resistance to heat transfer of 1.76 RSI (R-value of 10) as determined by ASTM C518 and a minimum comprehensive strength of 275 kPa (40 psi) as determined by ASTM D1621.
- .2 Approved products:
  - Dow STYROFOAM HIGHLOAD 40
  - Owens Corning Foamular 400
  - or approved equal

**3. EXECUTION**

**3.1 EXCAVATION**

- .1 Excavate trenches to the lines, grades and elevations shown on the Contract Documents. For pipe trenches, comply with Pipe Trench Width Schedule.
- .2 Where a trench box and/or cage will be employed for a trench excavation refer to Uni-Bell's latest edition of "Handbook of PVC Pipe – Design and Construction" for the trench design and method of installation.
- .3 Where shoring will be employed for trenching and/or protection of utilities and structures the Contractor must engage the services of qualified professional engineer who is registered or licensed Alberta to design and inspect shoring and anchoring required for work.
- .4 Grade and shape pipe trench to give uniform and even bearing for each length of pipe. Dig bell holes at each joint as required.

**3.2 MOISTURE CONTENT CONTROL OF BACKFILL MATERIAL**

- .1 Uniform moisture content of each layer of fill to be within the Optimum Moisture Content limits specified in Backfilling Schedule, as determined by ASTM D698 test procedures.
- .2 When the moisture content in the fill material is lower than that specified for placement, add water and mix with the material to achieve uniform moisture content in the material to conform to the requirements.
- .3 When the moisture content in the fill material is higher than that specified for placement, dry the material by scarifying, disking, mixing and harrowing to achieve uniform moisture content in the material that conforms to the requirements.

**3.3 PLACEMENT AND COMPACTION OF BACKFILL MATERIAL**

- .1 Backfill trenches using fill materials as specified in Backfilling Schedule.
- .2 Place fill materials in layers not exceeding loose thickness specified in Backfilling Schedule.
- .3 Uniformly compact each layer of fill to minimum percentages of Standard Proctor Density specified in Backfilling Schedule, as determined by ASTM D698 test procedures.
- .4 Uniform moisture content of each layer of fill to be within the Optimum Moisture Content limits specified in Backfilling Schedule.

- .5 Where a trench box and/or cage is employed, ensure that the pipe installation and pipe zone compaction requirements are met. Refer to Uni-Bell's, latest edition of "Handbook of PVC Pipe - Design and Construction" for trench box/ cage design and methods of installation. The installed pipe and its embedment will not be disturbed when using movable trench boxes and/or cages. Movable supports will not be used below the top of the pipe zone unless an approved method is used to maintain the integrity of the embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compaction of embedment material.
- .6 Where shoring is employed, the shoring professional will provide the Contractor instructions how the backfill schedule requirements will be achieved. Provide instructions to the Owner's Representative for review and comment at least 7 days prior to commencing backfilling
- .7 When compacting in the pipe zone, care should be taken to avoid contact between the pipe and the compaction equipment (mechanical tampers, tamping bars, etc.).
- .8 Compaction in the haunch area is to be obtained by use of mechanical tampers and tamping bars. Care should be taken to ensure that the pipe does not "float" due to the compacting methods.
- .9 When compacting initial backfill, mechanical tampers are to be used adjacent to the pipe. Mechanical tampers shall not be used directly above the pipe until a minimum of 300 mm of backfill material is in place above the pipe.
- .10 When compacting backfill in the intermediate zone, roller compacting equipment is not to be used until a minimum of 500 mm of backfill material has been placed above the top of pipe.
- .11 The use of hydro-hammer in the pipe zone is not be permitted.
- .12 When compacting backfill above the pipe zone, hydro-hammer is not to be used until a minimum of 1,000 mm of backfill material has been placed above the top of pipe.

### **3.4 UTILITY CROSSINGS**

- .1 Install crossings to the lines, grades and elevations shown on the Contract Documents.
- .2 Comply with requirements of crossing agreement, permit or other crossing requirements issued by utility company.

### **3.5 PIPE TRENCH WIDTH**

- .1 Except as otherwise specified, minimum and maximum trench widths, up to a point 300 mm above top of pipe, will be as specified in Pipe Trench Width Schedule.
- .2 Maximum trench widths indicated in Pipe Trench Width Schedule exclude an allowance for shoring.

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- .3 Trench width at any point will not be less than trench width at any depth below such point.

**3.6 PIPE TRENCH WIDTH SCHEDULE**

<b>Pipe Size (Outside Diameter)</b>	<b>Minimum Trench Width</b>	<b>Maximum Trench Width</b>
850 mm diameter or less	300 mm greater than external pipe diameter	600 mm greater than external pipe diameter or 750 mm total trench width, whichever is greater
Greater than 850 mm diameter	300 mm greater than external pipe diameter	600 mm greater than external pipe diameter

**3.7 BACKFILLING SCHEDULE**

<b>Location</b>	<b>Fill Material</b>	<b>Max. Lift Thickness</b>	<b>Minimum Compaction</b>	<b>Moisture Content Variance from Optimum</b>
<b>Pipe Zone – pipe bedding</b> Type 1	Zone 4 Granular Material	150 mm	95%	OMC to +2%
<b>Pipe Zone - haunching</b> Type 1	Zone 4 Granular Material	150 mm	95%	OMC to +2%
<b>Pipe Zone – initial backfill</b> Type 1	Zone 4 Granular Material	150 mm	95%	OMC to +2%
<b>Intermediate Zone</b> Type 1	Suitable Native Material	150 mm	98%	OMC to +2%
<b>Final Zone to 1.0m below subgrade</b> Type 1	Suitable Native Material	150 mm	98%	OMC to +2%

**3.8 CONCRETE BEDDING AND ENCASEMENT**

- .1 Place concrete to details indicated or directed by Owner's Representative
- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 SECTION INCLUDES**

- .1 Demolition of indicated portions of existing building.
- .2 Removal of building equipment and fixtures as required to facilitate renovations, including salvage of existing items to be reused in new construction.
- .3 Cutting of existing surfaces as required to receive work of Mechanical & Electrical.
- .4 Protective hoardings and barricades.

**1.3 REFERENCE DOCUMENTS**

- .1 Unless otherwise specified, carry out demolition work in accordance with the most current version of the following standards:
- .2 CSA S350-M1980, Code of Practice for Safety in Demolition of Structures.
- .3 Alberta Occupational Health and Safety Act
- .4 Alberta Occupational Health and Safety Code
- .5 Wherever conflicts or overlap in standards conflict, the most stringent standard shall govern.

**1.4 SUBMITTALS**

- .1 Where required by authorities having jurisdiction, submit for approval, drawings, diagrams, details and supporting data clearly showing sequence of demolition, removal work of structures. Provide Consultant with copy of such drawings.
- .2 Drawings for structural elements shall be designed by and bear signature and stamp of qualified professional Engineer registered in Alberta.

**1.5            EXISTING CONDITIONS**

- .1      Visit and examine the site and become familiar with all features and characteristics affecting the work. No allowances will be made by the Owners for any difficulties encountered due to any features or peculiarities of the site or existing conditions which exist at the time of examination prior to submission of bid.
- .2      Inspect the premises to determine the conditions under which the work is to be done and the amount of materials and debris to be removed.
- .3      Provide at least one person who is familiar with the scope and intent of the Work and ensure that he is present at all times during all phases of the demolition.
- .4      Take over structures to be demolished based on their condition at date and time of bid closing.

**1.6            CHANGED CONDITIONS**

- .1      If the condition of structures to be demolished is significantly different when work is commenced, relative to the condition at time of examination prior to bidding, immediately inform the Consultant.

**1.7            EXISTING SERVICES**

- .1      Verify with the Consultant, all services which are to remain and which are to be removed or relocated.
- .2      Arrange and pay for disconnecting, removing and capping utility services within area of demolition. Disconnect and stub off as required, removing line as far back as possible to lines remaining in service.
- .3      Place markers to indicate location of disconnected services. Identify service lines and capping locations on as-built drawings.
- .4      Locate all electrical wiring in demolition areas and determine all requirements before disconnecting and capping.
- .5      Notwithstanding any industry trade scope definitions, mechanical demolition must be done by the mechanical Subcontractor, and electrical demolition must be done by the electrical Subcontractor.

**1.8            PROTECTION**

- .1      Do not interfere with use of adjacent building nor portions of existing building to remain in use. Maintain free and safe passage to and from occupied buildings.
- .2      Cease operations and notify the Consultant immediately, if safety of structure appears to be endangered. Take all precautions to properly support structure. Do not resume operations until reviewed with the Consultant.

- .3 Ensure safety of persons in area not enclosed with barriers preventing entrance of the public or other workers. Provide, erect and maintain hoardings, barricades, lighting and guard rails as required by local authority's regulations and by-laws to provide full protection for occupants of building and workers.
- .4 Cease operations and notify the Consultant immediately if previously unidentified hazardous materials are encountered. Do not commence demolition operations until all hazardous materials have been removed and areas to be demolished have been inspected and approved by the Authority Having Jurisdiction, after the hazardous materials have been removed.
- .5 Prevent debris from blocking drainage systems and inlets, mechanical and electrical systems which remain operational.
- .6 Protect electrical and mechanical system components which are intended to remain, or required to serve areas not being demolished. Do not demolish any electrical or mechanical components before they have been identified. If mechanical or electrical components or systems whose disposition (to be demolished or to be retained) is not described in the drawings are encountered, notify the Consultant.
- .7 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.
- .8 Provide required bracing, shoring and underpinning to prevent movements, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades.
- .9 Take precautions to support structure. When the safety of the building being demolished, adjacent structures or services appear to be endangered, cease operations and inform Consultant immediately.
- .10 Temporarily suspend work that is without continuous supervision, shall be closed to prevent entrance of unauthorized persons.

**1.9 SCHEDULING**

- .1 Schedule demolition work with the Owner's representative to cause minimum interference with other portions of the building and site.

**1.10 HAZARDOUS MATERIALS**

- .1 All Contractors performing demolition Work are to obtain a copy of the Hazardous Building Materials Survey and the Environmental Site Assessment from the Construction Manager and familiarize themselves with the types and locations of all known hazardous materials.



- .2 Removal and disposal of Hazardous Materials to be as directed in the Hazardous Building Materials Survey using a qualified and experienced hazardous material removal contractor in accordance with the requirements of the Authority Having Jurisdiction. Hazardous removal Contractor shall be approved by the Consultant prior to commencing with demolition work.
- .3 Do not commence demolition operations until all hazardous materials have been removed and areas to be demolished have been inspected and approved by the Authority Having Jurisdiction, after the hazardous materials have been removed.
- .4 Cease operations and notify the Consultant immediately if unexpected hazardous materials are encountered.

**1.11 TEMPORARY PARTITIONS**

- .1 Erect and maintain dustproof partitions, seal off ducts as required to prevent spread of dust and fumes to other parts of the building. On completion, remove partitions and make good surfaces to match adjacent surfaces.

**1.12 SALVAGEABLE AND RECYCLABLE MATERIALS**

- .1 Except where otherwise specified, all materials are specified to be permanently removed from the place of the work shall become Subcontractor's property. Maximize to the fullest extent possible, salvage and recycling of such materials, consistent with proper economy and expeditious performance of the Work.

**2. PRODUCTS**

**2.1 SALVAGEABLE AND RECYCLABLE MATERIALS**

- .1 In addition to the items noted as salvaged for reuse in this project, all existing items which are to be removed or demolished, are to be inspected by the Owner. If the Owner wants the demolished or removed items, turn them over to the Owner. If the Owner does not want the demolished or removed items, then they become the property of the Contractor and are to be immediately removed from site.
- .2 To reduce the quantity of material otherwise destined for disposal at a landfill, the Contractor is encouraged to consider utilizing the services of businesses and non-profit organizations that specialize in salvage and recycling of used building materials, but does so at his own option and risk
- .3 A current listing of recyclers specializing in specific categories of materials may be obtained during normal office hours from:
  - .1 Alberta Environment
  - .2 Recycling Branch

- .3 Recycle Info Line
- .4 Phone: (780) 427 6982 or 1-800-463-6326
- .5 Website:www.recyclinghotline.ca

**2.2 MATERIALS TO BE RETAINED BY THE OWNER**

- .1 Items such as cornerstones and their contents, commemorative plaques and tablets found or indicated, as well as items deemed to be of historic significance, heritage or character defining; remain the property of the Owner. Notify Consultant prior to removal and obtain approval regarding method of removal.
- .2 The Owner will review all existing items to be demolished. Carefully remove without damage, items selected by the Owner for salvage, and tag them to identify location of origin.
- .3 Items so designated on the drawings as to be retained, are to be removed and turned over to the Owner.
- .4 Carefully remove without damage, items to be retained by the Owner, or to be retained for reincorporation in the Work, and if required to ensure reinstallation in the correct location, tag them to identify location of origin.
- .5 Deliver and store where directed by the Owner, on site.

**3. EXECUTION**

**3.1 SAFETY**

- .1 Unless otherwise specified, carry out demolition work in accordance with CSA S350 Code of Practice in Demolition of Structures and Alberta Building Code 2006, and all other applicable provincial regulations.
- .2 Provide bracing and shoring as required to adequately support the work until permanent construction is installed.

**3.2 EXISTING SERVICES**

- .1 Do not disrupt active or energized utilities traversing premises.

**3.3 PREPARATION**

- .1 Disconnect all service lines as noted on the mechanical and electrical drawings. Post warning signs on all services and equipment which must remain energized to serve other areas during period of demolition. Identify and clearly mark services which are to be retained, including those which can be disconnected during demolition.
- .2 Do not disrupt active or energized utilities designated to remain undisturbed.

- .3 Where applicable, maintain continuity of fire detection, security, and fire protection sprinkler systems throughout demolition.
- .4 Cap pipes which are only valved off prior to cutting, prior to end of day.
- .5 Cap sewer connections gas tight.
- .6 Report unanticipated conditions to the Consultant.
- .7 Remove existing mechanical and electrical systems progressively as new systems are installed and brought into service, eventually removing all existing systems in areas indicated.
- .8 Do not proceed with general demolition in an area until the parties primarily responsible for electrical and mechanical work have signed an authorization to proceed.

### 3.4 **DEMOLITION - GENERAL**

- .1 Demolition by explosives will not be allowed.
- .2 Completely demolish structures and appurtenances in an orderly and careful manner.
- .3 Partial demolition of structures to remain to be demolished by hand demolition.
- .4 Demolish basement walls and footings, and concrete floors below and on grade and remove from site.
- .5 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling.
- .6 Demolish in a manner to minimize dusting. Keep dusty materials wetted. Do not cause flooding, contaminated run-off, or icing.
- .7 Employ rodent and vermin exterminators to comply with health regulations.
- .8 Dispose of demolished materials off site except where noted otherwise.
- .9 Do not pile debris on floors in excess of the live load limit for the floor.
- .10 Immediately as demolition progresses, repair any resulting damage to existing parts intended to remain.

### 3.5 **DEMOLITION - PARTIAL**

- .1 Demolish parts of building to permit construction of addition and remedial work and to accommodate new work, including that required for connection of new addition, to extent indicated on Drawings. Demolish in an orderly and careful manner.
- .2 Perform demolition in accordance with applicable local and provincial authorities having jurisdiction.

- .3 Remove building equipment and fixtures as indicated and as required to expedite the work.
- .4 Where new Work is shown in the same location as existing work, remove existing work as required to accommodate new Work.
- .5 Repair all demolition performed in excess of that indicated or required, to the approval of the Consultant and at no expense to the Owner.
- .6 Completely remove all miscellaneous metals to electrical and mechanical items and all other items which are abandoned.
- .7 Remove existing doors and frames, millwork and portions of existing millwork, ceilings, partitions and portions of existing partitions, finishes including floor finishes as indicated, equipment including mechanical and electrical equipment, masonry and framed construction and the like, as indicated and as required to accommodate new construction.
- .8 Demolish all other existing items as indicated or as otherwise required to accommodate new Work. Do not demolish heritage finishes or elements without the approval of the Consultant.
- .9 Demolish the portion of building noted including removal of roofs, walls, floors, paving, foundation walls and footings to 300 mm below the final building top of slab elevation and as required to complete new work.
- .10 Leave intact existing foundation walls and footings below 300 mm below grade at building perimeter and interior walls and/or framing members which provide lateral support for perimeter walls unless specifically required to complete new work.
- .11 Collapse enclosed spaces existing below grade, if any.
- .12 Remove combustible materials, plastics, metal, glass, wood, and other organic material from site.
- .13 Break up and remove existing slabs on grade.
- .14 On completion, grade and level the finished site around remaining structure, sloped to drain away from remaining structure and in manner to prevent puddles, flush with adjacent grades, adding clean granular fill as required.

**3.6 HAZARDOUS MATERIAL REMOVAL**

- .1 Perform all hazardous material demolition, removal and disposal using a qualified hazardous materials removal contractor as approved by the Consultant and in accordance with the requirements of the Authority having Jurisdiction.

**3.7 GENERAL ITEMS**

- .1 Cap and identify exposed utilities, as indicated in Mechanical and Electrical drawings and specifications, and coordinate with the Owner.

- .2 Cut openings, holes, chases as required to accommodate new Mechanical and Electrical work. Cut holes in existing concrete slabs and concrete block walls and exterior envelope as required. Perform cutting and partial demolition outside of the renovation area, as required to accommodate routing of mechanical and electrical items. Do not oversize holes.

**3.8 BACKFILL**

- .1 Backfill demolished building excavation to adjacent surface elevation using common material and place and compact to density all as specified in Section 02315.
- .2 Fill materials and areas to be filled shall be free of standing water, frost, frozen materials, trash, and debris.

**3.9 RESTORATION**

- .1 Immediately as the work progresses, repair all vibration and excavation damages to existing adjacent properties and active underground services.
- .2 Upon completion of work, remove debris, trim surfaces and leave the work site clean.
- .3 Reinstate areas and existing works outside area of demolition to conditions that existed prior to commencement of work, including exposed concrete to remain.

**3.10 DISPOSALS**

- .1 Unless indicated otherwise, dispose of demolished materials off-site.
- .2 Selling or burning materials on site is not permitted.

**3.11 CLEANUP**

- .1 Remove all debris and rubbish away from site at regular intervals.
- .2 Leave site free of all debris and rubbish. Broom all hard surfaces.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of Water Pipe and Fittings specified herein.

**2. PRODUCTS**

**2.1 GENERAL**

- .1 All pipes to have ends sealed by Manufacturer prior to shipping.
- .2 All pipe are to be cylindrical and straight, with ends cut square to the longitudinal axis and having a smooth finish free from imperfections such as grooves or ripples.
- .3 All Polyvinyl Chloride (PVC) pipe will have the following information continuously indent printed or spaced at intervals not exceeding 1.5 m:
  - .1 Name and/or trademark of the pipe
  - .2 Nominal pipe size
  - .3 Pressure rating and/or DR number
  - .4 Manufactured standard design basis
  - .5 A production code from which the date of manufacture can be determined.

**2.3 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS**

- .1 Pipe sizes 100 mm to 300 mm in diameter
  - .1 All pipe and joints will be to the latest revision AWWA C900, CSA certified as meeting latest revision CSA 3-B137.3-M, SDR 18, pressure class 150.
  - .2 PVC Fittings to the latest revision AWWA C-907, CSA certified as meeting latest revision CSA 3-B137.2, SDR 18, pressure class 150, bell ends, c/w 1 MPa elastomeric gasket push-on joint.
- .2 Pipe sizes 350 mm to 900 mm in diameter
  - .1 All pipe and joints will be to the latest revision AWWA C905, CSA certified as meeting latest revision CSA 3-B137.3-M, SDR 25, pressure class 165.
  - .2 PVC Fittings to be latest revision AWWA & CSA.
- .3 All PVC pipe to measure the equivalent of cast iron outside diameter, bell end, c/w SBR or NBR gaskets of a pressure actuated seal design.
- .4 All PVC pipe to be capable of deflecting at joint.

- .5 All pipe to be supplied with integral wall thickened bell ends and continuous gaskets.

### **3. EXECUTION**

#### **3.1 PIPE AND FITTING INSTALLATION**

- .1 Installation and handling of pipe to be according to the manufacturer's recommendations and applicable AWWA Specification for the type of pipe selected or as specified herein.
- .2 All water mains to be installed with a minimum cover of 2.5 m above the crown of the pipe. Mains with less than 2.5 m cover will be installed with an insulating frost shield unless otherwise directed by Owners Representative.
- .3 Install pipe to the lines, grades and elevations shown on the Contract Documents. Lay the pipes on the prepared bed, true to line and grade, with pipe invert smooth and free of sag or high points. Ensure barrel of each pipe is in contact with shaped bed throughout the full length of pipe. Commence laying pipe and proceed in a given direction with bell ends of pipe facing towards next pipe to be installed.
- .4 For ties to existing water mains requiring interruption of the water service, advise the Owners Representative 48 hours in advance of the proposed interruption for approval. Upon approval notify the occupants, residents and businesses at least 24 hours in advance by way of a written notice and verbal advisory. Submit a copy of the notice to the Owners Representative for approval prior to distribution. Minimize the period of time of the interruption and schedule the interruption for a non-peak demand time. Notify the fire department of the water supply service interruption to any hydrants.
- .5 Lower pipe into the trench by hand or by mechanical equipment. Lift pipe by means of slings and lowered into the trench. By no means will the pipe be lifted with equipment that gouges or scars the pipe or be allowed to be pulled over the ground. Do not roll pipe into the trench. If the Contractor elects to use a narrow trench, the method of lowering the pipe into the trench will be such that no rocks or lumps of earth fall into the trench beneath the pipe. Lumps of earth and rock greater than 25 mm will not be permitted beneath the pipe and must be removed prior to pipe replacement.
- .6 The assembly of the gasket joint will be performed as recommended by the pipe manufacturer and applicable AWWA Specification for the type of pipe selected. In all cases, clean the gasket, the bell or coupling interior, especially the groove area, and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket; pipe spigot, bevel, gasket groove and sealing surface for damage or deformation. Apply Lubricants as specified by the pipe manufacturer.
- .7 Good alignment of the pipe is essential for easy assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Firm and steady pressure will be applied either by hand or by bar and block assembly until the spigot easily slips through the gasket. Do not swing or stab the joint or suspend the pipe and swing it into the bell or use excavating equipment to force pipe sections together. Complete each joint before laying next length of pipe.

- .8 Handle pipe in a manner to prevent damage to the pipe walls. Pipe strung along the trench will, if necessary, be supported on timber skids sufficiently protected to prevent injury. Securely close the open end of pipe at the end of each day's work to prevent the entrance of small animals, or the introduction of foreign matter of any nature, and do not reopen the ends until work is resumed. Exercise care in joining sections of the pipe, in order to minimize any possibility of foreign matter whatsoever being inside the pipeline after the completion. Any obstructions remaining in the line after the completion thereof to be removed.
- .9 Do not install pipe on frozen bedding.
- .10 Water PVC pipe and fittings will have Type 1 backfill as per Section 02319 – Trench Excavating and Backfilling.
- .11 Install sacrificial anodes and corrosion protective tape on all cast iron fittings.
- .12 Provide thrust blocking on all pipe and fitting deflecting more than 5 degrees.

**3.2 TOLERANCE**

- .1 Maintain constructed grade to within - 50 mm an + 50 mm from the lines, grades and elevations shown in the Contract Documents. Where departures occur, return to established grade gradually over a distance of not less than 25 meters.

**3.3 TESTING AND INSPECTIONS**

- .1 All pipe and fittings to be pressure tested.
- .2 All pipe and fittings on a potable water system to be flushed and disinfected including bacteriological testing.

**END OF SECTION**



**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of "Valves and Valve Boxes" specified herein.

**2. PRODUCTS**

**2.1 VALVES**

- .1 Resilient Wedge Gate Valves:
  - .1 100 mm diameter valves are not permitted.
  - .2 Valves sized 150 to 300 mm diameter will be resilient wedge gate valves, conforming to latest revision AWWA C509, c/w fully rubber encapsulated solid wedge, non-rising stem, suitable for direct bury.
  - .3 Valves to open counter clockwise. (Turn left to open).
  - .4 Valve body to be constructed of cast iron, in accordance with ASTM A126, Class "B". All nuts, bolts, and washers will be stainless steel.
  - .5 Interior and exterior of valve to be epoxy coated, as per latest revision AWWA C550.
  - .6 Bronze valve stem to be operated by a 50 x 50 mm square operating nut. The valve stem (stuffing box) will contain a double "O" ring seal.
  - .7 Valve ends to be push-on "Tyton Joint" conforming to latest revision of AWWA C111 / ANSI A21.11.
  - .8 Approved Products:
    - Clow f-6112 resilient wedge gate valve

**2.2 CAST IRON VALVE BOXES**

- .1 To be completely bituminous coated sliding type, adjustable over a minimum of 450 mm. Bottom casing to be large round type with minimum inside diameter of 240 mm. All castings will clearly have the manufacturer's identification cast on them.
- .2 Depth of bury to be 2.00 m (6.5') to 3.05m (10') or as shown on contract documents.
  - .1 Valve operating extension spindle to be 25 x 25 mm square. Spindle length will be such that the operating nut will not be more than 300 mm below the cover when set on the valve-operating nut.

- .2 Bottom of spindle to fit 50 x 50 mm square valve operating nut and will be riveted to spindle.
- .3 Top of spindle will have removable 50 x 50 mm square operating nut c/w stonecatcher flange.
- .4 Top casing to fit over 133 mm (5.25") inside diameter bottom casing.
- .5 Lid to be 11.35-kg (25-lbs.) minimum, marked "WATER".
- .6 Approved Products:
  - Norwood "Type A"
  - Trojan Industries "Type A"
  - Sovereign Castings Ltd. "Type A" modified to City of Lethbridge specification.

### **3. EXECUTION**

#### **3.1 VALVE INSTALLATION**

- .1 Set and joint all valves in accordance with the manufacturer's recommendations and applicable AWWA Specifications.
- .2 Ensure that the stuffing glands are properly packed with a high-grade packing and tighten gland bolts prior to installation.
- .3 Install concrete base for valves and anchors as per the drawings.
- .4 Provide sacrificial anodes and corrosion protective tape on all valves.
- .5 Set the valve accurately in position and place the valve box carefully over the bonnet with the valve casing perpendicular to the axis of the pipe, and adjust the top box to the grades specified.
- .6 Secure the extension rod to the valve nut. Install extension rod and valve Box Riser plumb over the valve.
- .7 Backfill for valves and valve boxes shall be consistent with the connecting pipe backfill.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of "Couplings" specified herein.

**2. PRODUCTS**

**2.1 COUPLINGS**

.1 Stainless Steel Couplings:

- .1 Designed for joining plain end pipes of equal outside diameter. To be flexible, all stainless steel construction. All welded stainless steel to be "passivated" after welding to eliminate sensitizing of the stainless steel.

- .2 Shell, Sidebars, Nuts, and Bolts to be Type 304 fully passivated stainless steel. Gasket to be continuous ringed S.B.R. rubber conforming to latest revision AWWA C-111 / ANSI A21.11.

.3 Approved Products:

- Robar 1606 Style 2 - for sizes 100 mm to 350 mm
- Robar 1606 Style 3 - for sizes 400 mm to 600 mm
- Robar 1736AS - for sizes 100 mm to 300 mm
- Robar 1596 - for sizes 100 mm to 300 mm
- Canpac CS Series - CS2 for sizes 100 mm to 350 mm  
CS3 for sizes 400 mm to 600 mm

.2 Epoxy Coated Couplings:

- .1 To be cathodically fitted and protected by cap type anodes. Anodes to be 300-gram zinc alloy caps meeting latest revision ASTM B418, Type 1, threaded onto the coupling bolts. Electrical continuity between bolts and end plates to be achieved by removing the epoxy coating from the end plates, under the nut bearing area or with a factory installed anode strap.

.2 Epoxy Coated couplings are supplied in the four following configurations:

- Standard Couplings: designed for joining plain end pipes of equal outside diameter.
- Transition Couplings: designed for connecting pipes of the same nominal size, which have great differences in outside diameter. Transition to be made by "stepped-down" centre ring, c/w special end plate.
- Reducing Couplings: designed for connecting pipes of different nominal sizes. Reduction to be made by "stepped-down" centre ring, c/w special end plate.

- Multi Range Couplings: Straight and transition couplings are used to make a non restrained connection between two pipes of the same nominal size but with same or different outside diameters. One range fits all pipe outside diameters, IPS PVC to rough barrel AC.
- .3 Centre ring to be cast ductile iron to latest revision ASTM A536, factory coated with corrosion protective epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum.
- .4 End plates to be heat-treated cast ductile iron to latest revision ASTM A536, factory coated with corrosion protective epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum. End plates will be provided with one 6 mm (1/4") SAE J429 Grade 5, NC cadmium plated setscrew to provide electrical conductivity between the end plates and the sleeves.
- .5 Gasket to be S.B.R. rubber conforming to latest revision AWWA C-111 / ANSI A21.11.
- .6 Bolts to be 15.875 mm (5/8") NC trackhead, c/w heavy-duty hex nuts. Material to be low alloy steel conforming to latest revision AWWA C-111 / ANSI A21.11. All bolts (except threaded area) to be factory coated with corrosion protective epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum.
- .7 Coupling components to be marked as follows:  
Centre Ring: Nominal size and manufacturers' name.  
End-Plate: O.D. range and manufacturers' name.  
Gaskets: O.D. range and manufacturers' name.
- .8 Approved Coupling Products
  - Robar 1506
  - Robar 1519
  - Robar 1596
  - Robar 1726
  - Romac 501
  - Ford Meter Box Co.
  - FC2W Ultra Flex Coupling
  - TPS Hymax 2000
  - TPS Hymax CP
- .9 Approved Anode Products:
  - "Protecto-Caps" 300 P60W

### 2.3 RESTRAINERS

- .1 Restrain PVC pipe back to nearest fitting. Use cast iron fittings when restrainers are required.
- .2 Approved Products:
  - Ford Meter Box Co. – Uniflange Restrainers 1300 Series

**3. EXECUTION**

- .1 Install all couplings, tapping sleeves and restrainers in accordance with manufacturer recommendations.
- .2 Backfill for couplings, tapping sleeves and restrainers will be consistent with the connecting pipe.
- .3 Install sacrificial anodes and corrosion protective tape on all epoxy coated couplings, tapping sleeves and restrainers.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Cathodic Protection” specified herein.

**2. PRODUCTS**

**2.1 CORROSION PROTECTIVE TAPES AND WRAPS**

- .1 Field installed corrosion protective coatings to be two part paste & tape systems.

- .2 Approved Products:

- **Polyken 900 system:**  
No. 930 Joint Wrap Tape  
No. 931 Filler Tape
- **Denso of Canada Ltd:**  
Denso Paste  
Denso Tape
- **Canada Pipeline Accessories Corp.:**  
Petro Primer Paste  
Petro 40 Tape  
Petro Overwrap Tape
- **Polyguard Products Inc.**  
Polyguard 600 Primer  
Polyguard 600 Series Coating Tape  
Polyguard 606 Filler System
- **The Trenton Corporation**  
Trenton Tec-Tape Primer  
Trenton Tec-Tape Wrapper  
Trenton Glas-Wrap  
Trenton Fill-Putty

**2.2 CATHODIC PROTECTION**

- .1 General

- .1 Prior to backfilling, arrange for the Owner’s Representative to witness the installation of the sacrificial anode, wires, cadwelding, etc., and the necessary continuity check. Location of anode packs to be reviewed by the Owner’s Representative.

.2 Sacrificial Anodes

Anode lead wires will be 3 metres in length and will consist of AWG#10/7 stranded copper wire with RWU-90 insulation. Zinc anodes are to be supplied with a white lead wire and magnesium anodes with a blue lead wire. The lead wire will be connected to the core with silver solder. The entire connection will be insulated by filling the recess with an electrical potting compound.

The anode will be packaged in a water permeable cardboard containing a backfill mixture of the following composition:

Ground Hydrated Gypsum	75%
Powdered Wyoming Bentonite	20%
Anhydrous Sodium Sulphate	5%

Backfill will have a grain size so that 100% is capable of passing through a 20 mesh screen and 50% will be retained by a 100 mesh screen. The mixture will be firmly packaged around the anode within the cardboard tube by means of adequate vibration. Cardboard tube size and backfill material volume will be sufficient to provide a maximum thickness of 25 mm of backfill between all parts of the anode and the anode packaging.

All anodes will carry a label identifying the manufacturer's name, type of anode and the net weight. Cardboard tubes used to package anodes will have sufficient strength to permit normal shipping and handling without failure.

Zinc Anodes

Zinc anodes will conform to ASTM B418 Type II. All anodes will have a minimum open circuit potential of -1.10 volts referenced to Cu/CuSO<sub>4</sub>. Zinc anodes will have the following composition:

Aluminum	0.005%	maximum
Cadmium	0.003%	maximum
Iron	0.0014%	maximum
Lead	0.003%	maximum
Copper	0.002%	maximum
Zinc	remainder	

Magnesium Anodes

Magnesium anodes will conform to ASTM B843 grade M1C. Anodes will have a minimum open circuit potential of -1.70 volts referenced to Cu/CuSO<sub>4</sub>. Minimum acceptable current efficiency is 48%. Testing of these properties will be in accordance with ASTM G97. These anodes will be cast with a perforated galvanized steel core. The weight of the core will not exceed 0.15 kg per meter. One end of the anode will be recessed so that the core is accessible for the lead wire connection.

Magnesium anodes will conform to the following composition (limits are given as maximum weight percent unless shown as a range):

Aluminum	0.01
Manganese	0.50 to 1.3
Silicon	0.05
Copper	0.02
Nickel	0.001
Iron	0.03
Other metallic Impurities	0.05 ea
Magnesium	remainder

### **3. EXECUTION**

#### **3.1 INSTALLATION OF CORROSION PROTECTIVE COATINGS**

- .1 Install corrosion protective coatings as per manufacturer's recommendations.
- .2 Ensure steel to be coated is clean so that coating adheres to the surface.
- .3 Allow cadwelds to cool before placing coating over the cadweld.

#### **3.2 INSTALLATION OF SACRIFICIAL ANODES**

- .1 Remove the plastic bag from the anodes, leaving the cloth bag or cardboard casing intact.
- .2 Place the anodes a minimum distance of 1.0 m from the main in a horizontal position at approximately the same elevation and parallel to the main.
- .3 Ensure that soil is packed uniformly around the anodes to eliminate voids or air pockets adjacent to the anodes.
- .4 Wet the installed anode and surrounding soil prior to backfilling
- .5 Cadweld anode lead wire to the buried metal item to be cathodically protected.
- .6 Provide one (1) 5.4 kg anode for:
  - .1 each buried valve

#### **3.3 CADWELDING**

- .1 Remove a small portion of coating on the metal item to receive the anode lead wire.



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- .2 Thoroughly clean area to be cadwelded and file metal until a shiny, roughened surface is obtained approximately 75 mm square.
- .3 Crimp a copper sleeve onto the bared end of the wire to be cadwelded.
- .4 Use a cadweld mold M108 or equal and powder CA-15 or equal.
- .5 Knock any slag off of the completed cadweld and file smooth any sharp edges.
- .6 Thoroughly coat and cover the cadweld and any area adjacent that has had the coating removed with an adhesive moulded plastic patch.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for the location, use, and placement of “Water Service Connections” specified herein.
- .2 This Section may also be used as a reference section. All materials specified in Part 2, Products, may not necessarily be required.

**2. PRODUCTS**

**2.1 GENERAL**

- .1 For service connection sizes 100 mm to 300 mm diameter, pipe to be Polyvinyl Chloride (PVC) Pressure Pipe as specified in Section 02511 – Water Pipe and Fittings..
- .2 Valves and Valve Boxes for service connection sizes 100 mm to 300 mm diameter to be as specified in Section 02515 – Valves and Valve Boxes.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for the location, use, and placement of “Hydrostatic Pressure Testing” specified herein.
- .2 This Section may also be used as a reference section. All materials specified in Part 2, Products, may not necessarily be required.

**2. PRODUCTS**

- .1 Potable water system
  - test water must be potable water.
- .2 Non-potable water or sanitary forcemain system
  - test water must be either potable water or clean, non-potable water
- .3 Purchase all necessary water for hydrostatic pressure testing from the Owner, unless otherwise approved by the Owner’s Representative.

**3. EXECUTION**

- .1 Subject the newly laid pipe to hydrostatic pressure and leakage tests after backfilling. Supply all labour, equipment and materials required to perform the hydrostatic and leakage tests. Equipment will include a pump, pipe connections, pressure gauges with adequate pressure range, fittings, lines, trucks, tanks, and all other necessary equipment.
- .2 Notify the Owner and the Owner’s Representative at least 24 hours prior to starting the tests. The tests are to be witnessed by the Owner’s Representative.
- .3 Do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used for thrust blocks.
- .4 Open all valves necessary to test section of pipe.
- .5 Test pipeline in sections not to exceed 500 m in length unless otherwise authorized by Owner’s Representative.
- .6 Any leaks, breaks, failures, or blockages, which are a result of faulty material and/or workmanship are the sole responsibility of the Contractor at no cost to the Owner.
- .7 Supply all water, materials, equipment and fittings required for pipe pressure and leakage testing.

**3.1 PVC PIPE**

- .1 After completing the installation of the Pipeline, or a section of the line, the line will be hydrostatically pressure tested. The completed PVC line will be tested at a pressure equal to one and one-half times the maximum operating pressure, but not in excess of the Manufacturer's recommended operating pressure measured at the lowest point in the test section.
- .2 To compensate for initial pipe stretch and to expel all entrapped air, the pipe will be pressurized until pressure is maintained before the test period is started.
- .3 After completion of the initial expansion phase, the pressure will be at the specified level and the test period will commence. The test period will be for a period of 2 hours and will only commence prior to 3:00 p.m.
- .4 After the test period, a measured amount of "make-up" water will be added to the line to return the pipe to the test pressure. The amount of "make-up" water will not exceed the allowance given in Table 1.

<b>Table 1: Allowable Make-up Water for PVC Pipes with Elastomeric Joints (U.S. Gallons per hour per 1,000ft or 50 Joints)</b>							
<b>Nominal Pipe Size</b>		<b>Test Pressure</b>					
(in)	(mm)	(50 psi)	(100 psi)	(150 psi)	(200psi)	(250 psi)	(300 psi)
4	100	0.19	0.27	0.33	0.38	0.43	0.47
6	150	0.29	0.41	0.50	0.57	0.64	0.70
8	200	0.38	0.54	0.66	0.76	0.85	0.94
10	250	0.48	0.68	0.83	0.96	1.07	1.18
12	300	0.57	0.81	0.99	1.95	1.28	1.41
14	350	0.67	0.95	1.16	1.34	1.50	1.65
16	400	0.76	1.08	1.32	1.53	1.71	1.88
18	450	0.86	1.22	1.49	1.72	1.92	2.12
20	500	0.96	1.35	1.66	1.91	2.14	2.35
24	600	1.15	1.62	1.99	2.29	2.56	2.82
30	750	1.43	2.03	2.48	2.87	3.21	3.53
36	900	1.72	2.43	2.98	3.44	3.85	4.24
42	1050	2.01	2.84	3.48	4.01	4.49	4.94
48	1200	2.30	3.25	3.98	4.58	5.13	5.65

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for the location, use, and placement of “Flushing and Disinfection” specified herein.

**1.2 SCOPE**

- .1 This standard presents mandatory procedures for the flushing and disinfection of new and repaired potable water mains. All new water mains will be flushed and disinfected before they are placed in service. All water mains taken out of service for inspection, repair or other activities that might lead to contamination of water will be disinfected before they are returned to service.

**1.3 PURPOSE**

- .1 This section defines the minimum requirements for the disinfection of water mains, including the preparation of water mains, application of chlorine, and sampling and testing for the presence of coliform bacteria.

**2. PRODUCTS**

- .1 The forms of chlorine that may be used in the disinfection operation are;
- Calcium Hypochlorite solution conforming to AWWA B300
  - Chlorine liquid conforming to AWWA B301

**3. EXECUTION**

**3.1 GENERAL**

- .1 The Owner’s Representative will witness flushing and disinfecting operations. The Contractor is responsible for notifying the Owner’s Representative at least four (4) days in advance of commencing the disinfecting process. The Contractor is responsible for making the necessary arrangements for the supply of water for the flushing operation.
- .2 Thoroughly flush each completed section of main and services over 50 mm (2 inches) to remove all foreign matter. When flushing has been completed to the satisfaction of the Owner’s Representative, inject the main with a chlorine solution (e.g. calcium hypochlorite) at a dosage of at least 50 mg/L. The point of application will be at or near the beginning of the pipe extension and the discharge point at or near the end of the line being treated.

- .3 Inject the chlorine solution while the line is being slowly charged to ensure an even distribution. When the main has been fully charged, valve the main off and let stand for 24 hours. During the detention period, operate all valves and hydrants on the line to ensure that all parts have contacted the chlorine solution. The water in the main must have a chlorine concentration of 25-50 mg/L at the end of the 24-hour period. Thoroughly flush the mains to expel all heavily treated water. Take and test water samples from the line both chemically and bacteriologically. Provide results to Owners Representative for review.
- .4 Do not put a new main into service until a certificate stating that the water is free from contamination has been issued by a recognized laboratory.
- .5 Disinfecting, flushing and obtaining water samples from the mains must be carried out in the presence of the Owner's Representative.
- .6 Ensure that water from the mains in the area will not be used for drinking or other domestic purposes until the mains have been disinfected, samples taken and these samples certified as being free from contamination.
- .7 Purchase all necessary water for flushing and disinfection from the *Owner*.
- .8 Install any necessary chlorination points along the pipeline route in order to properly inject the disinfectant. Connections to be main to be completed at no cost to the Owner. The connections made will be appropriately marked and abandoned to the satisfaction of the Owner's Representative.
- .9 Ensure that all water flushed from the main is safe to be discharged into the disposal point. Abide by all local and Provincial regulations relative to the discharge of super-chlorinated water.
- .10 The addition of an additive to the discharge water may be required in order to neutralize the super chlorinated water prior to disposal. Contractor is responsible for all costs related to this work.

### **3.2 DISINFECTION AND FLUSHING**

- .1 The basic disinfection procedure consists of:
  - .1 inspecting all materials to be used to ensure the integrity of the materials;
  - .2 preventing contaminating materials from entering the water main during storage, construction, or repair and noting potential contamination at the construction site;
  - .3 removing, by flushing or other means, those materials that may have entered the water main;
  - .4 chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main;
  - .5 protecting the existing distribution system for backflow caused by hydrostatic pressure test and disinfection procedures;
  - .6 documenting that an adequate level of chlorine contacted each pipe to provide disinfection;

- .7 determining the bacteriological quality by laboratory test after disinfection;
  - .8 final connection of the approved new water main to the active distribution system.
- .2 Preventive and Corrective Measures During Construction:
- .1 General:
    - .1 Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing these organisms. Therefore, the procedures of this section must be observed to assure that a water main and its appurtenances have been thoroughly cleaned for the final disinfection by chlorination. Also, any connection of a new water main to the active distribution system prior to the receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until bacteriological tests described in Section 3.3 of this standard are satisfactorily completed.
  - .2 Keeping Pipe Clean and Dry:
    - .1 The interiors of pipes, fittings, and valves must be protected from contamination. Pipe delivered for construction will be strung to minimize the entrance of foreign material. All openings in the pipeline will be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.
  - .3 Delays:
    - .1 Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination.
  - .4 Joints:
    - .1 Joints of all pipes in the trench must be completed before work is stopped. If water accumulates in the trench, the plugs will remain in place until the trench is free of water.
  - .5 Packing Materials:
    - .1 Yarning or packing material will consist of molded or tubular rubber rings, rope of treated paper, or other approved materials. Materials such as jute or hemp will not be used. Packing material will be handled in a manner that avoids contamination. If asbestos rope is used, asbestos must be prevented from entering into the water-carrying portion of the pipe.

.6 Sealing Materials:

- .1 No contaminated material or any material capable of supporting prolific growth or microorganisms will be used for sealing joints. Sealing material or gaskets will be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets must be suitable for use in potable water and must not contribute odors. It will be delivered to the job in closed containers and will be kept clean and applied with dedicated, clean applicator brushes.

.7 Cleaning and Swabbing:

- .1 If dirt enters the pipe, it will be removed and the interior pipe surface swabbed with a 1 to 5% hypochlorite disinfecting solution. If, in the opinion of the Owner's Representative, the dirt remaining in the pipe will not be removed using the flushing operation, then the interior of the pipe must be cleaned using mechanical means, such as a hydraulically propelled foam pig (or other suitable device acceptable to the Owner's Representative) in conjunction with the application of a 1% hypochlorite disinfecting solution. The cleaning method used must not force mud or debris into the interior pipe-joint spaces and must be acceptable to the Owner's Representative.

.8 Wet-trench construction:

- .1 If it is not possible to keep the pipe and fittings dry during installation, the water that may enter the pipe-joint spaces will contain an available chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench or by treating the trench water with hypochlorite tables.

.9 Flooding by storm or accident during construction:

- .1 If the main is flooded during construction, the Owner's Representative may require the following procedure be followed. The decision will be based on site specific conditions.

The main will be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater will then be filled with a chlorinated potable water that, at the end of a 24 hour holding period, will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main will be disinfected using the continuous-feed or slug method.



.10 Backflow Protection:

- .1 When specified by the Owner’s Representative, the new water main will be kept isolated from the active distribution system using a physical separation until satisfactory bacteriological testing has been completed and the disinfectant water flushed out. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing will be supplied through a temporary connection between the distribution system and the new main. The temporary connection will include an appropriate cross-connection control device consistent with the degree of hazard (a double check valve assembly or a reduced pressure zone assembly).

In **most** cases a closed gate valve will be considered to be sufficient isolation.

It will be necessary to re-establish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfectant water prior to final connection of the new main to the distribution system.

.3 Pre Flushing

- .1 The source water used for disinfection and pressure testing will be flushed prior to its use to ensure that contaminants or debris are not introduced into the new pipe. Adequate drainage must be provided during flushing. Drainage will not take place away from the construction area.
- .2 Flushing operations are required to produce a minimum water velocity of 0.76 m/s in the water main. The following table provides the reference information between main pipe diameter, require flow in the main pipe to achieve the minimum water velocity and the required outlets to achieve the require flow for a water main with 40 psi.

Pipe Diameter (mm)	Required Flow In Main (l/s)	Size of Tap			Number of 63.5 mm (2½”) Hydrant Outlets
		(25 mm)	(38 mm)	(50 mm)	
100	6.3	1	-	-	1
150	12.6	-	1	-	1
200	25.2	-	2	1	1
250	37.9	-	3	2	1
300	56.8	-	-	2	2
400	100.9	-	-	4	2

.4 Final Flushing

.1 Clearing the main of heavily chlorinated water:

.1 After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water will be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use.

.2 Disposing of Heavily Chlorinated Water:

.1 Under no condition is heavily chlorinated water to be discharged to the Storm Sewer system. Heavily chlorinated water may be discharged to the Sanitary Sewer system with permission from the Owner.

Where discharge to the Sanitary Sewer System is impractical, chlorinated water will be treated with an approved de-chlorinating agent and monitored to ensure that chlorine levels do not adversely affect the environment.

.5 Procedures When Cutting Into or Repairing Existing Mains

The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to the completion of bacteriological testing in order to minimize the time customers are without water.

.1 Trench Treatment:

When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from this pollution. Tablets have the advantage in this situation, because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

.2 Swabbing with Hypochlorite Solution:

The interior of all pipe and fittings (particularly couplings and sleeves) used in making the repair will be swabbed or sprayed with a 1% hypochlorite solution before they are installed.

.3 Flushing:

Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing will be started as soon as the repairs are completed and will be continued until discolored water is eliminated.

.4 Slug Chlorination:

Where practical, in addition to the procedures previously described, the section of the main in which the break is located will be isolated, all service connections shut off, and the section flushed and chlorinated. The dose may be increased to as much as 300 mg/L and the CT reduced to as little as 15 min. After chlorination, flushing will be resumed and continued until discolored water is eliminated and the chlorine concentration in the water exiting the main is no higher than the prevailing water in the distribution system or that which is acceptable for domestic use.

.5 Bacteriological Samples:

Bacteriological samples will be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples will be taken on each side of the main break. If positive bacteriological samples are recorded then the situation will be evaluated by the Owner's Representative who can determine corrective action.

.6 Special Procedure for Caulked Tapping Sleeves

Before a tapping sleeve is installed, the exterior of the main to be tapped will be thoroughly cleaned and the interior surface of the sleeve will be lightly dusted with calcium hypochlorite powder.

Tapping sleeves are used to avoid shutting down the main. After the tap is made, it is impossible to disinfect the annulus without shutting down the main and removing the sleeve. The space between the tapping sleeve and the tapped pipe is approximately 13 mm, so that as little as 1000 mg/m<sup>2</sup> of calcium hypochlorite powder will provide a chlorine concentration of more than 50 mg/L.

### 3.3 VERIFICATION

.1 Bacteriological Tests:

.1 Standard Conditions:

After final flushing, and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples taken at least 24 hours apart, will be collected from the new main. (NOTE: The pipe, the water loaded into the pipe, and any debris all exert a chlorine demand that can interfere with disinfection).

At least one set of samples will be collected from every 350 m of the new water main, plus one set from the end of the line and at least one set from each branch. All samples will be tested for bacteriological quality in accordance with Standard Methods of the Examination of Water and Wastewater, and must show the absence of coliform organisms.

Testing for chlorine residual and turbidity will also be conducted.

A standard heterotrophic plate count MAY be required at the option of the Owner's Representative, because new material does not typically contain coliforms but does typically contain HPC bacteria.

.2 Special Conditions:

If trench water has entered the new main during construction or if, in the opinion of the Owner's Representative, excessive quantities of dirt or debris have entered the new main, bacteriological samples will be taken at intervals of approximately 60 m and the location will be identified. Samples will be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.

.3 Sampling Procedure:

Samples for bacteriological analysis must be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater. No hose or fire hydrant will be used in the collection of samples. (NOTE: For pipe repairs, if no other sampling port is available, well flushed fire hydrants may be used with the understanding that they do not represent optimum sampling conditions). The sampling pipe must be dedicated and clean, and disinfected and flushed prior to sampling. A corporation cock may be installed in the main with a copper-tube gooseneck assembly.

.4 Record of Compliance:

The record of compliance will be the bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination.

.2 Re-Disinfection

If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected the new main may be re-flushed and must be re-sampled. If check samples also fail to produce acceptable results, the main will be re-chlorinated by the continuous-feed or slug method until satisfactory results are obtained. (NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main to determine the source of turbidity).

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunctions with other Sections for the location, use, and placement of “Thrust Blocking” specified herein

**2. PRODUCTS**

**2.1 CONCRETE**

- .1 Concrete mix will satisfy the requirements of Exposure Classification C-2 of Table 1 in the latest revision of CAN/CSA A23, and will be in accordance with the following minimum requirements unless shown in the Contract Documents:
  - 28 day compressive strength – 20 MPa
  - Maximum nominal size of coarse aggregate – 25 mm
  - Slump – maximum 75 mm
  - Air Content – 4% to 7%
  - Maximum water cementing materials ratio – 0.45
  - Portland Cement – Type 50 or HS, Sulfate Resistant
  - Minimum cement content – 300 kg/m<sup>3</sup>
  - Fly Ash Content – 20% max.
- .2 Two layers of 6 mil polyethylene to be placed between all fittings, valve, and pipe and the concrete.

**3. EXECUTION**

- .1 All bends, fittings, valves and all points where there is thrust will be anchored to prevent movement by providing suitable thrust blocking, as shown on the Contract Documents.
- .2 Thrust-blocking material will be purchased from a reputable concrete supplier and will not be manufactured on site.
- .3 Thrust blocking will be placed between solid ground and the fitting to be anchored; the area of bearing between the pipe and the ground in each instance will be that shown on the Contract Documents. The blocking will be so placed that the pipe and fitting joints will be accessible for repair.
- .4 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants, and fittings and undisturbed ground as indicated or as directed by the Owner’s Representative.
- .5 Bearing areas will be inspected by the Owner’s Representative prior to placing concrete.

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- .6 Keep joints and couplings free from concrete.
- .7 Do not backfill over concrete for a minimum of 24 hours after concrete is placed.
- .8 Backfill for thrust blocking to be consistent with connecting pipe .

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other sections for location use and placement of “Sanitary Sewer Pipe and Fittings” specified herein.

**2. PRODUCTS**

**2.1 LINE CODE CLASSIFICATION**

- .1 Use the following code classification to determine pipe diameter, type and rating from the drawings:  
S 200 PVC SDR 35      200mm diameter SDR 35 PVC pipe

**2.2 GENERAL**

- .1 All pipe to have ends sealed by manufacturer prior to shipping.
- .2 Rubber gasket joints are required for all pipe.
- .3 All pipe are to be cylindrical and straight, with ends cut square to the longitudinal axis and having a smooth finish free from imperfections such as grooves or ripples.

**2.3 PIPE**

- .1 “Smooth Wall” Polyvinyl Chloride (PVC) Pipe
  - .1 All pipe will have the following information continuously indent printed and spaced at intervals not exceeding 1.5 m:
    - .1 Name and/or trademark of the pipe.
    - .2 Nominal pipe size.
    - .3 Pressure rating and/or DR number.
    - .4 Manufactured standard design basis.
    - .5 A production code from which the date and place of manufacture can be determined.
  - .2 For pipe sizes 200 mm to 375 mm in diameter all pipe to be PVC gravity sewer pipe to latest revision ASTM D3034, SDR 35, CSA certified as meeting the latest revision CAN/CSA B182.2-M, integral locked-in gasket bell and spigot system.

**3. EXECUTION**

**3.1 PIPE INSTALLATION**

- .1 Installation and handling of pipe will be according to the manufacturer's recommendations and applicable AWWA Specification for the type of pipe selected or as specified herein.
- .2 All sanitary sewer pipe to be installed with a minimum cover of 2.5 m above the crown of the pipe or with an insulation frost shield, unless otherwise directed by the Owners Representative.
- .3 Install pipe to the lines, grades and elevations shown on the Contract Documents. Pipe bedding as specified. Lay the pipes on the prepared bed, true to line and grade, with pipe invert smooth and free of sag or high points. Ensure barrel of each pipe is in contact with shaped bed throughout the full length of pipe. Commence laying pipe at outlet and proceed in an upstream direction with bell ends of pipe facing upgrade toward the next pipe to be installed.
- .4 For ties to existing mains requiring interruption of the sewer service, advise the Owner's Representative 48 hours in advance of the proposed interruption for approval. Upon approval notify the occupants, residents and businesses at least 24 hours in advance by way of a written notice and verbal advisory. Submit a copy of the notice to the Owner's Representative for approval prior to distribution. Minimize the period of time of the interruption and schedule the interruption for a non-peak demand time.
- .5 Lower pipe into the trench by hand or by mechanical equipment. Lift pipe by means of slings and lower into the trench. Do not lift pipe by equipment that gouges or scars the pipe or allow pipe to be pulled over the ground. Do not roll pipe into the trench. If the Contractor elects to use a narrow trench, the method of lowering the pipe into the trench will be such that no rocks or lumps of earth fall into the trench beneath the pipe. Lumps of earth and rock greater than 25 mm will not be permitted beneath the pipe and must be removed prior to pipe placement.
- .6 The assembly of the gasket joint will be performed as recommended by the pipe manufacturer and applicable AWWA Specification for the type of pipe selected. In all cases, clean the gasket, the bell or coupling interior, especially the groove area, and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket; pipe spigot, bevel, gasket groove and sealing surface for damage or deformation. Apply lubricants as specified by the pipe manufacturer.
- .7 Good alignment of the pipe is essential for easy assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Firm and steady pressure will be applied either by hand or by bar and block assembly until the spigot easily slips through the gasket. Do not swing or stab the joint or suspend the pipe and swing it into the bell or use excavating equipment to force pipe sections together. Complete each joint before laying next length of pipe.



- .8 Handle pipe in a manner to prevent damage to the pipe walls. Pipe strung along the trench will, if necessary, be supported on timber skids sufficiently protected to prevent injury. Securely close the open end of pipe at the end of each day's work to prevent the entrance of small animals, or the introduction of foreign matter of any nature, and do not reopen the ends until work is resumed. Exercise care in joining sections of the pipe, in order to minimize any possibility of foreign matter whatsoever being inside the pipeline after the completion. Any obstructions remaining in the line after the completion thereof are to be removed.
- .9 For concrete sewer pipe, mortar the joints in the interior of 900 mm diameter and larger pipe. On the exterior of the pipe use mortar to caulk the joints and allow at least one hour set time before backfilling. Smooth finish the surface of all joints.
- .10 When installing the pipe bedding/haunching material ensure that the pipe is adequately secure to prevent the pipe from lifting or moving laterally while the pipe bedding/haunching material is being placed and compacted around the pipe.
- .11 For special fittings and tie-ins, cut the pipe to the length required as recommended by the pipe manufacturer without damaging the pipe or its coating. The end will be cut smooth at right angles to the axis of the pipe.
- .12 Flush all new sanitary sewer lines. Prevent any large debris from entering the existing system by using a screen at the downstream tie to the existing system.
- .13 Do not install pipe on frozen bedding.
- .14 If a grade laser is used for pipe alignment and grade control, the installed pipe must be checked and verified at several intermediate points and termination points by surveys with a tape and surveyors level.
- .15 Sanitary pipe and fitting will have Type 1 backfill as per Section 02319 – Trench Excavating and Backfilling

**3.2 TOLERANCE**

- .1 Maintain constructed grade pipe to within + 5 mm and – 5 mm from the lines, grades and elevations shown in the Contract Documents. Where departures from grade occur, pipe will be removed to the last joint where the pipe is within allowable tolerance and pipe will be reinstalled to within tolerance.
- .2 Flexible Pipe
  - .1 The Contractor will repair all deficiencies found during testing and inspections. In general deficiencies include: improper joints; any cracked, sheared, out of round or unduly deflected pipe in excess of 7.5% deflection for flexible pipe; sags or rises which pond water in excess of 15 mm; protruding service connections; and visible leaks.

- .4 Construct sanitary sewer as watertight as possible using rubber gaskets to the pipe manufacturer's specifications. Infiltration of groundwater into the entire system will not exceed 4.6 litres per day per mm of pipe diameter per km of sewer, and the leakage into any section between adjacent manholes will not exceed three times that amount. After the installation and backfilling of sewer pipe, services and manholes is completed, the Owner's Representative will have the right to require the Contractor to measure the leakage of groundwater. Should this leakage exceed the amount specified, the Contractor will at his own expense repair the sewer by replacing or otherwise, until the leakage does not exceed the amount specified.

**3.3 TESTING AND INSPECTIONS**

- .1 Provide video inspections of sanitary sewer line as per Section 02655 – Video Inspections.
- .2 If the video reveals any ovality (out of round) in the “smooth wall” polyvinyl chloride (PVC) pipe, perform a deflection test to ensure those sections of pipe have not deflected in excess of 7.5%. A successful deflection test requires a mandrel, not less than 92.5% of the base internal diameter (as defined by the CSA or ASTM standard to which the pipe is manufactured), be pulled through the pipe.
- .3 All pipe deflection testing will be completed in conjunction with video inspections.
- .4 Contractor will inform the Owner's Representative 48 hours before all testing and inspections are to begin.

**END OF SECTION**

1415-057-00

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Sanitary Service Connections” specified herein.

**2. PRODUCTS**

**2.1 “SMOOTH WALL” POLYVINYL CHLORIDE (PVC) PIPE**

- .1 For PVC service connections 100 mm to 150 mm in diameter, all pipe to be to latest revision ASTM D3034, CSA certified as meeting latest revision CSA B182.1-M, SDR 28, integral locked-in gasket bell and spigot joints.
- .2 For PVC service connections 200 mm and larger, all pipe to be as per Section 02530 – Sanitary Sewer Pipe and Fittings; sub-section 2.2.2 “Smooth Wall” PolyVinyl Chloride (PVC) Pipe.
- .3 All pipe will have the following information continuously indent printed and spaced at intervals not exceeding 1.5 m:
- .1 Name and/or trademark of the pipe.
  - .2 Nominal pipe size.
  - .3 Pressure rating and/or DR number.
  - .4 Manufactured standard design basis.
  - .5 A production code from which the date and place of manufacture can be determined.

**2.2 POLYVINYL CHLORIDE (PVC) FITTINGS**

- .1 For PVC service connections 100 mm to 150 mm in diameter, all fittings to be to latest revision ASTM D3034, CSA certified as meeting latest revision CSA B182.1-M, SDR 28, integral locked-in gasket bell and spigot joints.

**2.5 FLEXIBLE RUBBER COUPLINGS**

- .1 Flexible rubber couplings to be elastomeric PVC construction c/w stainless steel straps.
- .2 Approved Products:
- Fernco, #1056 Series
  - Clow, “Super-Seal”
  - Mission Rubber Co. – “Flex-Seal”
  - Pipeconx

**2.6 CORE BELL FITTINGS**

- .1 For adapting SDR 35 or SDR 28 to concrete mains or concrete manholes.

- .2 Approved Products:
- Galaxy Plastics Ltd. – for sizes 100 mm to 250 mm

### 3. EXECUTION

#### 3.1 GENERAL

- .1 Installation and handling of pipe and fittings will be according to the manufacturer's recommendations for the type of pipe and fitting selected or as specified herein.
- .2 All sanitary service connections to be installed with a minimum cover of 2.5 m above the crown of the pipe. Services with less than 2.5 m cover will be installed with an insulating frost shield unless otherwise directed by Owner's Representative.
- .3 Lay pipe straight and true at a minimum grade of two percent (2%) for 100 mm services and one percent (1%) for 150 mm services. Maximum vertical deflection will be 22.5 degrees in any one bend. No horizontal bends will be allowed. Make all service lead joints watertight. No part of the saddle or service pipe will protrude beyond the inside surface of the sewer main.
- .4 Take extra care in backfilling and tamping along the pipe and at connections.
- .5 Prior to commencing backfilling of the service trench the installation will be inspected and approved by the Owner's Representative.
- .6 Cleanouts will be installed at every horizontal change in direction.
- .7 Remove material that drops into the sewer during service installation and tie-in work.
- .8 Backfill for sanitary service will be consistent with the connecting sanitary main work.
- .9 Provide video inspections of all sanitary sewer service work as per Section 02655 – Video Inspections.

#### 3.2 REPLACEMENT OF EXISTING SANITARY SEWER SERVICE

- .1 Notify the occupants, residents or business a minimum of 48 hours in advance of any interruptions to the existing service.
- .2 Restore sanitary service within 24 hours of being disconnected.
- .3 Locate existing sanitary tie-in locations prior to connection to the sanitary main. Install services to existing buildings to best suit the existing service connection location.

**3.5 TOLERANCE**

- .1 Maintain constructed grade to within – 10 mm and + 10 mm from the lines, grades and elevations shown in the Contract Documents. Where departures from grade occurs, pipe will be removed to the last joint where the pipe is within allowable tolerance and pipe will be reinstalled to grade.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use, and placement of “Sewer Bypass Pumping” specified herein.
- .2 The intent of this Section of work is for the Contractor to maintain flows in the sanitary sewer system at all times in order to facilitate the work of this Contract. This includes flows in the main line and from each affected service connection.

**2. PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

- .1 Provide all pumps, automated level controls, pipes, hoses, connectors, and related equipment and power sources required for sewer bypass pumping.
- .2 Maintain pumps in good operating condition at all times. Have at the Site at all times, at least one standby pump for each category of pump required for sewer bypass pumping. Have on site at all times, a standby generator with the capacity of replacing any of the pump generators.
- .3 Install a replacement pump or pumps of equal capacity before removing a pump or pumps for maintenance.
- .4 Provide continuous full-time (24 hours per day) monitoring of the pumping system to ensure continuous operation.
- .5 Make arrangements for a vacuum truck (minimum 7500 litre capacity) to be available on an emergency basis.
- .6 Approved sewage bypass pumping contractors:

**Canadian Dewatering Ltd.**  
8350-1<sup>th</sup> Street North West  
Edmonton, AB T6P 1X2  
Telephone: (780) 400-2260  
Facsimile: (780) 400-2261

**Xylem Inc (formerly Flygt Dewatering)**  
6704-30<sup>th</sup> Street South East  
Calgary, AB T2C 1N9  
Telephone: (403) 279-8371  
Facsimile: (403) 279-0948

**3. EXECUTION**

**3.1 GENERAL**

- .1 Design, construct and maintain Temporary Work, construct related Permanent Work, as required for sewer bypass pumping, including all necessary cofferdams, channels, flumes, drains, pipes, hoses, connections, and sumps and other temporary diversion and protective works, and furnish all materials required therefore. Furnish, install, maintain and operate all necessary pumping and other equipment, for diverting sewer flows around the work in progress for the duration of the work.
- .2 Maintain all sumps, trenches and discharge lines to ensure proper containment and free flow to and from the pumps and other diversion and protective works at all times.
- .3 Obtain necessary permits.
- .4 Ensure that sewer bypass pumping procedures do not interfere with the operation of utilities, roadways and business operations serviced by the line.
- .5 Repair damage to any part of the work caused by sewer flows or failure of protective works at no extra cost to the Owner.
- .6 Ensure procedures for "Sewer Bypass Pumping" do not cause pollution in the area. Locate and control discharges of sewer flows to avoid causing damage to property, pollution of watercourses, nuisance on roads, or injury to the public or wildlife.
- .7 Remove any Temporary Work after having served its purpose so as not to interfere in any way with the operation of the utility or with adjacent landowners.
- .8 Make provisions for handling residual water, storm runoff and snowmelt that may enter excavations or infrastructure from time to time.
- .9 Make arrangements with the Owner, landowners, businesses and any other agencies, which may be affected by sewer bypass pumping.
- .10 Retain the services of a qualified sewage bypass pumping contractor to supply, install, maintain and remove the sewage pumping system during construction requiring sewage bypassing. The qualified sewage bypass pumping Contractor will provide pumping construction plans outlining specific procedures and techniques that will be implemented for each sewage bypass set up. Provide these plans to the Owner's Representative at least 14 days prior to beginning any bypassing operations. Modify as required by the Owner's Representative and Owner.
- .11 Prepare contingency plans for fuel and hazardous waste spills, storm run-off and flooding. Provide these plans to the Owner's Representative at least 7 days prior to beginning any sewage bypass pumping. Modify as required by the Owner's Representative or Owner.

**END OF SECTION**

**1415-057-00**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Storm Sewer Pipe and Fittings” specified herein.

**2. PRODUCTS**

**2.1 LINE CODE CLASSIFICATION**

- .1 Use the following code classification to determine pipe diameter, type and rating from the drawings:

ST 200 PVC SDR 35    200 mm diameter SDR 35 PVC pipe

**2.2 GENERAL**

- .1 All pipe to have ends sealed by manufacturer prior to shipping.
- .2 Rubber gasket joints are required for all pipe.
- .3 All cement used in the manufacture of concrete pipe to be Type 50 (or Type HS). Sulfate Resistant, Portland Cement, CSA certified as meeting CAN/CSA-A5-M.
- .4 All pipe are to be cylindrical and straight, with ends cut square to the longitudinal axis and having a smooth finish free from imperfections such as grooves or ripples.

**2.3 “SMOOTH WALL” POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS**

- .1 For pipe sizes 200 mm to 375 mm in diameter all pipe and fittings to be PVC gravity sewer pipe to latest revision ASTM D3034, SDR 35, CSA certified as meeting the latest revision CAN/CSA B182.2-M, integral locked-in gasket bell and spigot system.
- .2 For pipe sizes 450 mm to 1,200 mm in diameter all pipe and fittings to be PVC gravity sewer pipe to latest revision ASTM F679, SDR 35, CSA certified as meeting the latest revision CSA B182.2-M, integral locked-in gasket bell and spigot system.

**3. EXECUTION**

**3.1 PIPE AND FITTING INSTALLATION**

- .1 Installation and handling of pipe will be according to the manufacturer's recommendations and applicable AWWA Specification for the type of pipe selected or as specified herein.



- .2 All storm sewer main pipe to be installed with a minimum cover of 1.2 m above the crown of the pipe. Mains with less than 1.2 m cover will be installed with an insulating frost shield unless otherwise directed by Owner's Representative.
- .3 Install pipe to the lines, grades and elevations shown on the Contract Documents. Pipe bedding as specified. Lay the pipes on the prepared bed, true to line and grade, with pipe invert smooth and free of sag or high points. Ensure barrel of each pipe is in contact with shaped bed throughout the full length of pipe. Commence laying pipe at outlet and proceed in an upstream direction with bell ends of pipe facing upgrade toward the next pipe being installed.
- .4 For ties to existing mains requiring interruption of the storm sewer service, advise the Owner's Representative 48 hours in advance of the proposed interruption for approval. Upon approval notify the occupants, residents and businesses at least 24 hours in advance by way of a written notice and verbal advisory. Submit a copy of the notice to the Owner's Representative for approval prior to distribution. Minimize the period of time of the interruption and schedule the interruption for a non-peak demand time.
- .5 Lower pipe into the trench by hand or by mechanical equipment. Lift pipe by means of slings and lower into the trench. Do not lift pipe with equipment that gouges or scars the pipe or be allowed the pipe to be pulled over the ground. Do not roll pipe into the trench. If the Contractor elects to use a narrow trench, the method of lowering the pipe into the trench will be such that no rocks or lumps of earth fall into the trench beneath the pipe. Lumps of earth and rock greater than 25 mm will not be permitted beneath the pipe and must be removed prior to pipe placement.
- .6 The assembly of the gasket joint will be performed as recommended by the pipe manufacturer and applicable AWWA Specification for the type of pipe selected. In all cases, clean the gasket, the bell or coupling interior, especially the groove area, and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket; pipe spigot, bevel, gasket groove and sealing surface for damage or deformation. Apply Lubricants as specified by the pipe manufacturer.
- .7 Good alignment of the pipe is essential for easy assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Firm and steady pressure will be applied either by hand or by bar and block assembly until the spigot easily slips through the gasket. Do not swing or stab the joint or suspend the pipe and swing it into the bell or use excavating equipment to force pipe sections together. Complete each joint before laying next length of pipe.
- .8 Handle pipe in a manner that prevents damage to the pipe walls. Pipe strung along the trench will, if necessary, be supported on timber skids sufficiently protected to prevent injury. Securely close the open end of pipe at the end of each day's work to prevent the entrance of small animals, or the introduction of foreign matter of any nature, and do not reopen the ends until work is resumed. Exercise care in joining sections of the pipe, in order to minimize any possibility of foreign matter whatsoever being inside the pipeline after the completion. Any obstructions remaining in the line after the completion thereof are to be removed.

- .9 For concrete sewer pipe, mortar the joints in the interior of 900 mm diameter and larger pipe. On the exterior of the pipe use mortar to caulk the joints and allow at least one hour set time before backfilling. Smooth finish the surface of all joints.
- .10 When installing the pipe bedding/haunching material ensure that the pipe is adequately secure to prevent the pipe from lifting or moving laterally while the pipe bedding/haunching material is being placed and compacted around the pipe.
- .11 For special fittings and tie-ins, cut the pipe to the length required as recommended by the pipe manufacturer without damaging the pipe or its coating. The end will be cut smooth at right angles to the axis of the pipe.
- .12 Flush all new storm sewer lines. Prevent any large debris from entering the existing system by using a screen at the downstream tie to the existing system.
- .13 Do not install pipe on frozen bedding.
- .14 If grade laser is used for pipe alignment and grade control, the installed pipe must be checked and verified at several intermediate points and termination points by surveys with a tape and surveyors level.
- .15 Storm pipe and fittings will have Type 1 backfill as per Section 02319 – Trench Excavating and Backfilling.

**3.2 TOLERANCE**

- .1 Maintain constructed grade pipe to within - 10 mm and +10 mm from the lines, grades and elevations shown in the Contract Documents. Where departures from grade occur, pipe will be removed to the last joint where the pipe is within allowable tolerance and pipe will be reinstalled to grade.
- .2 Flexible Pipe
  - .1 The Contractor will repair all deficiencies found during testing and inspections. In general deficiencies include: improper joints; any cracked, sheared, out of round or unduly deflected pipe in excess of 7.5% deflection for flexible pipe; sags or rises which pond water in excess of 15 mm; protruding service connections; and visible leaks.
- .3 Construct storm sewer as watertight as possible using rubber gaskets to the pipe manufacturer's specifications. Infiltration of groundwater into the entire system will not exceed 4.6 litres per day per mm of pipe diameter per km of sewer, and the leakage into any section between adjacent manholes will not exceed three times that amount. After the installation and backfilling of sewer pipe, services and manholes is completed, the Owner's Representative will have the right to require the Contractor to measure the leakage of groundwater. Should this leakage exceed the amount specified, the Contractor will at his own expense repair the sewer by replacing or otherwise, until the leakage does not exceed the amount specified.

**3.3 TESTING AND INSPECTIONS**

- .1 All storm sewer mains and leads will be inspected by means of video camera for leaks and other deficiencies as noted under Subsection 3.2 – Tolerance.
- .2 Provide video inspections of storm sewer lines as per Section 02655 – Video Inspections.
- .3 If the video inspection reveals any ovality (out of round) in the flexible pipe storm sewer pipe, the Contractor will perform a deflection test to ensure those sections of pipe have not deflected in excess of 7.5%. A successful deflection test requires a mandrel, not less than 92.5% of the base internal diameter (as defined by the CSA or ASTM standard to which the pipe is manufactured), be pulled through the pipe.
- .4 All pipe deflection testing will be completed in conjunction with the video inspections.
- .5 Contractor will inform the Owner's Representative 48 hours before all testing and inspections are to begin

**END OF SECTION**

**1415-057-00**

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this section in conjunction with other sections for location use and placement of “Precast Concrete Manholes” specified herein.

**1.2 SHOP DRAWINGS**

- .1 Provide shop drawings for each manhole and vault for review prior to fabrication.

**2. PRODUCTS**

**2.1 GENERAL**

- .1 Concrete:
  - .1 Construct all manholes as shown in the Contract Document plans, standard drawings and detailed drawings.
  - .2 All cement for cast-in place or precast concrete to be Type HS (formerly Type 50) Sulfate Resistant, Portland Cement, CSA certified as meeting the latest revision of CAN/CSA-A5-M.
  - .3 All concrete for cast-in-place or precast to meet the latest revision of CAN/CSA-A23.1- “Concrete Materials and Methods of Concrete Construction”.
  - .4 Concrete: minimum compressive strength of 30 MPa at 28 days.
  - .5 Slump: maximum 75 mm.
  - .6 Air content: 5 to 7 percent.
  - .7 Reinforcing steel: 400 MPa minimum yield strength.
  - .8 Non-precast pipe connections require the barrel openings to be cored/saw cut. Openings can not be greater than the outer diameter of the pipe by more than 50 mm in any direction.
  - .9 For connections PVC pipe to manholes the following methods are approved:
    - .1 Approved coupling and gasket at the pipe/manhole junction and non-shrink grout between coupler and manhole barrel.
    - .2 Three O-ring rubber gaskets placed with a snug fit to the pipe, with the two outer rings placed 2.5 cm away from the centre ring. All three rings will be mortared in place within the opening of the manhole barrel.

- .2 Metal Castings:
  - .1 Castings to be grey iron to latest revision ASTM A48, minimum strength class 20. Castings will be true to pattern, and free of cracks, gas holes, flaws and excessive shrinkage.
  - .2 Castings to be sand blasted or cleaned and ground to eliminate surface imperfections. Surface castings to be free of burnt sand, and will be cast reasonably smooth. Runners, risers, fins, and all other cast pieces will be removed.

## **2.2 PRECAST MANHOLES**

- .1 Precast reinforced manhole sections; precast monolithic base and precast slab top to meet the latest revision of ASTM C478M. Barrels to be 1220 mm minimum inside diameter (I.D.) c/w safety lift rings and matching female and male bell and spigot joints in precast manhole sections.
- .2 All manholes to have flat slab tops with opening offset for vertical ladder installation.
- .3 Shop drawing of precast monolithic bases to be submitted to Owner's Representative for review and approval prior to installation.
- .4 Adjusting rings (collars) to latest revision ASTM C478M. 50 mm, 75 mm, 100 mm, 150 mm and 200 mm thick collars are permitted. The total rise of adjusting rings a minimum of 50mm and a maximum of 305 mm. A maximum of two adjusting rings (collars) are permitted in any one manhole.
- .5 Manholes to be complete with ladder rungs 400 mm "on center" vertically. For manholes with pipe greater than 450 mm in diameter, rungs to be at 90 degrees to channel. For manholes with pipe less than 450 mm in diameter, rungs to be in line with channel.
- .6 All joints to be made watertight using flexible butyl resin sealant, Tylox Superseal Pre-lubricated gasket or approved equal.
- .7 All mortar to use aggregated meeting the latest revision CSA A82.56-M, cement CSA certified as meeting CAN/CSA3-A8-M, Type HS (formerly Type 50), Sulphate Resistant.

## **2.3 LADDER RUNGS**

- .1 All ladder rungs to be drop step type, to latest revision ASTM C478M. Rungs to be minimum 250 mm wide. Rung material to be:
  - .1 Coated Aluminum Rungs: to be 20 mm (3/4") O.D. aluminum tubing coated with low density polyethylene, 3 mm (1/8") thickness. Coating to have integral slip resistant pattern.
  - .2 Aluminum Rungs: to be 20 mm (3/4") O.D. aluminum tubing. Tubing to have integral slip resistant pattern.
  - .3 Galvanized Steel Rungs: to latest revision CSA G30.12, No. 25M billet steel deformed bars, hot dipped galvanized to latest revision CSA G164.

- .2 All rungs to be fastened to concrete with low density polyethylene anchor sleeves.

## 2.4 MANHOLE FRAMES AND COVERS

- .1 Manhole frame and cover will constitute one unit. Manhole frame to have a minimum opening of 610 mm and the frame height of 150 mm.
- .2 Manhole covers to bear evenly on the frames.
- .3 Manhole frames and covers to have a minimum weight of 158.9 kg (350 lbs) per set. Cover to be cast without perforation, complete with two 25 mm diameter lifting holes. Covers to be marked with the “Town of Taber” and with “Sanitary Sewer” or “Storm Sewer”, as required.
- .4 Approved Products:
  - Trojan Industries TF-50 TSC (Town of Taber)
- .5 Where manhole covers are subject to surface water flowing into the manhole “Parson Inserts” are to be used to plug removal holes in the covers.

## 3. EXECUTION

### 3.1 MANHOLE INSTALLATION

- .1 Excavate for installation of manholes to the required depths and lateral dimensions to allow for the safe and accurate installation of the structure. Comply with all safety requirements.
- .2 The excavation for the manhole will be free of any standing water.
- .3 Remove any unstable subgrade and replace with compacted native material or compacted granular material to bridge the unstable subgrade condition.
- .4 Place manhole base on undisturbed stable ground or 150 mm minimum of compacted well graded granular material (98% Standard Proctor Density) or a 25 mm skin coat of lean concrete.
- .5 For cast-in-place manhole slab or base, place specified reinforcing steel and miscellaneous metals on undisturbed stable ground, compacted granular material or lean concrete.
- .6 Where a new manhole is to be installed on an existing run of pipe, ensure that the existing pipe is fully supported during the installation and carefully remove that portion of the existing pipe to dimensions required. Make joints watertight.
- .7 Place stub outlets and bulkheads at elevations and in positions shown in the Contract Documents. Bench the manholes to provide a smooth U-shaped channel. Side height of channel to be 0.50 times diameter of sewer. Slope the floor towards the channel. Curves in channel will be made smoothly. Slope the invert of the channel to establish the sewer grade.

- .8 For precast barrels, set the bottom section in a bed of cement mortar and bond to concrete slab or base. Make each joint watertight with an approved bituminous compound. Clean all surplus mortar and joint compounds from interior surface of manhole as work progresses. Do not flush debris into sewer. Plug all lifting holes with cement mortar or epoxy resin cement to make a watertight seal.
- .9 Install precast manhole sections, base, slab top and cover plumb, level and in accordance with the lines, grades and elevations shown in the Contract Documents. Ensure the ladder rungs are aligned in a straight vertical line. The hole in the slab top will be aligned with the ladder rungs.
- .10 Where deemed expedient and appropriate to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete the installation with the appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .11 After installation of the manholes, backfill the excavated area around the manholes with compacted backfill to the lines, grades and elevations shown in the Contract Documents. Exercise care to ensure that the backfill is brought up evenly around the manholes. Compacted backfill will be in accordance with Type 1 backfill as per Section 02319 – Trench Excavating and Backfilling; sub-section 3.7 Backfilling Schedule.
- .12 Do not displace the alignment of manhole sections during backfill operation.
- .13 Clean all manholes of debris preventing any large debris from entering the new or existing system.
- .14 Any manhole that requires the contractor to add additional inverts must have the concrete saw cut and/or cored.

**3.2 TOLERANCE**

- .1 Maintain constructed grade to within - 10 mm and + 10mm from the lines, grades and elevations shown in the Contract Documents.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for “Video Inspections” requirements specified herein.
- .2 This Section includes video inspections of pipes that are under or adjacent to the work of the Contract and which may not be included as items of Work.

**1.2 QUALIFICATIONS**

- .1 The Contractor will retain the services of a qualified video inspection contractor who is a member in good standing with the National Association of Sewer Service Companies (NASSCO). The closed-circuit television (CCTV) operator will have the following training:
  - Pipeline Assessment and Certification Program (PACP) – main line inspections.
  - Manhole Assessment and Certification Program (MACP) – manhole inspections.
  - Lateral Assessment and Certification Program (LACP) – service line inspections

**1.3 VIDEO INSPECTION REPORT AND DVD SUBMITTALS**

- .1 Provide the Owners Representative with two (2) copies of all video inspection reports and corresponding DVDs for each video inspection.
- .2 Submit pre-construction video inspections of existing pipes for review one week prior to any underground construction activities.
- .3 Submit post-construction (pre-roadwork) video inspections for review a minimum one week prior to any surface work activities.
- .4 Perform post-construction (pre-roadwork) video inspections in stages to allow adequate time for the Owners Representative to review the submissions and to allow time for any repairs to be completed prior to any surface work activities.
- .5 Label all manholes in the video inspection reports and DVDs in accordance with the labelling shown on the contract drawings.
- .6 Ensure all disk numbers, individual video inspection names and video reference numbers correspond to the video inspection DVDs and reports.
- .7 Ensure the length of pipe measurement on the video inspections starts at 0.0 m from the inside edge of the manhole.
- .8 Video Inspection DVD Requirements
  - .1 All DVD disks will be compatible with standard NTSC DVD players.



- .2 All videos will be colour with a clean, in-focus picture of the entire periphery of the pipe.
- .3 DVD disks will have permanent labels that display the following information:
  - Project name.
  - Date report was completed.
  - List of individual video inspections included in disks including video reference numbers.
- .4 At the start of each individual video inspection run, the following information will be clearly displayed on the video:
  - Project name.
  - Date and time of survey.
  - Road name and location (House address for service inspection videos).
  - Upstream and downstream manhole information.
  - Direction of flow.
  - Pipeline operating state (in operation or out of operation).
  - Flow control used or not.
  - Approximate length of pipe in meters.
  - Size and type of pipe.
  - Video reference number.
- .5 The following information will be displayed on the individual video inspections at all times:
  - Upstream and Downstream manhole information (House address for service inspection videos).
  - The camera's reading position in the pipeline. The distances will be displayed in tenth of a meter increments.
  - Video reference number.
- .9 Video Inspection Report Requirements
  - .1 Report summary page including:
    - Project name.
    - List of individual reports including disks reference numbers and individual video inspection reference numbers.
  - .2 Sewer inspection code legend page including all codes used in the individual video inspection reports.
  - .3 Individual video inspection reports will include:
    - Project name.
    - Date and time video inspection was completed.
    - Upstream and downstream manhole information.
    - Direction of flow.
    - Flow control used or not.
    - Approximate length of pipe (in meters).

- Size and type of pipe.
- Video reference number.
- List of service connections, pipe material changes, rolled gaskets, sags and pipe defects including the camera's reading position in the pipeline, sewer inspection code, description, and reference to photos.
- Colour photographs of all connections and pipe defects.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Control all flows necessary to complete the work, including any required pipe plugging and bypass pumping work.
- .2 Notify Owners Representative at least 48 hours prior to any video inspections.

**3.2 FLUSHING AND CLEANING**

- .1 Flush and clean all mains as required, to undertake video inspections of the pipe.
- .2 Re-flush and re-clean the mains as necessary to remove any debris remaining from flushing and cleaning operations.
- .5 Remove and dispose of all waste materials resulting from the flushing and cleaning work. A filtering device will be utilized to prevent waste materials from entering sewers outside of the work area.
- .6 Should the video inspection show unsatisfactory flushing and/or cleaning, the pipe will be re-flushed, re-cleaned and re-inspected to the satisfaction of the Owner's Representative.

**3.3 VIDEO INSPECTIONS**

- .1 Video inspect the mains and services with no active flows entering it.
- .2 Video inspections with sags ponding in excess of 20% of the pipe capacity will require re-inspection in conjunction with cleaning operations to achieve a clear video inspection of the pipe condition. Other measures may be employed to achieve a clear video inspection of the sag pipe sections.
- .3 Video inspections will be completed from upstream to downstream where possible.

- .4 The video camera will stop and observe at the best of the cameras ability all connections and defects in correspondence with the video inspection report. Photographs will be taken at all these locations.
- .5 If a blockage or obstruction is encountered its location will be recorded and the remaining section of pipe will be video inspected from the other end to confirm the obstruction location.

**3.4 POST-CONSTRUCTION VIDEO INSPECTIONS**

- .1 The Contractor is responsible to repair and re-inspect any pipe deficiencies resulting from construction activities identified by the post-construction video inspections.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Bituminous Prime Coat, Tack Coat and Fog Coat” specified herein.
- .2 The Work covered in this Section consists of the furnishing of all labour, plant and material and performing all operations in connection with supplying and placing “Bituminous Prime Coat, Tack Coat and Fog Coat” as specified and/or in accordance with industry standards established by the Asphalt Institute.

**2. PRODUCTS**

**2.1 PRIME COAT, TACK COAT, FOG COAT**

- .1 The asphalt required will be SS-1 emulsified asphalt and SS-1H emulsified asphalt conforming to the current issue of ASTM D2028 for Asphalt, Cut Back (Rapid Curing Type) or ASTM D2027 for Asphalt, Cut Back (Medium Curing Type).

**2.2 SAND COVER**

- .1 The materials for sand cover will consist of clean granular mineral material approved by the Owner’s Representative, all of which will pass a 5mm sieve.

**3. EXECUTION**

**3.1 APPLICATION TEMPERATURE**

- .1 The application temperature of the prime, fog and tack coat will be as specified by the Manufacturer. The ambient air temperature will be at least 4 degrees C. when applying the prime, tack or fog coat.

**3.2 PRIME COAT**

- .1 Immediately prior to applying the prime coat the surface of the base course will be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities. All loose and foreign material will be removed from the surface.
- .2 The prime coat will consist of a ratio of two parts SS-1 emulsified asphalt to one part water and applied uniformly at a rate of 1.75 to 2.25 l/m<sup>2</sup>, depending on the surface's absorption characteristics. The prime coat will be applied to a uniformly damp base course when the ambient air temperature is at least 4 degrees Celsius. The prime coat will be allowed to cure for a minimum of two hours or until full curing has taken place.

- .3 To ensure uniformity of application a drip pan will be inserted under the nozzles when the application is stopped, and building paper will be spread over the treated surface to allow sufficient distance on restarting so that the nozzles are operating at full force when the untreated surface is reached. The building paper will then be removed and destroyed. A narrow spout pouring pot or hand spray will be used to apply primer material necessary to touch up spots unavoidably missed by the distributor.
- .4 Work adjacent to the roadway will be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the concrete will be cleaned at the expense of the Contractor. Maintain the primed surface until the surface course has been placed. Maintenance will include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

### **3.3 TACK COAT**

- .1 Apply tack coat between successive lifts of asphaltic concrete. The surface will be free from foreign material prior to application of the Tack Coat. Sweep the asphalt surface prior to the tack coating, if required. The Tack Coat will consist of a ratio of one part SS-1H emulsified asphalt to one part water and applied at a uniform rate of 0.5 litres per square metre. The Tack Coat will be allowed to cure for a minimum of two hours or until full curing has taken place.

### **3.4 FOG COAT**

- .1 The surface will be free from foreign material prior to application of the fog coat. The fog coat, if required, will consist of a ratio of one part SS-1H emulsified asphalt to one part water and applied at a uniform rate of 0.5 l/m<sup>2</sup>. The fog coat will be allowed to cure for a minimum of two hours or until full curing has taken place.
- .2 Traffic may be permitted to run on the completed fog coat immediately after the asphalt has cured.

### **3.5 SAND COVER**

- .1 The prime coat should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, then just sufficient sand will be spread over the surface to blot up excess prime coat and prevent it from being picked up by any traffic.

### **3.6 EQUIPMENT**

- .1 The pressure distributor used for applying asphaltic material will distribute the asphaltic material in a uniform spray without atomization, in the amount and between the limits of temperature specified. Suitable means for accurately indicating the temperature of the asphaltic material will be provided at all times.
- .2 The thermometer well will be so placed as not to be in contact with a heating tube. The distributor will be so designed that the normal width of application will be not less than 2 metres with provision for the application of lesser width when necessary.

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- .3 If provided with heating attachments the distributor will be so equipped and operated that the asphaltic material will be circulated or agitated throughout the entire heating process.
- .4 The distributor will be equipped with a speed indicator registering metres per minute and a meter registering litres per minute passing through the nozzles. Both of these gauges will be readily visible to the operator of the distributor.

**3.7 DEFICIENT APPLICATION**

- .1 Areas that have uneven, non uniform, excessive or deficient application will be repaired immediately at the expense of the Contractor.

**3.8 QUALITY OF MATERIALS**

Submit data from an independent accredited testing laboratory as required by the Engineer to substantiate that the quality of materials proposed meet these specifications. Provide manufacturer's data as requested by the Owner's Representative.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Hot Mix Asphaltic Concrete” specified herein.
- .2 The Work includes the supply of aggregates and asphalt cement, asphalt plant mixing, transporting, placement, finishing and compaction to requirements specified herein.
- .3 Asphalt concrete Type I and Type II of this specification will be used for construction of Arterial and Collector roadways or other high loading applications, as designated by the Owner.
- .4 Asphalt concrete Type III of this specification will be used for construction of Residential roadways or other low traffic areas, as designated by the Owner.

**1.2 DEFINITIONS**

- .1 “RAP” is defined as Recycled Asphalt Product that is obtained from the cold milling of hot mix asphaltic concrete
- .2 “A Lot” is a portion of the work being considered for acceptance, and is defined as one day of plant production for each mix type. Any portion of the work may be deemed a lot at the discretion of the Owner’s Representative.
- .3 “Job Mix Formula” is defined as the aggregate proportioning (including RAP), target gradation, asphalt content and air void content from the Mix Design that subject to approval by the Owner’s Representative.

**1.3 SAMPLES**

- .1 At least two (2) weeks prior to commencing work, inform the Owner’s Representative of proposed source of aggregates and provide access for sampling.
- .2 At least four (4) weeks prior to commencing work submit to the Owner’s Representative one 5L container of asphalt cement proposed for use.
- .3 Submit asphalt cement samples in new metal containers.
- .4 Identify the supplier of the asphalt cement.
- .5 Provide access for Owner’s Representative to sample material actually incorporated in the work as required.

**1.4 SUBMISSIONS**

- .1 Submit proposed asphalt concrete mix design and trial mix design results to Owner’s Representative for review and approval at least two (2) weeks prior to commencing.

- .2 Submit new mix design at least two (2) weeks prior to contemplated change in source of asphalt cement or aggregate.
- .3 Trial mix designs will be performed by an independent testing consultant and submitted under the signature and professional seal of a qualified materials engineer to the Owner's Representative.

**1.5 DELIVERY AND STORAGE**

- .1 Aggregates:
  - .1 Deliver and stockpile aggregates in accordance with the requirements of this Section.
  - .2 Stockpile minimum of 50% of the total amount of aggregate required before commencing production of trial mix design.
  - .3 Handle and transport aggregates to avoid segregation, contamination and degradation.
  - .4 Stockpile aggregates in sufficient quantities to meet project schedules. When hauling into stockpiles after plant mixing commenced, do not deposit material against working face of stockpile.
  - .5 Separate aggregate stockpiles by substantial dividers or stockpiles far enough apart to prevent intermixing.
  - .6 Reject intermixing or contaminated materials. Remove and dispose of rejected materials as directed by the Owner's Representative within 48 hours of rejection.
  - .7 Construct stockpiles in uniform lifts using trucks or rubber tired loading equipment, being careful to avoid segregation by spillage of material over the ends of previously placed lifts. Do not use conveyors or tracked equipment in stockpile construction.
  - .8 Provide a previously stabilized stockpile base or provide a compacted sand base not less than 300mm in depth to prevent contamination. Alternatively, stockpile aggregates on ground but do not incorporate bottom 300mm of pile into work.
- .2 Asphalt Cement:
  - .1 Provide approved storage, heated tanks and pumping facilities for asphalt cement.
  - .2 Provide, upon request, freight and waybills for asphalt cement shipments received.
  - .3 Stockpile minimum of 100% of total amount of RAP required before commencing production of trial mix design.



- .4 Handle and transport RAP to avoid segregation, contamination and degradation.
- .5 Separate aggregate and RAP stockpiles by substantial dividers or stockpiles far enough apart to prevent intermixing.
- .6 Reject intermixing or contaminated materials. Remove and dispose of rejected materials as directed by the Owner's Representative within 48 hours of rejection.
- .7 Conveyors may be allowed to stockpile RAP subject to approval by the Owner's Representative. No equipment will be allowed on the RAP stockpile. Construct stockpiles being careful to avoid segregation by spillage of material over the ends of previously placed lifts.
- .8 Provide free draining gravel stockpile base not less than 300mm in depth to prevent contamination of RAP.

## **2. PRODUCT**

### **2.1 MATERIALS**

- .1 Aggregates:
  - .1 Coarse aggregate is aggregate retained on the 5,000 $\mu$ m sieve and fine aggregate is aggregate passing the 5,000 $\mu$ m sieve.
  - .2 Aggregate material will be crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps cementation, organic materials, frozen material and any other deleterious materials.
  - .3 Gradations to be within limits specified, when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSB 8-GP-2M rather than ASTM E11.
  - .4 Aggregates from source will be processed to meet the following requirements:
    - .1 Natural fines pre-screened and stockpiled with more than 10% of material retained on 5,000 $\mu$ m sieve and 100% passing the 10,000 $\mu$ m sieve.
    - .2 Pre-screened aggregates delivered to crushing plant will be pre-screened and will contain not more than 5% passing the 5,000 $\mu$ m sieve.
    - .3 Crushed aggregates will be separated and stockpile in accordance with the following:
      - .1 Coarse aggregates to contain not more than 10% of materials passing the 5,000 $\mu$ m sieve.
      - .2 Fine aggregate to contain not more than 20% of the materials retained on the 5,000 $\mu$ m sieve.

.5 Physical properties for aggregates:

<b>Requirement</b>	<b>ASTM Test Method</b>	<b>Type I Surface</b>	<b>Type II Base</b>	<b>Type III Surface</b>
Los Angeles Abrasion Gradation B % Loss	C131	32.0 max.	32.0 max.	32.0 max.
Magnesium Sulphate (% loss) Coarse Aggregate: Fine Aggregate:	C88	12.0 max. 12.0 max.	12.0 max. 12.0 max.	12.0 max. 12.0 max.
Lightweight Particles % by mass	C123	1.5 max.	1.5 max.	1.5 max.

.6 Blend Sand:

- .1 To consist of natural or manufactured sand passing 5,000 µm sieve.
- .2 Stockpile volumes will be maintained to ensure a minimum of 5,000 tonne of plant mix production at all times.

.7 Mineral Filler:

- .1 Finely ground particles of limestone, hydrated lime, Portland cement or other non-plastic mineral matter, thoroughly dry and free from lumps.
- .2 Add mineral filler when necessary to meet job mix aggregate gradation.

.8 Blended Aggregates:

- .1 Aggregate gradation requirements, including RAP:

<b>Sieve Size (µm)</b>	<b>Type I Surface</b>	<b>Type II Base</b>	<b>Type III Surface</b>
25,000		100	
20,000	100	85 - 95	
16,000	97 - 100	77 - 88	100
12,500	85 - 95	65 - 80	90 - 100
10,000	70 - 85	57 - 72	75 - 90
5,000	50 - 65	40 - 55	60 - 75
2,500	40 - 50	30 - 42	45 - 60
1,250	30 - 40	23 - 33	30 - 45
630	20 - 30	17 - 27	22 - 36
315	15 - 23	12 - 22	15 - 27
160	6 - 16	6 - 15	6 - 18
80	4 - 8	4 - 8	4 - 10

.2 Physical properties for blended aggregates:

<b>Requirement</b>	<b>ASTM Test Method</b>	<b>Type I Surface</b>	<b>Type II Base</b>	<b>Type III Surface</b>
Coarse Aggregate Fracture (two or more fractured faces), %	--	80 min.	60 min.	80 min
Flat and Elongated Particles (length to thickness ratio greater than 5), %	--	10 max.	10 max.	10 max.
Manufactured Sand * (fine aggregate), %				
Sand Equivalent Value (Mechanical Method)	D2419	45 min.	40 min.	45 min.
Maximum RAP (total mass), %	--	15 max.	15 max.	20 max.

\*mixes incorporating RAP 50% of the RAP fines to be considered manufactured sands.

.3 Reclaimed Asphalt Pavement (RAP):

- .1 RAP will be obtained from the cold milling of hot mix asphaltic concrete.
- .2 Gradation of virgin aggregate plus RAP will meet the gradation of combined aggregates indicated above when RAP is used.

.2 Asphalt Cement:

- .1 Asphalt Cement will be prepared by the refining of petroleum and shall not foam when heated to 177 degrees C.
- .2 The tolerance allowed by ASTM for testing precision will be applied for acceptance of asphalt cement.
- .3 Asphalt cement will meet the following requirements:

<b>Requirement</b>	<b>ASTM Test Method</b>	<b>Values</b>
Kinematic Viscosity at 135°C, mm <sup>2</sup> /sec	D2170	200-300
Absolute Viscosity at 60°C, 300mm, hg Vacuum, Pa.S	D2171	60-100
Penetration at 0°C, 200g, 60 sec; dmm	D5	30 min.
Flash Point (Cleveland Open Cup), °C	D92	201 min.
Thin Film Oven Test Penetration after test at 25°C, 100g, 5sec.;% of Original	D5	50 min.
Ductility at 25°C and 5 cm/min.; cm	D113	100 min.
Solubility in Trichloroethylene, % by Mass	D2042	99.5 min.

- .4 At least two (2) weeks prior to commencing work, the Contractor will submit to an approved testing laboratory for design mix, at least 5 litres in a new metal container of the asphalt cement he intends to use in the work along with the name of the supplier of the asphalt cement. Additionally the Contractor will provide if required, a current temperature - viscosity chart for the asphalt cement showing Kinematic Viscosity in mm<sup>2</sup>/sec over a temperature range of 105° C to 175° C, and submit the manufacturer's test data and certification that the asphalt cement meets the requirements within these specifications. The Contractor will pay for all shipping costs and for all laboratory tests.

## **2.2 MIX DESIGN**

- .1 Type I, II and III
  - .1 The Contractor will retain a qualified independent testing consultant to perform trial asphalt mix designs. Trial mix designs are to be submitted to the Owner's Representative for review.
  - .2 The mix design will follow the Marshall Method of mix design as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2), and will include five (5) separate trial values of asphalt content.
  - .3 Contractor will pay for all trial mix designs and submissions.
  - .4 Include the following data with the trial mix design submission:
    - .1 Aggregate specific gravity and absorption.
    - .2 Sand equivalent, coarse aggregate fracture, flat and elongated particles, and percent manufactured sand values.
    - .3 Asphalt cement supplier/refinery, specific gravity and mixing and compaction temperatures, based on temperature – viscosity properties of asphalt cement.
    - .4 Aggregate gradation and blending proportions including design asphalt content.
    - .5 Maximum theoretical density of each trial asphalt content.
    - .6 Where RAP is to be incorporated into the mix supply, RAP gradation, RAP asphalt cement content and design recycle percentage.
    - .7 Data to satisfy the requirements of following sections.
  - .5 Design Mix:
    - .1 Type I and Type II – By Marshall method, 75 blows on each face of test specimens using mechanical compactor.
    - .2 Type III – By Marshall method, 50 blows on each face of test specimens using mechanical compactor.

.6 Mix Physical Properties:

Property	TYPE I Surface	TYPE II Base	TYPE III Surface
Marshall Stability @ 60°C; kN	10.0 min.	10.0 min.	5.4 min.
Marshall Flow @ 60°C; 0.25mm Units	8 – 14	8 – 15	8 – 14
Voids in Mineral Aggregate, %	13.5 – 15.0 65 – 75	12.5 – 14.0 60 – 70	14.0 – 16.0 70 – 80
Voids filled with Asphalt, %	7.0 – 8.5	6.0 – 8.0	
Asphalt Film Thickness, um			7.0 min.

**2.3 JOB MIX FORMULA:**

- .1 Subject to approval by the Owner’s Representative, the aggregate proportioning (including RAP), target gradation, asphalt content and air void content from the Mix Design will become the Job Mix Formula for the supply of hot mix asphalt.
- .2 Once established, no alterations to the Job Mix Formula will be permitted unless the Contractor submits a new Job Mix Formula and it is approved by the Owner’s Representative.
- .3 If the sum of any alteration to the Job Mix Formula is in excess of any one of the following limits, a new Mix Design is required.
  - .1 + or – 5% passing the 5,000µm sieve size
  - .2 + or – 1% passing the 80µm sieve size
  - .3 + or – 0.30% asphalt content.
- .4 Any alterations to the Job Mix Formula will not result in properties which do not meet the requirement of this specification.

**2.4 TOLERANCES:**

- .1 All mixtures will be supplied to the approved Job Mix Formula within the range of tolerances specified.
- .2 Asphalt cement content: + or – 0.3% of approved Job Mix Formula value

.3 Aggregate Gradation:

Aggregate Passing Sieve Size (µm)	Tolerance (% By Mass)
Max. to size 5,000	+ or – 5.0
2,500 and 1,250	+ or – 4.0
630 and 315	+ or – 3.0
160	+ or – 2.0
80	+ or – 1.5

.4 Temperature: Mix temperature at point of plant discharge will not vary from that specified in the Job Mix Formula by more than + or – 10°C.

.5 Air Voids: + or – 1.0% of the Job Mix Formula value.

.6 Mixture Properties: Marshall Stability, Marshall Flow, Voids Filled with Asphalt, Voids in Mineral Aggregate and Film Thickness as per Mix Design.

.7 Moisture in Mix: Maximum permissible moisture at point of plant discharge is 0.2% by mass of mix.

.8 Asphalt cement recovered from freshly produced hot mix by the Abson Method, ASTM D1856 and subsequently tested in accordance with ASTM D5, will retain a minimum value of 50% of its original penetration value.

**3. EXECUTION**

**3.1 CONTINUITY OF PRODUCTION**

.1 During the time period that work is in progress on any project for which this specification is in effect, and at the discretion of the Owner’s Representative, the plant may be limited to producing only the mix type required for that project.

**3.2 PREPARATION OF HOT MIX MATERIAL**

.1 Preparation of Mineral Aggregate:

.1 The mineral aggregates will be dried to ensure the mix is discharged containing not more than 0.2 percent moisture, heated so that when delivered to the mixing unit, they will be at as low a temperature as is consistent with proper mixing and laying and in no case to exceed 163° C. The mineral aggregate may be fed simultaneously into the same dryer, but in all cases immediately after heating, they will be screened into bins.

- .2 Where reclaimed asphalt pavement (RAP) will be incorporated into the mix, the virgin aggregate may be heated to a higher temperature such that when dry mixed with the RAP the temperature is less than 163° C. The RAP will be passed over a 50mm screen prior to entering the plant.
- .3 For batch plants RAP will be introduced into the weigh hopper after some aggregate has been weighed. For approved drum or continuous plant RAP will be introduced through a calibrated cold feeder.
- .2 Preparation of Asphalt Cement:
  - .1 The asphalt cement will be carefully heated to a specified temperature between 118° C and 150° C depending on the temperature viscosity relationship, by approved means designed to secure uniform heating of the storage tank. The temperature differential aggregates and asphalt cement will at no time be more than 4° C.
- .3 Composition of Mixture:
  - .1 The mineral aggregate and asphalt cement will be mixed in a manner to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated and in such proportions as to produce a mixture having asphalt cement content as indicated by the approved job mix formula. When the mixture is prepared in a twin pug mixer, the volume of mineral aggregate and asphalt cement will not be so great as to extend above the tops of the mixer blades when the blades are in a vertical position.
  - .2 After the hot aggregate and mineral filler have been charged into the mixer, and thoroughly mixed for a period of not less than fifteen (15) seconds, as directed by the Owner's Representative, the asphalt cement will be added and the mixing continued for a period of at least twenty-five (25) seconds, and not more than forty-five (45) seconds.
  - .3 Asphalt cement recovered from freshly produced hot mix by the Adson Method, ASTM D1856, and subsequently tested in accordance with ASTM D5, will retain a minimum value of fifty percent (50%) of its original penetration value.

### **3.3 COMPLIANCE WITH SPECIFICATIONS**

- .1 Aggregate Gradation:
  - .1 When the gradation does not comply with tolerances set forth in Section 2.1.1 of this specification, the Owner's Representative will initiate the following action:
    - .1 When two (2) consecutive gradation analyses identify non-compliance with the specified tolerances, the Contractor will be served notice and a third test will be initiated.

- .2 If continued non-compliance is indicated from the third test, the Contractor will suspend production. He will not commence production again until he has demonstrated that corrective action has been taken and that the aggregate gradation is within the specified tolerance limits.

.2 Asphalt Temperature:

- .1 Plant mix which does not meet temperature requirements of Section 2.1.2, at the point of plant discharge will be rejected.

**3.4 PREPARATION FOR PAVING**

.1 General:

- .1 The Contractor will give the Owner's Representative a minimum of six (6) hours notice of his intention of commencing paving over any previously approved primed or tacked surface.
- .2 The hot asphaltic mixture will be laid upon a dry firm base, true to grade and cross-section and free from all screening or other loose or foreign material. No hot mix will be spread when the sub-base is wet or when other conditions prevent proper spreading, finishing or compaction.
- .3 If undercutting, and subsequent backfill with asphaltic concrete is done, the backfill operation will be performed sufficiently far ahead of the paving operation to allow the asphaltic concrete time to cool down enough to support equipment.

.2 Asphalt Placing Temperature:

- .1 No asphalt will be dispatched to the field unless the temperature as issued by Environment Canada, is rising and meets the following minimum temperature requirements:
  - .1 Thickness less than 50mm require +7°C {Lethbridge},
  - .2 Thickness greater than 50mm require +2°C {Lethbridge},
- .2 A tolerance will be permitted for plant start-up temperature.
- .3 No surface lift asphalt will be placed regardless of temperature until the road base is 5°C or higher.

.3 Hours of Operation:

- .1 No loads of asphalt will be dispatched from the plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the approval of the Owner's Representative.



- .4 Transportation of Hot Asphaltic Mixtures:
  - .1 To protect the load from adverse weather conditions during transit, trucks will carry at all times tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins will be used when ordered by the Owner's Representative.
  - .2 Vehicles used for the transportation of hot mix asphalt from the plant to the site of work will have tight metal boxes previously cleaned of all foreign matter, the inside surface may be lightly lubricated with a thin oil or soap solution just before loading. Excess lubrication will not be permitted.
  - .3 For purposes of checking asphalt mixture temperatures, trucks will have an accessible 13mm diameter hole drilled into the driver's side of the truck box, at a distance of 0.3m from the bottom of the box and 150mm clear of the reinforcing ribs.
  - .4 The speed and weight of hauling trucks will be regulated so that, if in the opinion of the Owner's Representative, no damage will occur to any portion of the work underway. Any damage to the prime coat or the bituminous mat caused by the Contractor's equipment will be repaired by the Contractor at his own expense.

### **3.5 SPREADING AND FINISHING EQUIPMENT**

- .1 Asphalt Spreader:
  - .1 The track mounted spreading machine will be self-propelled and capable of placing a uniform layer of asphalt mix to a depth shown on the plans or as ordered by the Owner's Representative.
  - .2 The screed will include a tamping bar or vibratory strike-off device for use when required. The screed will strike-off the mix to the depth and cross-sections specified and produce a finished surface of uniform texture.
  - .3 Control of the screed will be by automatic sensing devices. Longitudinal control will be accomplished by a sensor, which follows a string-line, ski, or other reference. The grade sensor will be movable and mounts provided so that grade control can be established on either side of the paver. A slope control will also be provided to maintain the proper transverse slope of the screed.
- .2 Hand Tools:
  - .1 Only lutes will be used during the spreading operation and when the asphalt is worked by hand in areas in which the paver cannot reach.
  - .2 Tamping irons used to consolidate the material along curbs, gutters and other structures inaccessible to the rollers will not weigh less than 11 kg and will have a bearing area not exceeding 310 sq. cm. Mechanical compaction equipment, satisfactory to the Owner's Representative, may be used instead of tamping irons.

- .3 For purposes of checking the finished surface, Contractors must provide and carry on each paving machine a 3 metre straight edge with an attached level.
- .4 The Contractor will supply propane torches for heating joints.

### **3.6 SPREADING OPERATIONS**

- .1 Pre-levelling for Asphalt Concrete:
  - .1 Pre-levelling of uneven or broken surfaces over which asphalt concrete is to be placed will be accomplished by the use of asphaltic concrete placed with a grader, paver, hand or by a combination of these methods as directed by the Owner's Representative.
  - .2 After placement, the asphalt concrete used for pre-levelling will be compacted thoroughly with a pneumatic-tired roller.
- .2 Asphalt Spreading Operation:
  - .1 The asphaltic concrete will be laid to the design thickness as shown on the contract drawings or as specified. New construction where an established; i.e. curb, is lacking, a string-line reference will be required. The maximum spacing between string-line stakes will not exceed 10 metres. The line will be tensioned to 450 N and secured. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written approval of the Owner's Representative.
  - .2 The spreader will be operated in such a manner as to distribute the asphaltic concrete mix to proper cross-section, width and thickness without causing segregation of the mix. Small segregated areas that may occur will be corrected immediately. The forward motion of the spreader will be controlled so that no irregularities in the pavement surface caused by excessive speed. The rate of placement of the mixture will be uniform, and will be co-ordinated with the production rate of the asphalt plant without intermittent operation of the spreader.
  - .3 Any failure of the machine to produce a smooth, uniformly dense mat, free from irregularities, will be corrected immediately to the satisfaction of the Owner's Representative.
- .3 Areas Inaccessible to Spreaders:
  - .1 Areas that are inaccessible to the spreading machine may be paved by other methods, as directed by the Owner's Representative. Graders or approved types of truck-attached spreaders will be used to pave inaccessible or irregularly shaped areas. Hand raking will be kept to a minimum.

- .2 In small areas or where the use of mechanical equipment is not practical, the mix may be spread and finished by hand. The asphaltic mixture will be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes in a loose uniform layer of uniform density and correct depth. Material must be handled so as to avoid segregation. Excessive oiling of tools will not be tolerated. Loads will be dumped any faster than can be adequately distributed by the rakers. Raking must be carefully and skilfully done, in such a manner that after the first passage of the roller over the mixture, a minimum amount of additional patching will be required.

### **3.7            COMPACTION EQUIPMENT**

- .1 The Contractor will supply sufficient compaction equipment to:
  - .1 Provide a compaction rate that will equal or exceed the placing rate of the spreader spreader.
  - .2 Ensure full compaction of the asphaltic concrete before the temperature of the mat falls below 80° C.

### **3.8            COMPACTION PROCEDURES**

- .1 General:
  - .1 The rollers will be kept in continuous motion while on the hot mat in such a manner that all parts of the pavement receive equal compression.
  - .2 The surface of the mixture after compaction will be smooth and true to established section and grade. Areas of .09 sq. m. or more in which any mixture shows an excess or deficiency of asphalt, or uneven distribution of asphalt due to insufficient mixing, or which become loose, broken, ravelled, mixed with dirt, or is in any way defective, will be removed and replaced with fresh asphalt at the Contractors' expense and be immediately compacted to conform with the surrounding area.
  - .3 Areas inaccessible to the roller will be compacted with mechanical or hand tampers.

### **3.9            JOINTS**

- .1 Longitudinal and Transverse Joints:
  - .1 Longitudinal and transverse joints will be made in a careful manner.
  - .2 Paving joints will not be placed in the same vertical plane. Longitudinal joints will be offset at least 150mm and transverse joints will be offset at least 2.0m.
  - .3 Edges which additional pavement is to be placed will be vertically formed to true line. A lute will be used immediately behind the paver when required to obtain a true line and vertical edge.

- .4 The exposed edges of all cold asphalt joints and the face of the concrete curb and gutter will be cleansed and painted with a thin coat of asphalt tack oil.
- .5 In making the joint along any adjoining pavement and after the hot mixture is placed by the finishing machine, just enough of the material will be carried back to fill any space left open. This joint will be properly "set up" with the back of the lute at proper height and level to receive the maximum compression under the rolling.
- .6 At the end of each day's paving of the surface course and upper lift of the base course mix, the uncompleted paving mats will be provided with vertically cut transverse joints. Joints between old and new pavements or between successive days' work will be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces.

### **3.10 SURFACE SMOOTHNESS**

- .1 General:
  - .1 The completed surface of the top or wearing surface will be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. Tolerances in both profile and crown are:
    - .1 Base Course - 10mm in 5 m
    - .2 Surface Course - 6mm in 5 m
  - .2 When the surface smoothness does not comply with tolerances, the pavement surface will be corrected by the addition of asphalt concrete mixture of an appropriate class to low places or the removal of material from high places by methods satisfactory to the Owner's Representative. Correction of defects will be carried out until there are no deviations anywhere greater than the allowable tolerances.
- .2 Repair of Defective Areas:
  - .1 Asphalt spreaders will be required for areas greater than 90 sq. m. The required equipment will be on site before placing of asphalt hot mix may commence.
  - .2 Where sixty percent (60%) of the road requires patching and/or several other patches are required across the width of the street it will be necessary to extend the treatment across the full width of the street.
  - .3 Placing of a patch on top of another will not be acceptable and in these cases the original asphalt must be removed.
  - .4 Where, in the opinion of the Owner's Representative, possible bridging exists, it will be necessary to remove the asphalt and the defective area. The base course will be brought back up to proper grade and use full depth asphalt patching.

- .5 All patches should be square with no jagged edges.
- .6 Asphalt patches should retain the proper cross-section and the edges will be properly feathered out.
- .7 Asphalt skin patching will be subject to the temperature requirements for asphalt surfacing.

**3.11 TESTING**

- .1 Quality Control:
  - .1 Quality control is the responsibility of the Contractor throughout every stage of the Work from aggregate processing to the final accepted product. Tests performed by the Owner's Representative will not be considered as quality control tests.
  - .2 The Contractor will be totally responsible for production of materials and construction that meet all specified requirements.
  - .3 All quality control will be conducted by qualified personnel. The Contractor will bear the cost of all quality control testing and consulting services.

.4 Pre-Production Quality Control Requirements are as follows:

<b>Quality Control Requirement</b>	<b>Test Standard</b>	<b>Minimum Frequency</b>
Asphalt Cement Certification	--	Once per Year or for change in supplier
Aggregate Physical Properties	See 2.2.5	Once per Year or for change in source
Crushed Coarse Aggregate Gradation Analysis and Fracture Content Manufactured Sand Aggregate Gradation Natural Fine Aggregate Gradation Blend Sand Aggregate Gradation	ASTM C 136 ASTM D 5821  ASTM C 117 ASTM C 126 ASTM C 117 ASTM C 126 ASTM C 117 ASTM C 126	One for every 1000 tonne of each class of material processed into stockpile, or one analysis for each material every production day when production rate is less than 1000 tonne.
Reclaimed Asphalt Pavement (RAP) Asphalt Content and Extracted Aggregate Gradation	ASTM D 2172 ASTM C 117 ASTM C 136	One for each 500 tonne delivered to stockpile, or one for each location when delivery rate is less than 500 tonne
Penetration of asphalt cement recovered from RAP by Abson Method	ASTM D 1856 ASTM D 5	One for each 2000 tonne delivered to stockpile
Trial Mix Design by Marshall Method	ASPHALT INSTITUTE MS-2	One per mix type every 3 years, or as required for a change in asphalt cement supply, aggregate gradation or aggregate source. *
Plant Calibration	--	As required

\* A laboratory/plant job mix formula verification is required each year when a trial mix design is not conducted.

.5 Pre-Production Quality Control test data will be reported to the Owner's Representative one week prior to commencing the project, or as requested.

.6 Post Production Quality Control Requirements are as follows:

<b>Quality Control Requirement</b>	<b>Test Standard</b>	<b>Minimum Frequency</b>
Hot Mix Asphalt Analysis (including Asphalt Content, Aggregate Gradation, Marshall Density and Void Properties)	ASTM D 6307 ASTM C 117 ASTM C 136 ASTM D 3203	One for every 500 tonne of each mix type supplied under this specification. *
Quality Control Charts (including 3 test running average for Binder Content, Aggregate Gradation, Marshall Density and Void Properties)	--	For each hot mix analysis. Test results and updated 3 test running average to be submitted to the Owner's Representative as they become available.
Hot Mix Asphalt Temperature	--	Minimum frequency not specified.
Cold Feed Aggregate Analysis	ASTM C117 ASTM C 136	Minimum frequency not specified.
Maximum Relative Density of Hot Mix Asphalt	ASTM D 2041	Minimum frequency not specified.
Compaction Monitoring (Core or Nuclear Density)	ASTM D 2726 ASTM D 2950	Minimum frequency not specified. **

\* Where an individual test indicates non-compliance, another test shall be initiated immediately.

\*\* Coring is subject to approval by Owner's Representative.

.7 Post-Production Quality Control test data will be reported to the Owner's Representative daily as the work proceeds.

.2 Quality Control Compliance:

.1 Asphalt Content, Aggregate Gradation and Mixture Properties

.1 The test data derived by Post-Production Quality Control mix testing, will be compared to the tolerances set forth in the production tolerances, Section 2.4, of this specification. The Contractor will document, and make available to the Owner's Representative, any adjustments made to correct noncompliance with the specified tolerances.

.2 The Contractor will suspend mix production when the 3 test running average for any property is outside of the specified tolerance limits for three consecutive tests. Supply will not commence again until it is demonstrated that corrective action has been taken.

.2 Hot Mix Asphalt Temperature

.1 Plant mix that does not meet temperature requirements of the production tolerances, Section 2.4, at the point of plant discharge will be subject to rejection at the discretion of the Owner's Representative.

.3 Acceptance Sampling and Testing:

- .1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements will be determined from acceptance testing as described in this section.
- .2 Acceptance testing is the responsibility of the Owner's Representative.
- .3 Initial acceptance testing will be undertaken free of cost to the Contractor.
- .4 A lot is a portion of the work being considered for acceptance, and is defined as one day of plant production for each mix type. Any portion of the work may be deemed a lot by the Owner.
- .5 Acceptance Testing requirements are as follows:

<b>Quality Acceptance Requirement</b>	<b>Test Standard</b>	<b>Minimum Frequency</b>
Hot Mix Asphalt Analysis (including Binder Content, Aggregate Gradation, Marshall Density, Maximum Relative Density, Void Properties, Marshall Stability and Flow)	ASTM D 6307 ASTM C 117 ASTM C 136 ASTM D 2041 ASTM D 3203	For each mix type, one test for each 3500 sq.m. of placement, or three tests per lot, which ever is greater.
Compaction Testing (Core Density) and Thickness Determination	ASTM D 2726 ASTM D 3549	For each mix type, one test for each 2000 sq.m. of placement, or three tests per lot, whichever is greater.
Hot Mix Asphalt Temperature	--	No minimum frequency.

.6 Acceptance Sampling Procedures:

- .1 Loose mix samples will be acquired from the Work site in accordance with Alberta Transportation Test (ATT) procedure ATT- 37. Auger samples may be used if approved by both the Owner's Representative and the Contractor.
- .2 The timing of mix sampling will be stratified, with each sample representing a similar production quantity.
- .3 Core locations will be selected using stratified random sampling procedures. The lot will be divided into segments meeting or exceeding the minimum frequency indicated in the Acceptance Testing requirements (Section 3.11.3) and of approximately equal area. In each segment, a test site will be located using random numbers to determine the longitudinal and transverse coordinates.



- .4 Areas within 3m of transverse joints, or 0.3m of a mat edge, are excluded from compaction acceptance sampling and testing.
- .7 Reporting Protocols
  - .1 Test reporting accuracy will be as stipulated in the referenced test procedures, including:
    - .1 Gradation to the nearest whole number, except the percent passing the 80mm sieve, which will be reported to the nearest 0.1%.
    - .2 Binder content to the nearest 0.01%
    - .3 Air voids and compaction to the nearest 0.1%.
    - .4 Thickness to the nearest whole millimeter (mm).
  - .2 Lot averages will be reported to the same accuracy as test results.
- .4 Appeal of Acceptance Testing Results:
  - .1 General
    - .1 The Contractor may appeal the results of acceptance testing for Compaction Standard, Asphalt Content or Air Voids for any lot subject to rejection or unit price reduction. The notice of appeal will be in writing and submitted to the Owner's Representative within 48 hours of receipt of the acceptance testing results.
    - .2 Appeals will only be considered if cause can be shown and the post-production quality control requirements have been satisfied.
    - .3 Quality Control tests initiated after the Contractor's receipt of the acceptance test results will not be considered when evaluating cause for appeal.
    - .4 Only Quality Control testing during production for the subject project will be considered when evaluating cause for appeal.
  - .2 Asphalt Content Appeal
    - .1 A stratified random sampling plan will be developed by the Owner's Representative with the same number of segments as the original number of samples for the subject lot. Sufficient core sample will be acquired from each segment to enable asphalt content determinations.
    - .2 For asphalt content appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Owner's Representative.

- .3 The average of the appeal test results will be used for acceptance and unit price adjustment, and shall be binding on both the Owner and the Contractor.
- .4 If the average appeal test result verifies that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the results show that a penalty or rejection no longer applies, the sampling and appeal costs will be the responsibility of the Owner.

.3 Compaction Standard or Air Void Appeals

- .1 The testing laboratory conducting the project acceptance sampling and testing will routinely retain companion samples sufficient for the determination of maximum relative density and/or Marshall density.
- .2 For compaction standard or air void (Marshall density) appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Owner's Representative.
- .3 The average of the appeal tests will be used for acceptance and unit price adjustment, and will be binding on both the Owner and the Contractor.
- .4 If the new compaction standard verifies that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the result shows that a unit price reduction no longer applies, the appeal testing costs will be the responsibility of the Owner.
- .5 If the new average air void content result verifies that any unit price reduction applies for that Lot, the costs of the appeal testing will be borne by the Contractor. If the results show that a unit price reduction no longer applies, the sampling and appeal costs will be the responsibility of the Owner.

.4 Core Density and Thickness Appeals

- .1 Core density and thickness appeals will only be considered if a case can be made that the stratified random sampling plan was biased or testing was in error.

**3.12 END PRODUCT ACCEPTANCE OR REJECTION**

.1 General:

- .1 The Contractor will provide an end product conforming to the quality and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship will be in accordance with accepted industry standards.

- .2 Acceptance of any Lot at full or increased payment will occur if there are no obvious defects and the Lot mean results for asphalt content, pavement density, air voids and thickness meet or exceed the specified tolerances.
- .3 Unit price reductions will only be applied on the basis on full acceptance testing in accordance with the Acceptance Testing Requirements Section 3.11.3.5

.2 Asphalt Content:

- .1 For full payment, the Lot Mean Asphalt Content must be within + 0.30% of the approved Job Mix Formula value, as specified in Section 2.4.
- .2 Payment adjustment for asphalt content is as follows:

<b>Asphalt Content Deviation from Job Mix Formula Value (%)</b>	<b>Payment Adjustment Factor (PA<sub>AC</sub>)</b>
+ or - 0.30 or less	1.00
+ or - 0.31 to + or - 0.50	As per Chart A
Greater than + or - 0.50	Reject *

\* Subject to removal and replacement at the discretion of the Owner's Representative.

.3 Pavement Compaction:

- .1 For full or increased payment, the Lot Mean Pavement Compaction must be equal to or greater than 93% of the Lot Mean Maximum Relative Density.
- .2 Payment adjustment for pavement compaction is as follows:

<b>Pavement Compaction % of Maximum Relative Density</b>	<b>Payment Adjustment Factor (PA<sub>COM</sub>)</b>
94.6 to 95.5 *	1.03
93.5 to 94.5 *	1.02
93.0 to 93.4	1.00
90.0 to 92.9	As per Chart B
Less than 90.0	Reject **

\* Where no individual test result is less than 93%, otherwise the payment adjustment factor is 1.00.

\*\* Subject to removal and replacement at the discretion of the Owner's Representative.

.4 Air Void Content:

- .1 For full payment, the Lot Mean Air Voids must be within + or - 1.0% of the Job Mix Formula value, as specified in Section 2.4.

- .2 Payment adjustment for air void content is as follows:

<b>Air Void Content % Deviation from Job Mix Formula Value</b>	<b>Payment Adjustment Factor (PA<sub>AV</sub>)</b>
Less than 1.0	1.00
1.0 to 2.0	As per Chart C
Greater than 2.0 (Lower Lifts)	0.80
Greater than 2.0 (Upper Lifts)	0.60

- .5 Thickness (New Construction and Top Lift Only)

- .1 Pavement of any type found to be deficient in thickness by more than 13.0 mm will be removed and replaced by pavement of specified thickness, at the Contractor's expense.
- .2 The Lot Mean Thickness for any Lot will be determined on the basis of the acceptance cores described in the Acceptance Testing Requirements, Section 3.11.3.4. Core thickness will be determined in accordance with ASTM D 3549.
- .3 If the deficiency of any individual core exceeds 13 mm, additional cores may be extracted in the proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area subject to be removed and replaced. The Contractor will pay for such additional coring.
- .4 For full payment, the Lot Mean Thickness must be equal to, or greater than, the specified thickness.
- .5 Payment adjustment for thickness is as follows:

<b>Average Thickness Compared to Specified Thickness</b>	<b>Payment Adjustment Factor * (PA<sub>T</sub>)</b>	
	<b>Total Thickness (Single or Multiple Lifts)</b>	<b>Top Lift Thickness (Multiple Lifts)</b>
Compliant or Greater	1.00	1.00
1mm to 13mm Deficient	As Per Chart D	As Per Chart D
More than 13mm Deficient	Reject **	Reject **

\* A single Thickness Payment Adjustment Factor shall be applied, Total Thickness or Top Lift Thickness, whichever results in the greatest adjustment.

\*\* Subject to removal and replacement at the discretion of the Owner's Representative.

- .6 Smoothness

- .1 The completed asphalt concrete surface will be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents, the tolerances in both profile and crown are:
- .1 Base Course - 10 mm in 3 m
- .2 Surface Course - 5 mm in 3 m

- .2 When deviations in excess of the above tolerances are found, the pavement surface will be corrected by methods satisfactory to the Owner's Representative. Correction of defects will be carried out until there.

.7 Segregation

- .1 The finished surface will have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.
- .2 All segregation will be evaluated by the Owner's Representative to determine repair requirements.
- .3 The severity of segregation will be rated as follows:
  - .1 Slight - The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.
  - .2 Moderate - Significantly more stone than the surrounding mix, and exhibit a lack of surrounding matrix.
  - .3 Severe - Appears as an area of very stony mix, stone against stone, with very little or no matrix.
- .4 Segregated areas will be repaired by the Contractor as directed by the Owner's Representative. The following methods of repair are identified.
  - .1 Slight - Squeegee asphalt to completely fill the surface voids.
  - .2 Moderate - slurry seal for full mat width.
  - .3 Severe - removal and replacement or overlay.
- .5 All repairs will be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Owner's Representative.
- .6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Owner's Representative.
- .7 Repairs will be carried out by the Contractor at their expense.

**3.13 PAYMENT ADJUSTMENT FOR NON-COMPLIANCE**

- .1 The Unit Price applicable to each Lot quantity of asphalt concrete will be calculated as follows:

$$\text{Adjusted Unit Bid Price} = (\text{Unit Bid Price}) \times (\text{PA}_{AC}) \times (\text{PA}_{COM}) \times (\text{PA}_{AV}) \times (\text{PA}_T)$$

Where:

$\text{PA}_{AC}$  = Asphalt Content Payment Adjustment

$\text{PA}_{COM}$  = Pavement Compaction Payment Adjustment

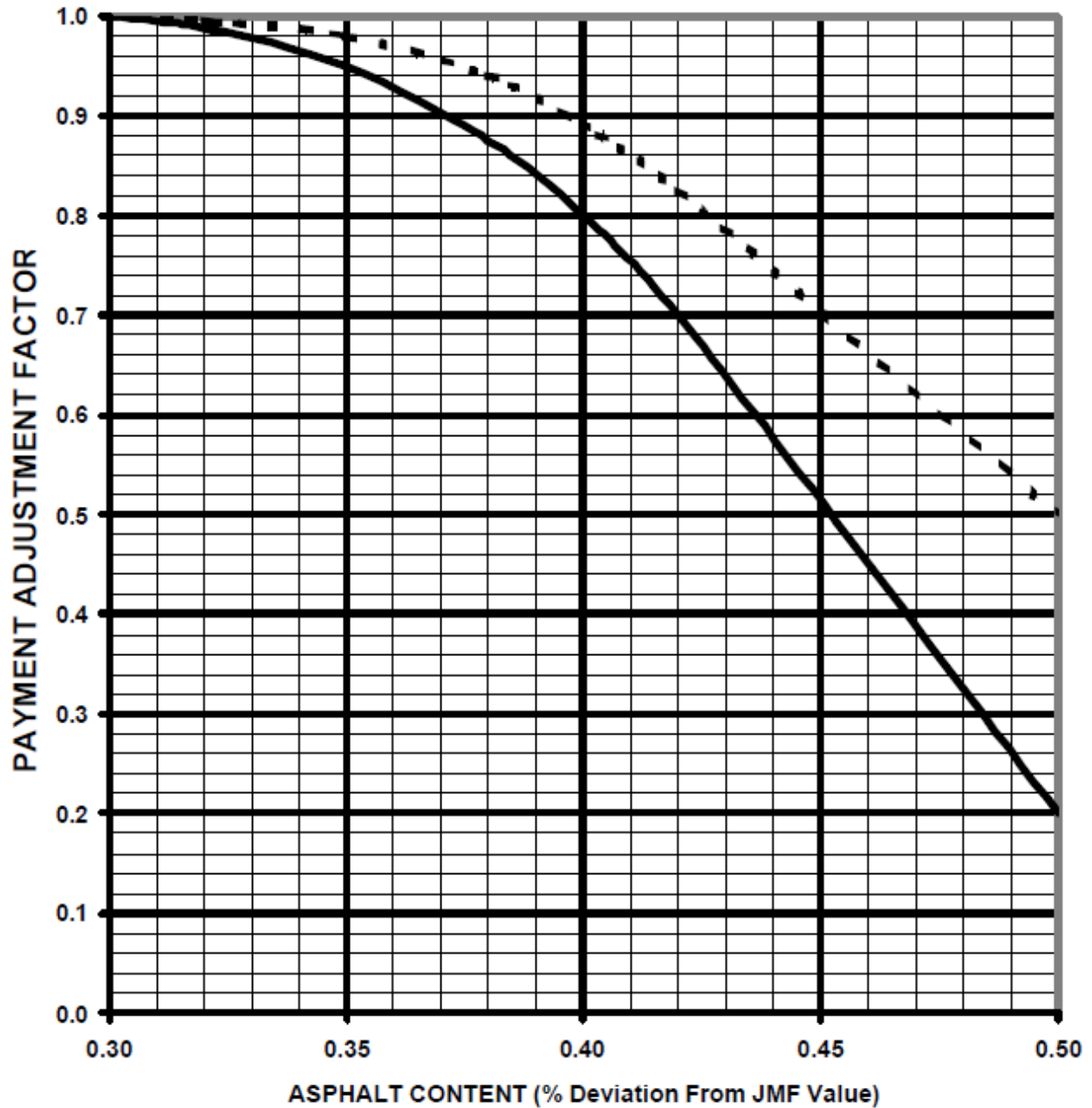
$\text{PA}_{AV}$  = Air Void Payment Adjustment

$\text{PA}_T$  = Thickness Payment Adjustment

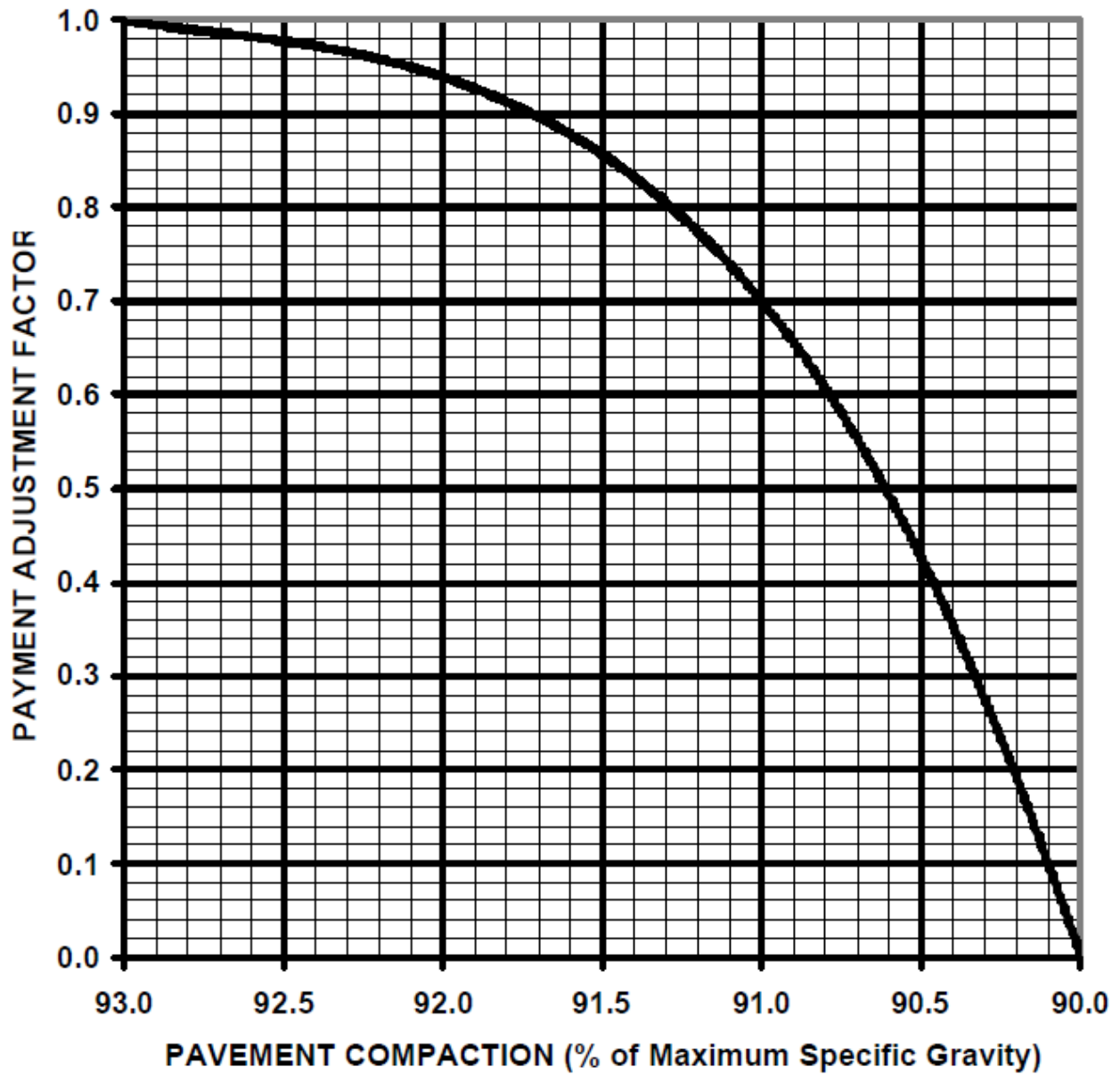
**END OF SECTION**

### CHART A ASPHALT CONTENT PAYMENT ADJUSTMENT FACTOR

— SURFACE LIFTS    - - - LOWER LIFTS

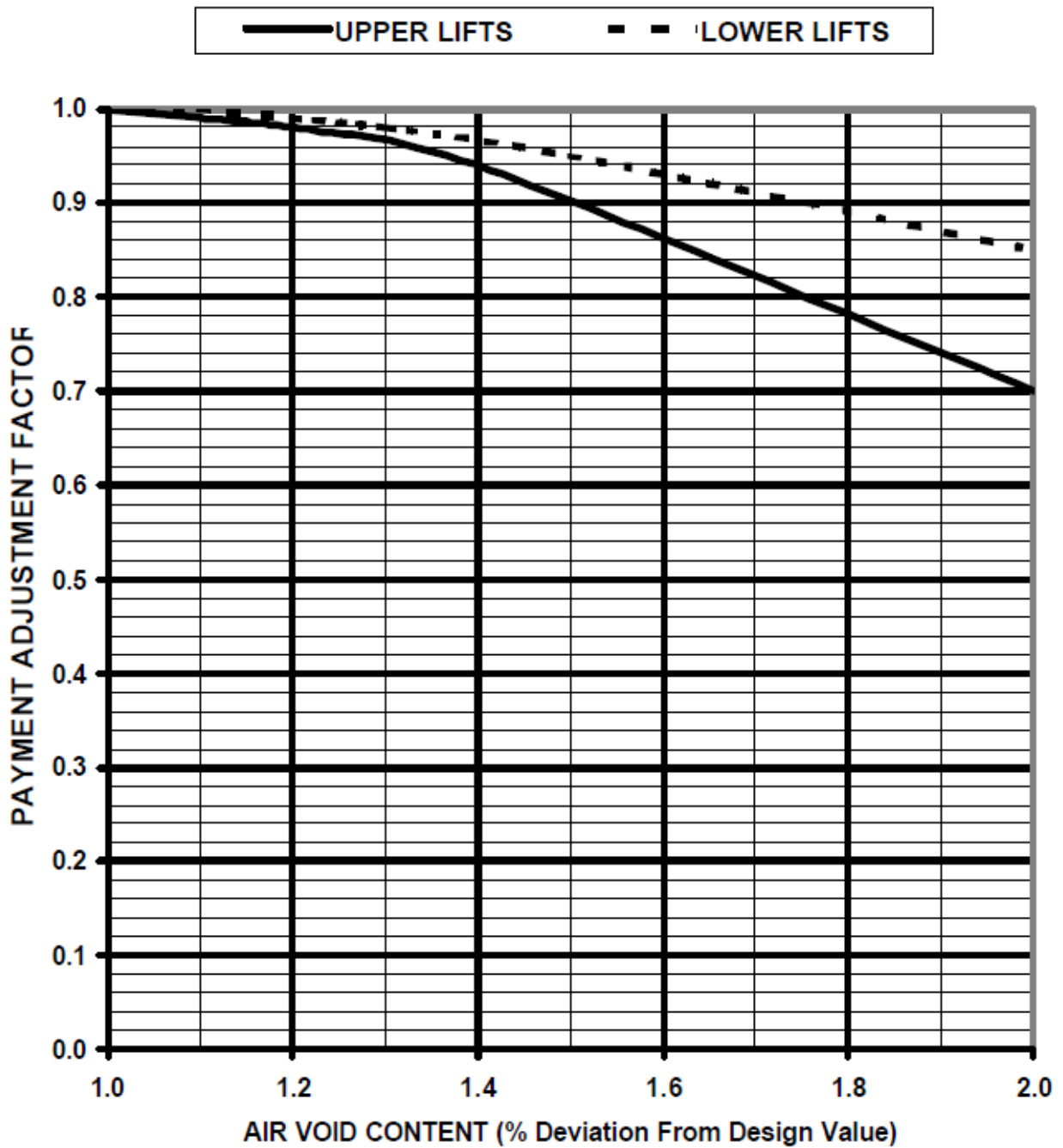


### CHART B COMPACTION PAYMENT ADJUSTMENT FACTOR

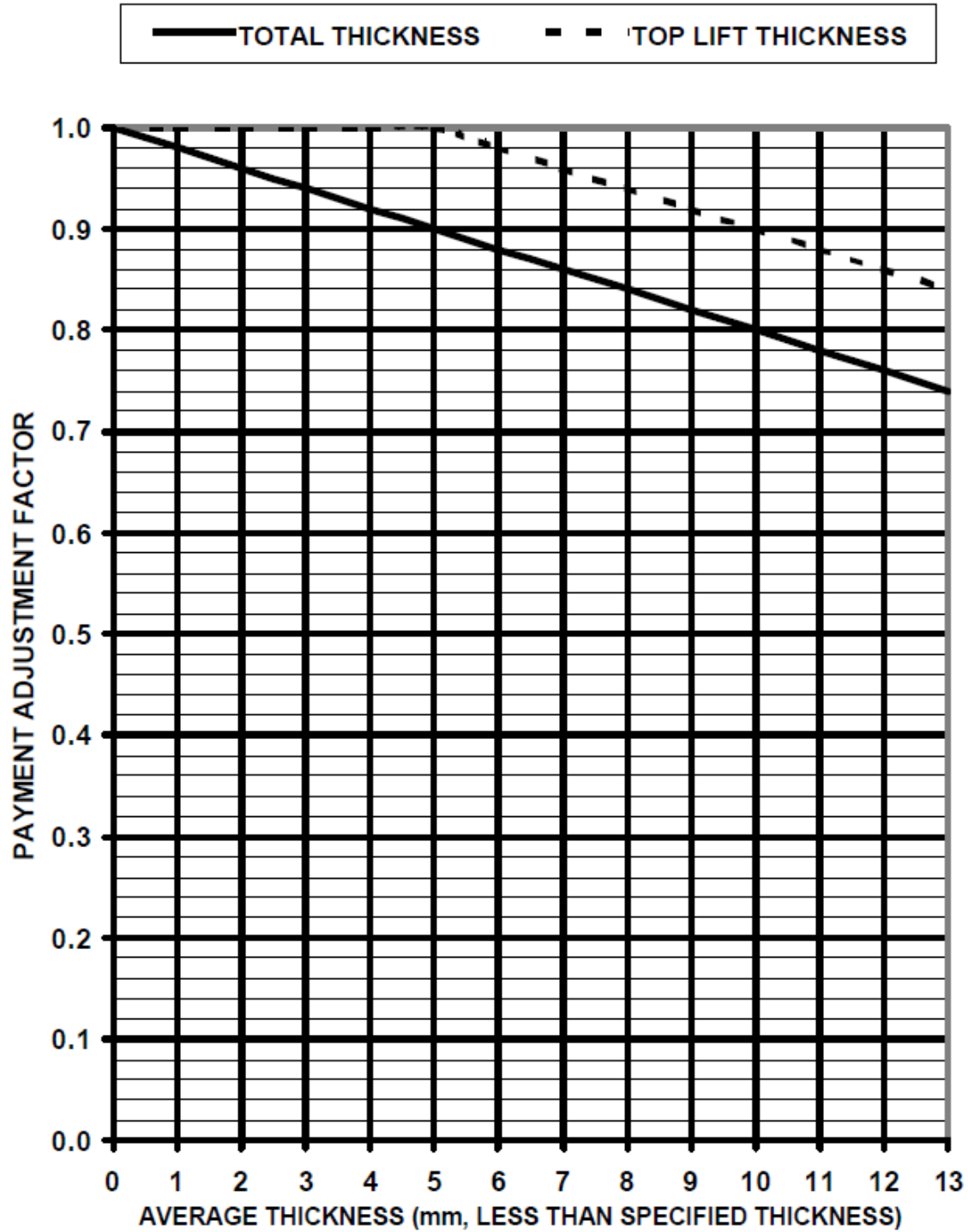




### CHART C AIR VOID CONTENT PAYMENT ADJUSTMENT FACTOR



### CHART D AVERAGE THICKNESS PAYMENT ADJUSTMENT FACTOR



**1. GENERAL**

**1.1 INTENT**

- .1 Read this section in conjunction with other sections for location, use and placement of “Pavement Markings” specified herein.

**1.2 REFERENCES**

- .1 Pavement markings to be in accordance with the latest edition of the “Manual of Uniform Traffic Control Devices for Canada” by the Traffic Association of Canada (TAC).
- .2 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner
- .3 CGSB 1-GP-12C-68, Standard Paint Colors
- .4 CGSB 1-GP-71-83, Method of Testing Paints and Pigments
- .5 CGSB 1-GP-74M-79, Paint, Traffic, Alkyd

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Paint: CGSB 1-G-12C, yellow 505-308, black 512-301, white 513-301
- .2 Thinner: CAN/CGSB-1.5
- .3 Glass beads: Overlay type: CGSB 1-GP-74M

**3. EXECUTION**

**3.1 EQUIPMENT REQUIREMENTS**

- .1 Paint applicator must be an approved pressure type (mobile) distributor capable of applying paint in a single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint as required.

**3.2 CONDITION OF SURFACES**

- .1 Pavement surface must be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.
- .2 Complete any surface preparation requirements recommended by the paint manufacturer.

### 3.3 APPLICATION

- .1 Provide traffic control as required to apply markings.
- .2 Owner's Representative to review Contractor pavement markings layout prior to paint application. Contractor to co-ordinate the review.
- .3 Unless otherwise approved by Owners Representative, apply paint only when air temperature is above 10°C, wind speed is less than 60km/h, and no rain is forecast within the next four (4) hours.
- .4 Apply traffic paint evenly at rate of 3 m<sup>2</sup>/L.
- .5 Do not thin paint unless approved by Owner's Representative.
- .6 Symbols and letters to conform to dimensions indicated.
- .7 Paint lines to be of uniform color and density with sharp edges.
- .8 Thoroughly clean distributor tank before refilling with paint of different color.
- .9 Apply glass beads at a rate of 200 g/m<sup>2</sup> of painted area immediately after application of paint.
- .10 Protect pavement markings until dry.
- .11 Protect adjacent structures, buildings, sidewalks, landscaping and other surface features against spillage and over-spray during painting operations.

### 3.4 PAVEMENT MARKINGS

- .1 Directional Dividing Line
  - .1 100 mm wide single solid yellow "Directional Dividing Line" along the center line of all paved roads.
- .2 Stop Line
  - .1 600 mm wide solid white "Stop Line" at each stop sign. The "Stop Line" to extend from the lip of gutter to the painted road centerline.
- .3 Parking Stall Line
  - .1 100 mm wide single solid white "Parking Stall Line" along three sides of each parking stall.
- .4 Handicap Parking Symbol
  - .1 100 mm wide white Handicap symbol and border line with light blue fill.
  - .2 Handicap parking symbols to be located along the entrance of the parking stall.

**3.5 CLEAN UP**

- .1 Remove spillage and over-spray of paint from pavement, sidewalks, building and other surface features. Use methods and materials without damaging and leaving visible residue on substrates.

**3.6 TOLERANCE**

- .1 Paint markings to be within - 12 mm and + 12 mm of dimensions indicated.

**END OF SECTION**

1415-057-00

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**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location use and placement of “Concrete Sidewalks, Curb & Gutters and Swales” specified herein.

**1.2 SUBMITTALS**

- .1 Provide concrete mix design for review.
- .2 Submit product literature for curing compound.
- .3 Provide shop drawings for review with profiles and dimensional information for any sidewalks, curb & gutters and swales that differ from the detailed drawings.

**1.3 TESTING**

- .1 Owner may appoint and pay for services of testing agency to do the following:
  - .1 Test fine and coarse aggregate.
  - .2 Take three test cylinders from load, or fraction thereof, of each type of concrete placed in any one day. Test cylinders will be cured on job-site under same conditions as concrete it represents.
  - .3 Test one cylinder in 7 days and remaining two cylinders in 28 days.
  - .4 Take at least one slump test and one entrained air test for each set of test cylinders taken.
  - .5 Take one additional test cylinder when the temperature is likely to fall below 5°C within 48 hours after placement and no provisions have been made to heat the concrete to greater than 10°C. Test cylinder will be cured on job-site under same conditions as concrete it represents and to be tested in 7 days.
  - .6 Immediately report results of field tests to the Contractor, for information only.
- .2 Submit the following to testing firm's laboratory:
  - .1 Proposed concrete mix design.
  - .2 Samples of fine and coarse aggregate, obtained in accordance with CSA A23.2-94, Sampling Aggregates For Use in Concrete.
  - .3 Results of Petrographic Examination to CSA A23.2-94, of aggregate representative of materials to be used for project.
- .3 Advise testing firm in advance of concrete placement.

- .4 The Owner may order additional testing at any time. Pay for those tests which indicate failure to comply with requirements.

## **2. PRODUCTS**

### **2.1 GENERAL**

- .1 The Work covered in this Section consists of the furnishing of all labour, plant and material and performing all operations in connection with waste excavation, sub-grade preparation, granular base, forming, supply and placement of reinforcing, supply and placement of concrete, surface finishing, jointing, concrete protection, backfilling, tolerances, maintenance and incidental items required to complete this item of Work.

### **2.2 MATERIALS**

#### **.1 Concrete:**

- .1 Concrete will be produced to provide 32 MPa minimum compressive strength at 28 days. Maximum course aggregate size will be 25 mm, aggregates will comply with latest revision of CAN3-A23.1. Water/cement ratio will meet CAN3-A23.1, Table 7, for Class A Exposure. Slump will be 40 mm to 75 mm at time of placement. Air content will be 5.5% to 8% at time of placing. Submit a mix design to the Owners Representative two weeks prior to commencing work for approval.
- .2 September 15 to May 15, Concrete will be produced to provide 27.5 MPa minimum compressive strength at 7 days and 32 MPa minimum compressive strength at 28 days. Maximum course aggregate size will be 25mm, aggregates will comply with latest revision of CAN3-A23.1. Water/cement ratio will meet CAN3-A23.1, Table 7, for Class A Exposure. Slump will be 40mm to 75mm at time of placement. Air content will be 6% to 8% at time of placing. Submit a mix design to the Owner's Representative two weeks prior to commencing work for approval.

#### **.2 Cement:**

- .1 Cement will meet the requirements of CAN3-A5 and will be Portland Cement, Type HS Sulfate Resistant.

#### **.3 Granular Base:**

- .1 Refer to Section 02273.

#### **.4 Curing Compound:**

- .1 Curing Compound will comply with latest revision of ASTM C309 and be a Fugitive Dye Type.

- .5 Formwork:
  - .1 Formwork will be steel or wood, free from warps, dents, nail-holes and other defects and will be of adequate strength to restrain concrete loads.
  - .2 Form release agent will be a non-staining mineral type with chemically active release agents containing compounds that react with free lime to provide water soluble soap, such as Formshield by W.R. Grace.
- .6 Admixtures:
  - .1 Air-entraining admixture will comply with latest revision of CAN3-A266.1
  - .2 Water reducing admixture will be a type WN complying with latest revision of CAN3-A266.2
  - .3 Admixtures to be used only when approved by the Owner's Representative.
- .7 Reinforcing:
  - .1 Reinforcing will be clean and free from defects, kinks, loose rust or mill scale at the time concrete is placed. Remove any coatings of hardened mortar and mill scale from the steel.
  - .2 Cold drawn steel wire will meet the requirements of ASTM Designation A-82.
  - .3 Wire mesh will meet the requirements of ASTM Designation A-185.
  - .4 Bar reinforcing will meet ASTM Designation A-184 and ASTM Designation A-304 intermediate grade new billet deformed steel.
- .8 Accessories:
  - .1 Form oil: non-staining mineral type.
  - .2 Formwork: pre-manufactured and profiled steel or wood forms.
  - .3 Poured Joint Filler: Asphalt elastic compound to ASTM D1190-96.
  - .4 Preformed Joint Filler: asphalt impregnated type to ASTM D1751-83.
  - .5 Curing Compound: to ASTM C309-97, Type 2 white pigmented, Class B resin-based, liquid membrane-forming type.



### **3. EXECUTION**

#### **3.1 SUBGRADE PREPARATION**

- .1 Subgrade will be excavated to the grade and section required to meet final curb and gutter, swale and sidewalk grades, alignments shown the contract documents and as specified by the Owner's Representative.
- .2 Excavation includes the removal and disposal of all material of whatever nature encountered, taken within the boundaries necessary for preparation and construction of concrete sidewalk, curb and gutter or monolithic sidewalk, catch basins and other structures to the required cross-section, alignment and depth. Remove all deleterious matter encountered at subgrade level and replace with approved gravel fill compacted in place. The subgrade must provide a uniform bearing capacity over the area of the structure. Excavation behind the concrete structure will be limited to 500 mm unless otherwise specified by the Owner's Representative. Where existing lawns are encountered the Contractor will cut the sod in a neat straight line to facilitate restoration with full width sod placement. Stockpile sufficient suitable earth materials necessary to backfill the concrete structures. Dispose of surplus excavated materials.
- .3 Compact the top 300 mm of the subgrade to a minimum of 98% of Standard Proctor Density prior to placing granular materials.
- .4 Where unstable material is encountered during excavation, notify the Owner's Representative and if directed, excavate the unstable material and backfill the area with approved pit-run gravel fill. The Contractor will be responsible for the replacement, at his own expense, of any failure of the sidewalk, swale or curb and gutter which, in the opinion of the Owner's Representative, was caused by an unstable base.

#### **3.2 GRANULAR BASE**

- .1 Granular base will be placed and compacted to a uniform 250 mm minimum thickness below all concrete curb and gutter, sidewalk, swales and other structures. Granular base will be compacted to minimum of 98% of Maximum Standard Proctor Density. If there is a possibility of excessive absorption of water from the concrete by the gravel base, sprinkle the base with water as required.

#### **3.3 FORMING**

- .1 Vertical surfaces will be formed to full depth. Forms will be securely positioned to the required lines and grades. All forms will be coated with form release agent.
- .2 Extruding and slip forming will be permitted subject to evaluation of the form cross section and mechanical equipment being proposed. Automatic grade and alignment control will be required.
- .3 Do not place concrete until forms and/or string lines have been reviewed by the Owner's Representative.

**3.4 CONCRETE**

- .1 Ready mixed concrete will be mixed and delivered in accordance with the requirements set forth in ASTM Designation C-94, CSA Standard A.23.1.3 or the latest revision thereof and will be subject to all provisions herein relative to materials, strength, proportioning, consistency, measurement and mixing.
- .2 Hand mixing is not permitted.
- .3 For site mixing, Contractor will submit specifications for batching and mixing equipment to the Owner's Representative for approval.
- .4 Deliver concrete to the point of deposit, rehandling of concrete will not be permitted. Concrete placement temperature will not be less than 20 degrees C or greater the 25 degrees C. Concrete operations will be continuous until the section, panel or scheduled pour is completed with the interval between placement of successive batches not greater than 45 minutes.
- .5 Place the concrete in a manner to prevent segregation of ingredients taking special care to place the concrete against the forms, particularly in corners, in order to prevent voids, rough areas and honeycombing.
- .6 Place concrete to the full specified depth. After spreading, strike-off and compact with an approved vibrating screed operating at a minimum of 5000 cycles per minute. Take every precaution to make all concrete solid, compact, watertight and smooth. Prevent concrete spillage into valve boxes, catch basins and related appurtenances.
- .7 Concrete surfaces will be finished to a smooth uniform finish, free of open texturing and exposed aggregate. Excess mortar will not be worked to the surface by excess trowelling. Neat cement will not be used as a drier to facilitate finishing. A broom finish surface will be applied to provide a non-skid texture. Outside edges of sidewalks and each edge of joints will be finished with a 50 mm edging tool having a 6 mm radius. Maintain the concrete structures cross section, grade and alignment when constructing the joint and when completing the concrete finishing.
- .8 Finish surfaces will be to within 3 mm in 3 metres from line, level or grade as measured with a straight edge placed on the surface. End all pours at a construction joint.
- .9 Provide 300mm long 10M rebar dowels at 300 mm on-centre to tie in to existing concrete structures and tie into successive pours. Drill 12 mm diameter by 150 mm deep holes in concrete structure. Set dowels into holes with hammer.
- .10 After initial set of concrete, the face of curb form will be removed and the curb will be finished with an approved nylon brush pulled lengthwise along the curb and gutter. Take adequate care in removing forms to avoid marring the concrete, patch as may be necessary immediately after removal of forms.

- .11 All concrete will be cured and protected in accordance with CAN3-A23.1. Spray exposed surfaces with curing compound immediately after form removal and/or patching. After the application is complete and set the surface will have a uniform appearance and colour.
- .12 Contractor will mark the sidewalk or curb and gutter with an approved marking tool indicating Contractor's name and year constructed. The letters and numerals of the marking tool will be 40 mm high. Make marks at the ends of each block and if the construction begins or terminates within the middle of the block, the Contractor will also mark these locations. Mark the corner of each apron and driveway.
- .13 Contractor will take all necessary action to ensure the cross section, grade and alignment of the concrete structure is maintained until the concrete has hardened sufficiently. This may include the installation of hand forms on extruded or slip formed concrete.
- .14 Heavy equipment used for road construction will not be used near the concrete for a period of 7 days after the pour or until the concrete has reached 70% of the specified 28 day compressive strength.

### **3.5 SURFACE, EXPANSION AND CONTRACTION JOINTS**

- .1 Surface joints will be 15 mm deep by 5 mm wide and constructed by means of a marking tool or other approved method. Surface joints will be constructed parallel and perpendicular to the concrete structure edge as shown on the Standard Drawings.
- .2 Contraction joints will be constructed 35 mm deep by 5 mm wide where shown on the drawings, but not more than 3 metres apart, by means of marking tool or other approved method. Round joint edges with an edger having a radius of 6 mm. Where sidewalk is adjacent to curb, joints of curb and gutters and sidewalk will coincide.
- .3 Expansion joints will be installed around manholes and catch basins and along any buildings or permanent structures or where specified. Use an approved mastic pre-formed material, 15 mm by 90 mm cross-section, laid plumb and straight 6 mm below the finished sidewalk grade.
- .4 Saw cut joints as required with a concrete saw capable of producing a true straight joint of constant depth.
- .5 Carefully fit, cut and mark the sidewalk around all openings, iron covers, manholes, vaults, valve boxes, lamp standards, hydrants, poles and other surface installations. The surface joint must be neatly tooled and marked. Place expansion joint material to the full depth of the sidewalk around all surface structures.
- .6 Construct surface, expansion and contraction joints ensuring the cross section, grade and alignment of the concrete structure is maintained.

### **3.6 FINISHING**

- .1 Remove forms on the face concrete structures after initial set of concrete.

- .2 Do not add water before or during finishing operation.
- .3 Finish concrete surfaces as follows:
  - .1 Do not trowel surfaces while bleed water is still present. Work surfaces as little as possible to achieve finish.
  - .2 Edge Finishing: finish edges, including joints, with 50 mm wide edging tool having 6 mm radius edge.
  - .3 Where broom finish is specified, use approved nylon brush to provide uniform texture and pattern.
  - .4 Ensure all joints, edges and surface works have a uniform, consistent and sealed finish.
  - .5 Ensure the concrete structure cross section, grade and alignment tolerances are achieved when finishing is complete.

**3.7 DRIVEWAYS**

- .1 Driveways will be constructed where shown on the drawings or where directed by the Owner's Representative.

**3.8 PROTECTION**

- .1 The Contractor will provide all equipment, materials and labour necessary to protect the concrete work from rain, dust, frost or other weather elements. The Contractor will provide all barricades, temporary structures, tarps and other measures for the protection of the concrete structures for a period of 5 days after finishing.
- .2 If mean daily temperature falls below 5° C, provide cold weather protection as set out in CAN3-A23.1
- .3 The Contractor will provide and maintain all equipment, materials and labour necessary to protect the concrete work from people, vehicles, animals and to protect the public. Protection of the concrete structures and the public include barricades, flashers, signage, temporary ramps, temporary walkways, flagging, construction fencing and other protective measures.
- .4 The Contractor will remain onsite to address any concrete finish issues that may arise until the concrete has sufficiently cured where the surface cannot be easily marked.

**3.9 WHEEL CHAIR RAMPS**

- .1 Wheel Chair Ramps will be constructed at all intersections for new construction or in existing sidewalks as shown on the drawings and as directed by the Owner's Representative.

**3.10 REINFORCING**

- .1 Reinforce monolithic and separate sidewalk, at public lanes, private and commercial driveways, with 10M bars @ 300 mm on-centre longitudinally with 50 mm cover of concrete on the edges and as shown on the Drawings.
- .2 Reinforce curb & gutter and swales at public lanes, commercial driveways, and road crossings with 10M bars as shown on the Drawings.
- .3 Reinforce aprons, private and commercial driveways with 10M bars @ 300 mm on-centre longitudinally and transversely with 50 mm cover of concrete on the edges.
- .4 Bar reinforcement will be supported above the compacted granular subgrade to ensure 50 mm cover of concrete. When overlapping bar reinforcement, the overlap length will be 36 bar diameters with the bars wired together.
- .5 Reinforce concrete structures as shown on the drawings, as indicated in the specifications and as directed by the Owner's Representative.

**3.11 BACKFILL**

- .1 Concrete will be cured for 7 days prior to backfilling. All concrete will be backfilled to the require grades to accommodate landscape and hard surface works.
- .2 In landscaped areas adjacent to the concrete structures, backfill with suitable earth materials compacted to minimum of 95% of Maximum Standard Proctor Density. Compact the backfill to the grade necessary to accommodate the specified surface restoration treatment (topsoil, sod, granular material, mulch, landscape features, etc.).
- .3 In hard surface areas adjacent to concrete structures, backfill with suitable earth materials compacted to minimum of 98% of Maximum Standard Proctor Density. Compact the backfill to the grade necessary to accommodate the specified surface restoration treatment (concrete paving stone, asphalt, foundation, etc.).

**3.12 ROAD RESTORATION**

- .1 Where the concrete structures are to be constructed on a road that is gravelled or paved, the excavation for the installation will be limited to 500 mm from the edge of the concrete structure. Excavation beyond the limits will be the responsibility of the Contractor and any additional costs removals and rehabilitation work will be at the Contractors expense.
- .2 Asphalt will be saw cut to achieve a neat vertical face for the rehabilitation work tie-in. Remove and dispose of materials necessary to effect construction of the work. Rehabilitate the road to specified structural sections with the specified granular and asphalt materials.

**4. TOLERANCES**

- .1 Concrete structures will be constructed to meet the following tolerances for the finish concrete surfaces:
  - .1 Trueness of surface: 6 mm maximum deviation in 3 m length.
  - .2 Elevation: 10 mm maximum deviation from design.
  - .3 Alignment: 15 mm maximum deviation from design.
  - .4 Cross section: 5 mm maximum deviation from design.
- .2 Concrete structures determined to be non-compliant with the tolerances will not be measured for payment or will be replaced as directed by the Owner's Representative.

**5. ADJUSTMENT OF PAYMENT FOR LOW STRENGTH CONCRETE**

- .1 Where the average applicable 28-day or 7-day compressive strength of the test cylinders exceeds the minimum design strength, the concrete will be paid for at the contract unit prices.
- .2 Where compressive strengths of the test cylinders for any portion of the work falls below the requirements specified herein, payment will be as follows:

<b>% Minimum Allowable Strength</b>	<b>% Payment</b>
100% or greater	100%
80% - 99.9%	$\frac{\text{Bid Unit Price} \times \text{Ave. Test Strength}}{\text{Minimum Allowable Strength}}$
70% - 79.9%	No payment or replace if directed by the Owner's Representative
Less than 70%	Replacement

**6. MAINTENANCE STANDARDS**

- .1 Maintenance standards will apply from substantial performance of the contract through to the warranty period and final acceptance for all sidewalks, curb and gutters, swales and other related concrete structure works. Maintenance work will be completed before the expiration of the warranty period unless the deficiencies are hazardous to the Public then the maintenance work will be performed immediately by the Contractor.

**6.1 SURFACE CONDITION**

- .1 Where the surface of a section of concrete exhibits a loss of surface mortar and/or aggregate more than 3 mm deep or if there is evidence of loose or lifting mortar, replace that section of concrete as directed by the Owner's Representative.
- .2 A replacement section of concrete is a 3.0m length of curb and gutter, swale or similar concrete structure, and a 1.5 m length of sidewalk flag section or similar concrete structure.
- .3 Where possible, replacement sections of concrete to be defined by existing surface, expansion or contraction joints.

**6.2 SIDEWALK FAILURES**

- .1 Replacement of affected sections will be required when one or more of the following exists:
  - .1 Any crack greater than 3 mm in width.
  - .2 Any crack with vertical displacement or chipping or spalling edges.
  - .3 Any longitudinal crack greater than or equal to 1.5 mm in width.
  - .4 Displacement at a joint of greater than or equal to 12 mm.
  - .5 Dished surface of sidewalk where water ponds.
  - .6 Reverse crossfall or crossfall greater than 8% or less than 0.7%.
  - .7 Random cracking of any size.
  - .8 Spalling or loss of mortar to the finish surface.
  - .9 Any feature considered detrimental to pedestrian safety or the walk appearance.

**6.3 SECTIONAL REPLACEMENT**

- .1 All breakout must end at a contraction, expansion or surface joint. Saw cut edge of surface mark to a minimum depth of 30 mm. Contraction joints may be hand chiselled to produce a true straight joint. The concrete edge must be exposed and cleaned to produce a good bond. Replacement sections will be connected to adjacent concrete structures with 150mm long 10M rebar dowels at 300mm on-centre.
- .2 Saw cuts may be permitted to separate curb and gutter from the sidewalk flag section on monolithic sidewalks, at the discretion of the Owner's Representative.

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**6.4            GROUTING**

- .1      Grouting of cracks is not permitted.

**6.5            MORTAR, TAR AND/OR ASPHALT ON WALK**

- .1      Mortar, tar and/or asphalt on the flag section of the concrete sidewalk is not permitted.

**END OF SECTION**



**1. GENERAL**

**1.1 INTENT**

- .1 Read this section in conjunction with other sections for location, use and placement for “Sodding” specified herein.

**1.2 DELIVERY, STORAGE AND HANDLING**

- .1 Use all means necessary to protect material before, during and after installation. Provide adequate protection to materials which may deteriorate if exposed to elements.
  - .1 Fertilizer:
    - .1 Packaged in waterproof bags, with label clearly indicating net mass, analysis and manufacturer.
    - .2 Store on pallets and protect from the elements.
  - .2 Nursery sod:
    - .1 The sod to be cut by approved methods in accordance with recommendations of the Nursery Sod Growers Association of Alberta.
    - .2 Deliver sod rolled or flat to prevent tearing or breaking. Broken or irregular pieces are unacceptable.
    - .3 Deliver sod to site within 24 hours of being lifted.
    - .4 Sod to be protected during transportation to prevent drying out and to arrive at the site in a fresh and healthy condition.
    - .5 Sod to be installed immediately after arrival. If there is any delay in installation, sod to be kept moist and cool at all times until installation.

**1.3 MAINTENANCE PERIOD**

- .1 Maintain sodded areas from time of sodding until six weeks after date of Interim Acceptance of the Work.

**2. PRODUCTS**

**2.1 MATERIAL**

- .1 Fertilizer:
  - .1 Use complete commercial fertilizer, minimum of 50% of elements derived from organic sources.
  - .2 Owner’s Representative may adjust specified fertilizer after topsoil test analysis results are received, with no change in Contract Price.

- .2 Nursery Sod:
  - .1 freshly cut and healthy with strong, fibrous root system, free from stones and burned or bare spots, cultivated in nursery field as turf grass crop containing maximum of 2% of other grass species, and maximum of two broad leaf weeds and ten other weeds per 40 m<sup>2</sup>. Thickness of sod soil portion to be maximum of 40 mm and minimum 25 mm.
- .3 Water:
  - .1 Obtain water from source on site supplied by Owner where possibly or supply water as necessary.

## **2.2 SOD TYPE**

- .1 The grass sod to be a certified No. 1 cultivated turf grass sod from Canada No. 1 seed.
- .2 Grass sod to be grown and sold in accordance with the classification of the Southern Alberta Turf Grass Association.

## **3. EXECUTION**

### **3.1 FERTILIZING**

- .1 Apply fertilizer only after final grade has been approved by Owner's Representative.
- .2 Apply 12-51-0 fertilizer at 3 kg/100 m<sup>2</sup>.
- .3 Spread evenly with calibrated mechanical distributor.
- .4 Mix thoroughly into upper 50 mm of topsoil.

### **3.2 LAYING SOD**

- .1 Obtain the approval of the Owner's Representative for the; sod bed finish grades, final tith, surface flatness and fertilizer application before laying sod.
- .2 Firm the sod bed by rolling before laying sod.
- .3 Sod when ground is not frozen.
- .4 Rake and wet soil immediately before sodding. Stagger sod joints and butt tightly. No pieces to overlap. No visible open joints to exist after sod is laid.
- .5 Sod to be laid smooth and flush with adjoining grass areas.

- .6 Finish elevation of sod to match adjoining sidewalks, edging, paving and curbs.
- .7 Place sod so that watering will not interfere with other work.
- .8 Water immediately in sufficient quantities to obtain moisture penetration through sod and into upper 100 mm of topsoil.
- .9 After watering, roll sod to ensure sod contact with topsoil and to remove minor depressions and irregularities. Ensure sod has sufficient moisture content to achieve proper rolling.

### **3.3 LAYING SOD ON SLOPES**

- .1 Install rolls of sod transverse to the steepest slope and secure at regular intervals to prevent slippage. Maintain until there is a sufficient root catch.
- .2 Apply water in sufficient quantities to prevent grass and underlying soil from drying out.

### **3.4 PROTECTION OF SODDED AREAS**

- .1 Immediately after sodding, erect snow fence barricades and warning signs to protect sodded areas from traffic until grass is established.
- .2 Keep site well drained and landscape excavations dry.
- .3 Clean up immediately soil or debris spilled onto pavement, or concrete.

### **3.5 MAINTENANCE**

- .1 Apply water in sufficient quantities to prevent grass and underlying soil from drying out.
- .2 Areas with no irrigation system: supply labour, all hoses and attachments necessary to provide adequate watering to prevent grass and underlying soil from drying out.
- .3 Cut grass first time when it reaches height of 60 mm and maintain to minimum height of 50 mm. Do not cut more than 30% of blade at any one mowing. Remove clippings.
- .4 Repair areas which show root growth failure, deterioration, bare or thin spots, or which have been damaged by any means, including replacement operations.
- .5 Fertilize sod areas six weeks after sodding with 27-14-0 fertilizer. Spread evenly at rate of 3 kg/100 m<sup>2</sup>, water in well.
- .6 Postpone fertilizing until spring if application falls after August 15th.
- .7 Repeat rolling of sod as required to maintain a smooth grass surface.

**3.6 ACCEPTANCE**

- .1 Sodded areas will be accepted by Owner at end of maintenance period provided:
  - .1 Sodded areas are properly established.
  - .2 Turf is free of bare and dead spots.
  - .3 No surface soil is visible when grass cut to height of 50 mm.

**3.7 CLEAN-UP**

- .1 Broom clean pavement and sidewalks. Clear soil and rubble from underground or surface storm sewer lids.
- .2 Leave site in neat and clean condition. Remove excess material from site.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Read this Section in conjunction with other Sections for location, use and placement of “Restoration of Sitework” specified herein.

**2. PRODUCTS**

- .1 Not Applicable.

**3. EXECUTION**

**3.1 RESTORATION - GENERAL**

- .1 Restore all existing areas and sitework damaged or disturbed due to earthwork or other work of this Contract, back to their original condition or better.

**3.2 LANDSCAPE WORK**

- .1 Protect the integrity of the existing landscape features by implementing construction procedures that will minimize damages.
- .2 Restore all landscape features damaged or disturbed by the work, back to their original condition or better. All costs associated with this work will be borne by the Contractor.
- .3 Maintain all trees within the work site not identified for removal.
- .4 Minimize damage to trees, plants and shrubs during the course of construction.
- .5 Attend to damaged trees, plants or shrubs by qualified personnel.
- .6 All grassed areas will be restored with topsoil and sod.
- .8 Topsoil and sod reconstruction limits will be laid out by the Owner’s Representative when rough grading has been completed.
- .9 All landscape work will be completed to the satisfaction to the Owner.

**3.3 IRRIGATION WORK**

- .1 Maintain all irrigation system works, unless otherwise noted.
- .2 Restore all irrigation system components damaged or disturbed by the work, back to their original condition or better. All costs associated with this work will be borne by the Contractor.

- .3 All irrigation repair work will be constructed in accordance with the latest edition of the City of Lethbridge Construction Standards.
- .4 All irrigation work will be completed to the satisfaction to the Owner.

**3.4 CONCRETE STRUCTURE WORK**

- .1 Protect the integrity of existing concrete structures. This includes utilizing suitably sized equipment and implementing construction procedures that will minimize concrete damage.
- .2 Replace any concrete structures damaged or disturbed, outside of the construction limits. All costs associated with this work will be borne by the Contractor.

**3.5 ASPHALT WORK**

- .1 Protect the integrity of existing road, lane and driveway structures. This includes utilizing suitably sized equipment and implementing construction procedures that will minimize pavement damage.
- .2 Replace any asphalt pavement damaged or disturbed, outside of the construction limits. All costs associated with this work will be borne by the Contractor.
- .3 All pavement restoration and reconstruction work will consist of subgrade preparation; 250mm base granular material; prime coat; and 90mm Type III hot mix asphalt.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 Canadian Standards Association:
  - .1 CSA-A23.1-09 Concrete Materials and Methods of Concrete Construction.
  - .2 CSA-A23.2-09 Methods of Test for Concrete.

**1.3 APPOINTMENT OF TESTING AGENCY**

- .1 The Owner may hire a CSA-approved Testing Agency who shall test concrete, reinforcement, and grout as per this specification.
- .2 Testing paid for by the Owner:
  - .1 Review of initial mix designs.
  - .2 Testing as outlined in Section 3.0, except for testing required by the Contractor for stripping of formwork.
- .3 Testing paid for by the Contractor:
  - .1 Review of Contractor requested mix design changes.
  - .2 Any waiting time incurred by the Testing Agency in excess of 1/2 an hour.
  - .3 Any additional costs due to overtime, shift work, holiday or weekend work, except that the Owner will pay for holiday or weekend pickup when the concrete was placed on a regular workday.
  - .4 Costs for testing required by the Contractor for stripping of formwork, such as field cure cylinders etc.
  - .5 Cost for retesting or additional testing of concrete or reinforcement where tests have failed to meet the specified requirements.

**2. DUTIES**

**2.1 RESPONSIBILITY OF THE CONTRACTOR**

- .1 The Contractor shall cooperate fully with the Testing Agency.
- .2 The Contractor shall give the Testing Agency at least four (4) hours prior notice of a concrete placement.
- .3 Contractor shall provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, additional testing is necessary. This testing shall be done by a CSA-approved Testing Agency, but need not be the Owner's agency.
- .4 Core strengths must equal the specified strength if tested dry or 85% of specified if tested wet, with wet or dry tests as per the Standard.

**2.2 RESPONSIBILITY AND DUTIES OF THE TESTING AGENCY**

- .1 The Testing Agency is responsible to the Owner and has the authority to, and is expected to, reject any concrete not meeting the specifications.
- .2 If the Testing Agency becomes aware that concrete is being placed without their notification, or if insufficient notice is received, then the Testing Agency shall notify the Owner immediately.
- .3 Low 7-day, 28-day and 56-day strength tests shall be brought immediately to the attention of the Owner.

**3. TESTING - CONCRETE AND REINFORCEMENT**

**3.1 GENERAL**

- .1 All strength tests shall be numbered consecutively and the cylinders marked as follows:
  - .1 7-Day Test: Marked "A".
  - .2 28-Day Test: Two (2) cylinders marked "B" and "C".
  - .3 56-Day Test: Where these are required by the drawings and specifications, two (2) cylinders marked "D" and "E".
- .2 Test reports shall record:
  - .1 Name of Project
  - .2 Date and time of sampling
  - .3 Name of supplier



- .4 Delivery truck number
- .5 Batch time and discharge time
- .6 Identification of sampling and testing technicians
- .7 Exact location in the structure of the concrete sampled
- .8 Design strength of concrete sampled
- .9 Admixtures, cement type, maximum aggregate size
- .10 Air and concrete temperature
- .11 Slump, and air content
- .3 Field cured cylinders shall be marked "F".
- .4 Slump tests shall be performed prior to the addition of super-plasticizers.
- .5 Tests for slump and air content shall be taken with each strength test and as required by the specifications and drawings.
- .6 Analysis of Concrete Production
  - .1 A summary table and associated strip charts shall be submitted to the Owner for all classes of structural concrete placed on projects with 25 or more compressive strength tests.
  - .2 Summary tables are to indicate at least the following information:
    - .1 Classification of Concrete.
    - .2 Project name.
    - .3 Test number.
    - .4 Compressive strength of concrete.
    - .5 Supplier's ticket number.
    - .6 Date concrete placed.
    - .7 Time batched.
    - .8 Time tested.
    - .9 Slump.
    - .10 Air entrainment.

- .11 1-7 day and 2–28 day compressive strength test results for each test.
- .12 Average strength and within test variation for the two (2) 28-day concrete test results for each test
- .13 Moving average of 3 consecutive 28 day concrete test results.
- .14 Average and standard deviation of 28 day concrete test results and an evaluation of conformance to CSA production guidelines.
- .3 Charts shall plot concrete slump, air content, individual compressive strength tests, and the moving average of 3 consecutive compressive strength tests.
- .4 Tables and charts for each type or class of concrete are to be provided on a monthly basis for concrete supplied for the structure until completion of the concrete work.
- .5 When 56 day concrete testing is permitted by the Owner, summary charts and tables shall be provided for concrete tested at 56 days.
- .6 Chloride ion tests shall be performed on the first set of compressive test cylinders taken from the first [parking slab] pour and the first [post-tensioned slab] pour, to show that the chloride ion content of these mixes satisfies the limits set out in CAN/CSA A23.1.

**3.2 REGULAR TESTING - CONCRETE**

- .1 Conform to the standard, except each test shall consist of three (3) cylinders - one (1) for 7-day strength and two (2) for 28-day strength and 2 for 56 day strength where 56 day concrete is permitted by the Owner.
- .2 Testing for concrete with SCM's to reduce the cement content to conform to the standard, except each test shall consist of four (4) cylinders – one (1) for 7-day strength, one (1) for 28-day strength, and two (2) for 56-day strength.
- .3 Regular testing applied to all elements not listed in Clause 3.3 - Full Time Testing.

**3.3 FIELD CURED CYLINDERS**

- .1 Field cure cylinders shall be stored on the floor right below the slab they represent and be protected against wind unless the floor below is heated, in which case they shall be stored on top of the slab but covered with a plywood box. The cylinders are to be undisturbed at this location until picked up by the Testing Agency.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

**1.3 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Install following materials specified to be supplied under other Sections of these project specifications:
  - .1 Fabricated components, anchor bolts, bearing plates, sleeves and other inserts to be built into concrete.

**1.4 REFERENCE DOCUMENTS**

- .1 Provide concrete formwork in accordance with the following standards (latest revision) except where specified otherwise.
- .2 American Concrete Institute (ACI).
  - .1 ACI 347R - Guide to Formwork for Concrete.
- .3 Canadian Standards Association (CSA).
  - .1 CAN/CSA-A23.1 - Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA-S16 - Design of Steel Structures.
  - .3 CSA-S269.1 - Falsework for Construction Purposes.
  - .4 CAN/CSA-S269.3 - Concrete Formwork.
  - .5 CAN/CSA-Z809 - A Sustainable Forest Management System
  - .6 CSA-O86 Engineering Design in Wood.
  - .7 CSA O121 Douglas Fir Plywood
  - .8 CSA O151 Canadian Softwood Plywood

.9 CSA O153 Poplar Plywood

**1.5 SUBMITTALS**

.1 Shop Drawings:

- .1 Submit shop drawings for formwork and falsework in accordance with Division 01.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Each shop drawing submission shall bear stamp and signature of a qualified professional engineer registered or licensed in the Province of Alberta.

.2 Sample Panel:

- .1 Construct and erect a sample formwork panel for architectural concrete surfaces receiving special formed finish. Sample panel shall be of sufficient size to fully indicate special treatment, pattern, module, or finish required. Obtain Owner's approval prior to casting concrete sample.
  - .2 Cast concrete against sample panel. Obtain Owner's approval of resulting concrete surface finish prior to erecting subsequent forms.
  - .3 Approved concrete surface of sample will be considered the standard of quality for the finished work. Quality of all formwork shall match the approved sample panel.
  - .4 Leave sample panel and concrete sample exposed to view for duration of concrete work.
  - .5 Remove sample panel and concrete sample, if not incorporated into the work, from site when directed by the Owner.
- .3 For "Record Purposes Only," copies of the formwork design drawings including allowable concrete pour rate at least 15 days prior to erection.
- .4 Written documentation from the formwork design engineer certifying that the formwork construction complies with the design at least 1 day prior to concrete placement.

**1.6 QUALITY CONTROL**

- .1 Design of Formwork and Shoring by the Contractor
  - .1 Provide the design for all formwork and shoring. Design formwork to safely support all vertical and lateral loads, and so all concrete members will be of correct dimension, shape, alignment, elevation, position, and have a surface finish within specified tolerances. In general, design formwork in accordance with the applicable requirements of ACI 347R, CSA-O86, CAN/CSA-S16, CSA-S269.1, and CAN/CSA-S269.3.
  - .2 Provide formwork and shoring that has been designed and stamped by a Professional Engineer registered with the Association of Professional Engineers, Geologists and Geophysicists of Alberta.
  - .3 Re-design and replace any type of form or method of erection that does not consistently produce concrete work that meets the specified tolerances or finish requirements.
- .2 Regulatory Requirements
  - .1 Comply with the requirements of all applicable codes and regulations respecting safety in the design and construction of formwork and shoring.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Store formwork with the forming surfaces off the ground, and keep the forming surfaces clean.
- .2 Keep form liner away from direct exposure to sunlight.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Wood formwork materials:
  - .1 Wood formwork shall be Forest Stewardship Council (FSC) Certified unless it is rented or otherwise re-cycled wood material.
- .2 Formwork materials:
  - .1 Concrete without special architectural features: use plywood and wood formwork materials CAN/CSA O86. Square-edged, smooth surfaced panels true in plane, free of holes, surface markings, or defects.
  - .2 Concrete with special architectural features: use formwork materials to CAN/CSA A23.1 mouldings fabricated from mill finished pine.

- .3 Forms: Materials, consisting of lumber, steel, or other materials specifically designed for use as formwork, that are capable of consistently providing the specified lines, shapes, and finishes. Do not use modular forms such as basement wall forming systems.
- .4 Pan forms: removable as indicated, free of bends, dents and residual concrete, well matched, tight fitting and adequately stiffened to support concrete weight without deflection detrimental to appearance of finished concrete surfaces.
- .5 Tubular column forms: round, spirally wound laminated fibre form, internally treated with release material. Spiral pattern to show in hardened concrete.
- .6 Form Ties:
  - .1 Concrete without special architectural features: use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 Concrete with special architectural features: use snap ties complete with plastic cones and light gray concrete plugs.
- .7 Hangers: Break-off type hangers with removable cones or removable thread type hangers for deck forms.
- .8 Void Forms: low density bead board, structurally sufficient to support weight of wet concrete mix until initial set, 100 mm thick.

## **2.2 ACCESSORIES**

- .1 Form release agents: Ecologo certified under the Environmental Choice Program (ECP) or, if not Ecologo certified, Contractor shall:
  - .1 provide a product that conforms to the requirements for concrete release agents in accordance with ECP Certification Criteria Document (CCD) 143 governing Asphalt and Concrete Release Agents, excluding the provisions under Conditions for Ecologo Use and,
  - .2 if requested, provide the Owner with the same rights as the ECP under CCD 143 with regard to verification for product compliance.
  - .3 or low VOC.
- .2 Sealant: as specified.
- .3 Corner or Chamfer Fillets: mill finished pine, 20 mm width, maximum possible lengths, mitre ends.
- .4 Sealing Tape: self-adhesive.

**3. EXECUTION**

**3.1 PREPARATION**

- .1 Thoroughly clean forms of all dirt, mortar, and foreign matter before use.
- .2 Remove and replace formwork that is damaged, warped, distorted, or otherwise flawed as directed by the Owner.
- .3 Apply form release agent, except where form liner is provided, before placing reinforcing steel. Do not allow form release agent to coat reinforcing steel, or concrete surfaces at construction joints.
- .4 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.
- .5 Do not apply form release agent where wood graining characteristics are required on the finished concrete surfaces.

**3.2 INSTALLATION**

- .1 Provide forms wherever required to confine and shape concrete to the lines specified in the Contract Documents.
- .2 Provide forms that are sufficiently tight to prevent loss of mortar from the concrete.
- .3 Securely tie and brace the forms to maintain their shape and position, and to avoid warping and bulging. Minimize the number of form joints.
- .4 Fill joints between panels and depressions with sealant, and smooth off projections.
- .5 Provide 25 mm chamfers at all permanently exposed edges.
- .6 Arrange formwork for ease of dismantling and stripping, and so that removal of the forms does not damage the concrete. For blocking and supports which are to be left permanently in the concrete, fabricate the formwork blocking and supports from steel.
- .7 Do not use reinforcing steel, embedded parts, [or rock anchors] to support the forms.
- .8 Provide access panels at the bottom of wall forms to facilitate thorough inspection and removal of deleterious materials before concrete placement.
- .9 Properly identify, position, and secure blockouts, inserts, sleeves, anchors, conduits, and other embedded items.
- .10 Fabricate and erect falsework in accordance with CSA-S269.1.
- .11 Verify lines, levels, and centers before proceeding with formwork/falsework and ensure dimensions agree with drawings.

- .12 Obtain Owner's approval for use of earth forms framing openings not indicated on drawings.
- .13 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .14 Refer to architectural drawings for concrete and concrete members requiring architectural exposed finishes.
- .15 Do not place shores and mud sills on frozen ground.
- .16 Provide site drainage to prevent washout of soil supporting shores and mud sills.
- .17 Fabricate and erect formwork in accordance with CAN/CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA A23.1.
- .18 Provide a camber of 0.2% of span for beams unless noted otherwise on drawings.
- .19 Provide a camber of 0.2% of span for joists and slabs spanning over 3 m unless noted otherwise on drawings.
- .20 Align form joints and make watertight. Keep form joints to a minimum.
- .21 Use 20 mm chamfer strips on external corners and 20 mm fillets at interior corners of concrete members, unless specified otherwise.
- .22 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .23 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .24 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including paint.
- .25 Do not stagger joints of form lining materials. Align joints to obtain uniform pattern.
- .26 Clean formwork in accordance with CAN/CSA-A23.1, prior to placing concrete.
- .27 Re-use of formwork and falsework subject to requirements of CAN/CSA-A23.1.
- .28 Arrange and assemble formwork to permit removal without damage to concrete. Arrange forms to allow removal without removal of principle shores, where these are required to remain in place.



### 3.3 TOLERANCES

- .1 Design, construct, and maintain formwork so that the completed concrete work is within the specified structural tolerances for lines, levels, and dimensions as follows, or within the surface finish tolerances specified in Section Cast-in-Place Concrete, whichever is more stringent.
- .2 Tolerances are not cumulative and the most stringent requirements apply.
- .3 Structural tolerances:
  - .1 Deviation from Vertical Line: 6 mm in 3 m, 9 mm in 6 m, and 20 mm in 12 m or more.
  - .2 Deviation from Flat Surface, for Walls and Floors: 3 mm in 3 m.
  - .3 Deviation from Horizontal Line: 6 mm in 3 m.
  - .4 Deviation from Linear Building Lines from Drawings and Position of Columns, Walls, and Partitions: 6 mm.
  - .5 Deviation in Cross Sectional Dimensions of Columns and Beams, and in Thickness of Slabs and Walls: plus or minus 6 mm.
- .4 Tolerances for dimensions shown on the Drawings: Actual dimensions measured from a horizontal and vertical reference grid system to be within the tolerances specified in CAN/CSA-A23.1

### 3.4 INSERTS, EMBEDDED ITEMS, AND OPENINGS

- .1 Provide formed openings where required for pipes, conduits, sleeves or other work to be embedded in and passing through concrete members. Obtain Owner's approval before framing openings in slabs, beams, and columns, not shown on drawings.
- .2 Accurately locate and set in place items which are to be cast directly into concrete.
- .3 Coordinate forming of openings, slots, recesses, chases, and setting of sleeves, bolts, anchors, and other inserts with work of other Sections as required.
- .4 Coordinate installation of concrete accessories.
- .5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings in bottom of forms to allow flushing water to drain.
- .6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

**3.5 CONCRETE PLACEMENT**

- .1 Provide measures and means authorized by the Owner for checking alignment and elevations of forms, and to detect movements of the formwork and shoring during concrete placement.
- .2 Immediately prior to concrete placement, inspect the forms and verify that they are properly located, sufficiently rigid and tight, and clean and free of foreign material.
- .3 Provide experienced personnel to continuously inspect formwork and shoring for early detection of possible displacements, abnormal deflections, or other signs of distress during concrete placement. Provide additional bracing, wedges, shoring, and other materials as necessary to facilitate immediate adjustments as required.
- .4 Keep vibrators at least 50 mm away from the face of the formwork. Avoid excessive vibration of concrete.
- .5 Repair any concrete defects caused by faulty or inaccurate formwork.

**3.6 CLEANING**

- .1 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush completely with water to remove foreign matter. Ensure that water and debris drain to the exterior through clean-out ports.
- .2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

**3.7 FORMWORK REMOVAL**

- .1 Maintain formwork and shoring in place until the concrete has attained sufficient strength to support its own weight, construction loads, and other imposed loads.
- .2 Obtain authorization from the Owner prior to removing forms or shoring. Authorization by the Owner to remove forms does not in any way relieve the Contractor of its obligations to delay the removal of forms and shoring until the concrete has attained sufficient strength to support its own weight, construction loads, and other imposed loads.
- .3 Without limiting the Contractor's responsibilities, maintain forms or shoring in place for at least the following times after completion of concrete placement and obtain the Owner's confirmation that these times have been reached. Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 Three days for walls and sides of beams.
  - .2 Three days for columns.

- .3 One day for footings and abutments.
- .4 Do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight, plus construction loads and other design loads that are liable to be imposed. Verify strength of concrete by compression tests to the satisfaction of the Owner.
- .5 Remove falsework progressively, in accordance with CSA 269.1 and ensure that no shock loads or unbalanced loads are imposed on the structure.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- .7 Leave forms loosely in place for protection until curing requirements are complete.
- .8 Store removed forms for exposed architectural concrete in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .9 After removal, carefully clean and repair forms to be reused so the specified quality of the formed surface is achieved. Thoroughly remove film or splatter of hardened concrete.

**3.8 FIELD QUALITY CONTROL**

- .1 Inspect and check complete formwork, falsework, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and parts are secure.
- .2 Inform Owner when formwork is complete and has been cleaned, to allow for inspection.
- .3 For all exposed concrete surfaces do not re-use wood type formwork more than 5 times. Do not patch formwork.
- .4 Allow Owner to review each section of formwork prior to re-use. Formwork may be re-used if approved by the Owner.

**3.9 CLEAN-UP**

- .1 Clean-up and properly dispose of all formwork, temporary supports, tie rods, and construction debris.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 03050 Testing of Concrete
- .2 03300 Cast in Place Concrete
- .3 03350 Concrete Floor Finishes

**1.3 REFERENCE DOCUMENTS**

- .1 Provide concrete reinforcement in accordance with the following standards (latest revision) except where specified otherwise.
- .2 American Concrete Institute (ACI).
  - .1 ACI 315-99 - ACI Detailing Manual
- .3 American Society for Testing and Materials (ASTM).
  - .1 A775/A775M-07b Standard Specification for Epoxy-Coated Steel Reinforcing Bars
- .4 Canadian Standards Association (CSA).
  - .1 CSA A23.1 09 - Concrete Materials and Methods of Concrete Construction
  - .2 CSA A23.3-04 (R2010) - Design of Concrete Structures
  - .3 CAN/CSA-G30.18-09 - Carbon Steel Bars for Concrete Reinforcement
  - .4 CAN/CSA-G40.21-04 - Structural Quality Steels
  - .5 CAN/CSA-W186-M90(R2007) - Welding of Reinforcing Bars in Reinforced Concrete Construction

- .5 Concrete Reinforcing Steel Institute (CRSI):
  - .1 Reinforcing Steel Manual of Standard Practice.

#### 1.4 SUBMITTALS

- .1 Shop Drawings:
  - .1 Shop drawings at least 30 days prior to fabrication. Do not commence fabrication until the shop drawings have been reviewed by the Owner. Submit shop drawings including placing of reinforcement in accordance with Division 01.
  - .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Owner, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings, and locations of chairs, bolsters, spacers, and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.
  - .3 Detail lap lengths and bar development lengths to CSA A23.3. Provide Class B tension lap splices unless otherwise indicated or stipulated by the Standard.
- .2 Certified copy of mill test reports of reinforcing steel showing physical and chemical analysis results at least 30 days prior to fabrication.
- .3 Copy of the CRSI Fusion-Bonded Epoxy Coating Applicator certification for the plant.
- .4 Manufacturer's written instructions for installing mechanical splices prior to performing the work.

#### 1.5 QUALITY ASSURANCE

- .1 Provide Owner, upon request, with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcing work.
- .2 Inform Owner, upon request, of proposed source of material to be supplied.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Inspect each shipment of material and timely replace any damaged materials.
- .2 Store reinforcing steel above ground on platforms, skids or other support in separate bundles with identifying tags or marks that permit easy identification and handling. Protect reinforcing steel from mechanical damage and from exposure conditions that may produce rust. Prevent reinforcing steel from becoming coated with materials that would adversely affect the bond.

- .3 Handle epoxy-coated reinforcing steel with non-metallic slings and spreaders to prevent bar-to-bar abrasion and excessive sagging of bundles. Do not drop or drag epoxy-coated reinforcing steel. Do not store epoxy-coated reinforcing steel on-Site for more than 120 days, and limit exposure to sunlight by covering with opaque polyethylene sheeting or other protective material as authorized by the Owner.
- .4 Deliver, store and handle reinforcing steel, welded wire fabric and accessories in manner that prevents contamination which reduces bond, and damage to fabricated forms.
- .5 Protect reinforcement from rust, dirt, grease, form oil and other bond-breaking substances.

## **1.7 QUALITY CONTROL**

- .1 Inspect the finished reinforcing steel placement for each pour, rectify any defects, and complete the Concrete Pour Release Form as specified in Section 3300 Cast-in-Place Concrete for review by the Owner. Obtain the Owner's authorization to proceed prior to ordering concrete.
- .2 Employ a manufacturer certified under the CRSI Fusion-Bonded Epoxy Coating Applicator Plant Program to apply the epoxy coating on the reinforcing steel.

## **2. PRODUCTS**

### **2.1 REINFORCEMENT MATERIALS**

- .1 Provide materials with minimum 25% recycled content.
- .2 Reinforcing Steel: billet steel, grade 400, deformed bars to CAN/CSA G30.18, unless indicated otherwise.
- .3 Reinforcing Steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .4 Plain Round Bars: to CAN/CSA G40.21.
- .5 Epoxy Coating of Non-Prestressed Reinforcement: to A775/A775M.
- .6 Tie wire: Cold-drawn annealed steel wire ties in accordance with CSA-G30.3. Minimum gauge no. 16.
- .7 Chairs, Bolsters, Bar Supports and Spacers: to CSA A23.1.
- .8 Mechanical splices: In accordance with ACI 318, capable of developing a minimum of 125% of the yield strength of the reinforcing bar.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1, ACI 315, and Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.

- .2 Obtain Owner's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Owner, weld reinforcement in accordance with CAN/CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .5 Bundle and transport epoxy coated reinforcement in accordance with ASTM A775/A775M.
- .6 Fabricate within the following tolerances:
  - .1 Sheared Length: +/- 25 mm
  - .2 Stirrups, Ties and Spirals: +/- 10 mm
  - .3 Other Bends: +/- 25 mm
- .7 Locate reinforcing splices not shown on drawings at points of minimum stress.

### **3. EXECUTION**

#### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Owner.
- .2 When field bending is authorized, bending procedure shall conform to the Standard.
- .3 Replace bars which develop cracks or splits.

#### **3.2 PLACEMENT DETAILING**

- .1 Conform to CSA A23.1 and CSA A23.3 for hooks, bends, laps, and similar details not specifically shown.
- .2 For support bars not shown on drawings, use the sizes and spacing for applications as follows:
  - .1 Slab Top Reinforcing (10M): 10M bars spaced at 1000 mm o.c. maximum.
  - .2 Slab Top Reinforcing (15M and larger): 15M bars spaced at 1200 mm o.c. maximum.
  - .3 Slab Bottom Reinforcing: 15M bars spaced at 1200 mm o.c. maximum.
  - .4 Beam Stirrups: 15M bar in each corner.

- .3 Reinforce slab and wall openings, unless otherwise shown, as follows:
  - .1 Openings with greatest dimension of 600 mm or less: four 15M diagonal bars, 900 mm longer than greatest opening dimension.
  - .2 Openings with greatest dimension larger than 600 mm: two 15M bars on each side, top and bottom, 1500 mm longer than greatest opening dimension.
  - .3 Reinforce circular openings as square.
- .4 Secure chairs for reinforcing in place located at 1200 mm o.c. maximum.
- .5 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners.
- .6 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork, or piping.

### 3.3 PLACEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1. Chair slab reinforcing not further apart than 1.2 m in either direction.
- .2 Place, support and secure reinforcement against displacement. Do not deviate from required position.
- .3 Co-ordinate and schedule the installation of inserts, sleeves, anchors, conduits, waterstops, and other items to be embedded in concrete to avoid interference and delays with the placement of reinforcing steel.
- .4 Before placement, clean the surface of the reinforcing steel and the surface of any metal supports of dirt, grease, and heavy, flaky rust and mill scale that can be removed by firm rubbing or equivalent treatment, or other foreign substances, which, in the opinion of the Owner, are objectionable. After placement, maintain the reinforcing steel in a clean condition until completely embedded in concrete.
- .5 Accurately place and secure reinforcing steel and any other items in position so they are not displaced during concrete placement. Prevent disturbance of the reinforcing steel in concrete that has already been placed.
- .6 Obtain the Owner's authorization prior to incorporating any reinforcing steel splices that are not specified in the Contract Documents.
- .7 Do not use reinforcing steel as support for ramps, runways, walks, platforms, or other such purposes during construction.



- .8 Provide metal chairs, metal hangers, metal spacers, or other satisfactory metal supports for supporting reinforcing steel for walls and the underside of exposed slabs [except use plastic chairs, galvanized metal or epoxy-coated metal supports and spacers for epoxy-coated reinforcement]. For reinforcing steel adjacent to forms, use plastic chairs, galvanized metal or epoxy-coated metal - supports and spacers to maintain concrete clear cover and minimize the potential for staining of permanently exposed concrete surfaces In slabs placed on grade where the underside is not permanently exposed, use precast concrete supports that are specifically constructed for this purpose with the same properties as the concrete required at this location and properly cured. Use other types of supports subject to the authorization of the Owner.
- .9 Do not displace or damage vapour barrier. Repair and reposition vapour barrier as required.
- .10 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .11 Prior to placing concrete, obtain Owner's approval of reinforcing material and placement.
- .12 Ensure reinforcement location is maintained to provide required concrete cover to reinforcement during placement of concrete.

**3.4 MECHANICAL SPLICING**

- .1 Install mechanical splices in strict accordance with the manufacturer's written instructions and only at the locations specified in the Contract Documents, or as authorized by the Owner.
- .2 Use bar end gauges and profile gauges to verify the thread quality. Use a torque wrench to install the splices.
- .3 Provide plastic end and internal coupler protectors to protect the threads and couplers from contamination and damage.

**3.5 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**3.6 CLEANING**

- .1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.
- .2 Remove all loose scale, loose rust, and other deleterious matter from surfaces of reinforcing.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SELECTIONS**

- .1 Concrete Forms and Accessories: Section 03100.
- .2 Concrete Reinforcement: Section 03200.

**1.2 REFERENCE DOCUMENTS**

- .1 ASTM C109/C109M-08, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
- .2 ASTM C295-08, Standard Guide for Petrographic Examination of Aggregates for Concrete.
- .3 ASTM C309-08, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .4 ASTM C330-05, Standard Specification for Lightweight Aggregates for Structural Concrete.
- .5 ASTM C332-07, Standard Specification for Lightweight Aggregates for Insulating Concrete.
- .6 ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .7 ASTM C827-01a (2005), Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
- .8 ASTM C939-02, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
- .9 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
- .10 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- .11 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .12 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

- .13 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .14 CGSB 81-GP-1M- 77, Flooring, Conductive and Spark Resistant.
- .15 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
- .16 CAN/CSA-A23.2-04, Methods of Test for Concrete.
- .17 CAN/CSA-A23.3-04, Design of Concrete Structures.
- .18 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

**1.3 SUBMITTALS**

- .1 Comply with the requirements of Division 1. Requirements and the following:
- .2 Mix design identifying percent of recycled material used in the concrete for each type of concrete.

**1.4 QUALITY ASSURANCE**

- .1 Cast-in-place concrete to conform to CSA-A23.1
- .2 Testing shall conform to CSA-A23.2
- .3 These standards shall be available in Contractor's site office for use of Contractor and Consultant.

**1.5 INSPECTION TESTING**

- .1 Concrete work may be tested by a testing firm retained by the Owner.
- .2 Submit the following to testing firm:
  - .1 Results of petrographic examination of aggregates to ASTM C295, representative of aggregates to be supplied for project.
  - .2 Samples of fine and coarse aggregate.
  - .3 Proposed concrete mix design.
- .3 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials.
- .4 Advise testing firm in advance of concrete placement.

- .5 Provide and maintain facilities at the site for storage of concrete test cylinders for the first 24 hours.
- .6 Provide copies of mill test reports of cement as required.
- .7 Secure sufficient three and seven day cylinders for testing by concrete supplier to ensure concrete quality control.
- .8 Provide at least one cube test, to ASTM C109/C109M, on grout used under base plates and machinery.
- .9 Conduct core tests when required.
- .10 Testing firm will do the following:
  - .1 Take three test cylinders from each 60 m<sup>3</sup> of concrete, or fraction thereof, of each type of concrete placed in any one day.
  - .2 Take samples of concrete mix close to the point of final deposit in the form. Contractor shall provide suitable access to the work for obtaining samples.
  - .3 Moist cure and test one cylinder in 7 days and moist cure and test the remaining two cylinders in 28 days.
  - .4 Take one additional test cylinder when the temperature is likely to fall below 0°C within 48 hours after placing and no provisions have been made to heat the concrete to greater than 10°C. Test cylinder to be cured on job-site under same conditions as concrete it represents and tested in 7 days.
  - .5 Make at least one slump test and one entrained air test for each set of test cylinders taken.
- .11 Results of field tests will be reported immediately to the Contractor by the field representative of the testing firm. These results do not imply approval or disapproval of the work, but are for the Contractor's information. Acceptability of the work will be determined by the Consultant.
- .12 Results of concrete tests will be forwarded to the Consultant and to the Contractor. Included with the results will be the following information: Name of Project, Date of Sampling, Name of Supplier, Delivery Truck Number, Identification of Sampling and Testing Technician and exact location in the structure of the concrete sampled.

- .13 Testing firm personnel are not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to accept or reject any portion of the work.
- .14 Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

**1.6 ACCEPTABILITY**

- .1 Failure to comply with the requirements that control strength and durability will result in the structure being considered potentially deficient.
- .2 A structure will be considered potentially deficient when:
  - .1 Concrete used is not as specified in Concrete Mix Schedule in this Section.
  - .2 Improper curing methods or materials are used.
  - .3 There has been inadequate protection of concrete from extremes of temperature during early stages of curing and strength development.
  - .4 There has been mechanical injury from fire, construction overload or premature removal of forms.
  - .5 Poor workmanship is determined.
  - .6 Concrete differs from the required dimensions.
- .3 Strength evaluation tests and analysis.
  - .1 The Consultant may order an independent testing firm to obtain cores, x-rays, or similar non-destructive tests.
  - .2 The Consultant may order a load test and/or analysis as defined by CSA A23.3, Section 18, if the non-destructive tests are impractical or inconclusive.
  - .3 Reinforce by additional construction or replace as directed by the Consultant at own expense, concrete judged inadequate by structural analysis or by results of load tests.
  - .4 Pay the cost of testing and/or analysis which is required to demonstrate the adequacy of the structure which does not meet the requirements for strength or which has been placed before formwork and reinforcing have been inspected and approved by the Consultant.

- .5 The Consultant may order additional testing at any time even though the required tests indicate that the strength requirements have been met. In this instance the Consultants will pay for those tests that meet the specified requirements and the Contractor shall pay for those that do not.
- .4 Concrete not conforming to the lines, detail, strength and grade specified herein or as shown on drawings shall be modified or replaced at the Contractor's expense, to the satisfaction of the Consultant.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Provide an appropriate area on the job site where concrete trucks can be safely washed.
  - .2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Consultant.
  - .3 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .4 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local regulations.

**2. PRODUCTS**

**2.1 CONCRETE MATERIAL**

- .1 Portland Cement, Supplementary Cementing Materials, Cementitious Hydraulic Slag: to CAN/CSA-A3000.
- .2 Aggregates: to CSA A23.1 and as follows.
  - .1 Coarse aggregate to be normal density.
  - .2 Ironstone content of aggregates in exposed interior or exterior concrete subject to intermittent or continuous wetting shall not exceed the following, when tested to ASTM C295:
    - .1 Coarse Aggregate: maximum 1% by mass.
    - .2 Fine Aggregate Retained on 2.5 mm Sieve: maximum 1.5% by mass.

- .3 Ensure that no aggregates are used which may undergo volume change due to alkali reactivity, moisture retention or other causes. Confirm suitability of aggregate with a petrographic analysis if deemed necessary by the Consultant.
- .3 Water: potable, to CSA A23.1.
- .4 Admixtures: to CAN/CSA-A23.1. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
  - .1 Air Entrainment: conforming to CAN 3-A266.1.
  - .2 Chemical: conforming to CAN 3-A266.2; water reducing, strength increasing type, Superplasticizing.
  - .3 Pozzolanic Mineral: conforming to CAN/CSA-A23.5.

## 2.2 CONCRETE ACCESSORIES

- .1 Curing Compound: CSA A23.1 clear and to ASTM C309.
- .2 Shrinkage Compensating Grout: premixed compound consisting of non metallic aggregate, Portland cement, water reducing and plasticizing agents. Compressive strength of 16 MPa at 24 hours and 50 MPa at 28 days.
  - .1 Consistency: as follows:
    - .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 seconds.
    - .2 Flowable: to ASTM C827. Flow table, 5 drops in 3 seconds, (ASTM C109, applicable portions) 125 to 145 %.
    - .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 seconds, (ASTM C109, applicable portions) 100 to 125 %.
    - .4 Dry pack to manufacturer's requirements.
  - .2 Net shrinkage at 28 days: maximum 0%.
- .3 Bonding Agent: high polymer resin emulsion, mixed with cement mortar or grout to form a water resistant adhesive bond.
- .4 Dampproof Membrane Reinforced: 150 micrometre polyethylene film to CAN/CGSB-51.34.
- .5 Dampproofing, emulsified asphalt, mineral colloid type: to CAN/CGSB-37.2, and to Section 07 11 13 – Bituminous Dampproofing.

- .6 Non-Ferrous Grout: pre-mixed, non-shrink, minimum 35 MPa compressive strength.

**2.3 MIX**

- .1 Supply concrete mix proportioned to produce concrete specified in Concrete Mix Schedule.
- .2 Requirements not specified in Schedule shall conform to CSA A23.1.
- .3 Use of admixtures, other than air-entraining admixtures, are not permitted without prior approval of the Consultant.
- .4 Fly ash up to a maximum of 30% of the total cement content may be used for concrete placed at the following locations:
  - .1 Piles/Footings: 30%,
  - .2 Walls/Columns: 25%,
  - .3 Slabs: 20%,
  - .4 Toppings: 15%,
- .5 Superplasticizers shall be used in strict accordance with the recommendations of the manufacturer. Concrete slump after superplasticizing shall not exceed 200 mm.
- .6 All admixtures are subject to Consultant's approval. List all proposed admixtures in mix design submission. Do not change or add admixtures to approved design mixes without Consultant's approval.

**3. EXECUTION**

**3.1 PREPARATION**

- .1 Obtain Consultant's approval before placing concrete. Provide Consultant and testing agency 2 days notice prior to placing concrete.
- .2 Coordinate placement of waterstops, inserts and joint devices with erection of concrete formwork and formwork accessories.
- .3 Pumping of concrete is permitted only after approval of equipment and mix.
- .4 Ensure reinforcement and inserts are not disturbed during concrete placement.



- .5 Prior to placing concrete obtain Consultant's approval of method for protection of concrete during placing and curing.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality of concrete, ambient air temperature and test samples taken.
- .7 Clean previously placed concrete with steel brush. Use acid if necessary. Mix and brush on bonding agent in accordance with manufacturer's instructions.
- .8 In locations where new concrete is dowelled into existing work, drill holes into existing work. Place deformed steel dowels and pack solid with epoxy grout to anchor and hold dowels in place as indicated.
- .9 Do not place load upon new concrete until authorized by the Consultant.

### **3.2 SLEEVES AND INSERTS**

- .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by the Consultant.
- .2 Where approved by the Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by the Consultant.
- .3 Do not cut, bend, eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Consultant before placing of concrete.
- .4 Check locations and sizes of sleeves and openings shown on drawings.
- .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .6 Conduit and pipe embedded in concrete shall:
  - .1 Not displace more than 4% of the cross sectional area of a column, including the area of concrete displaced by the bending of the conduit, or the exit path of the conduit out of the column.
  - .2 Not exceed one-third of the solid portion of the slab thickness.
  - .3 Not be spaced closer than three diameters on centre.
  - .4 Have a minimum concrete cover of 25 mm.

**3.3 ANCHOR BOLTS AND BASE PLATES**

- .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .2 With approval of the Consultant, grout anchor bolts in preformed holes or holes drilled after concrete has set.
- .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
- .4 Set bolts and fill holes with epoxy grout.
- .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

**3.4 WATER STOPS**

- .1 Install water stops (150mm PVC Greenstreak) at vertical and horizontal construction joints as indicated on drawings and locations as per manufacturer's recommendations
- .2 Apply adhesive as per manufacturer's recommendations

**3.5 DAMPPROOF MEMBRANE**

- .1 Install dampproof membrane on prepared sub-grade under concrete slabs-on-grade inside building.
- .2 Lap dampproof membrane minimum 150 mm at joints and seal as recommended by manufacturer.
- .3 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.

**3.6 JOINT FILLERS**

- .1 Furnish filler for each joint in 2 pieces for depth and width required for joint. Top piece to be sized to provide 12 mm from top of slab to portion of joint filler to remain.
- .2 Fasten abutting pieces of joint filler and hold to shape by stapling or other positive fastening.
- .3 Locate and form construction joints as indicated. Install joint filler.

- .4 Remove upper portion of joint filler after slab has hardened to a point where removal will not damage slab edges.

**3.7 PLACING CONCRETE**

- .1 Perform cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .2 Revise, re-seat and correct improperly positioned reinforcing, immediately before placing concrete.
- .3 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows: At center of span of suspended slabs, beams and joists; in walls and columns immediately above or below floor construction; at center of steel beam that supports concrete slab.
- .4 Construction joints at center of span of suspended slabs beams and joists shall be adequately doweled and keyed.
- .5 Place floor slabs on grade as one continuous pour between construction joints indicated on drawings. Control joints for each pour shall be formed by sawing a continuous 1/4 slab depth slot at 6 m centers each way unless otherwise indicated on drawings. Sawing shall be done as soon as the concrete has sufficiently hardened to prevent raveling of the edges but in no case later than 18 hours after the concrete slab has been placed.
- .6 Isolate slabs on grade from vertical concrete using pre-moulded joint fillers extending from bottom of slab to within 12 mm of slab surface unless otherwise indicated.
- .7 Use winter concreting methods in accordance with CAN/CSA A23.1 when the mean daily temperature falls below 5°C.
- .8 Provide a camber of 0.02% of span for beams unless noted otherwise on drawings.
- .9 Provide a camber of 0.01% of span for joists and slabs spanning over 3 m unless noted otherwise on drawings.
- .10 Use procedures noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surfaces are not damaged.
- .11 Vibrate concrete using the appropriate size equipment as placing proceeds in strict accordance with Clause 19.5 of CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

- .12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solidly with non-shrink grout.
- .13 Do not place concrete if carbon monoxide producing equipment has been in operation in the building during the 12 hours preceding the pour. This equipment shall not be used during placing, or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or by an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.
- .14 Honeycomb or embedded debris in concrete is not acceptable.
- .15 Remove and replace defective concrete.

**3.8 CURING**

- .1 Cure concrete in accordance with CAN/CSA-A23.1 and as follows.
- .2 Wet cure flat slabs and floors shown to receive paint
- .3 All concrete shall receive moist curing for a period of seven days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:
  - .1 Surface covered with canvas, burlap or other satisfactory material and kept thoroughly wet.
  - .2 Surface sealed with polyethylene sheeting and the concrete kept thoroughly wet.
  - .3 Subject to the approval of the Consultant, a liquid membrane curing compound used in accordance with the manufacturer's recommendations may be used. Membrane to remain intact during the curing period.
- .4 Surfaces of concrete that are protected by formwork which is left in place for seven days shall not require any additional curing except as specified for hot weather. If the formwork is removed in less than seven days, the concrete shall receive moist curing until seven days have elapsed since the concrete was placed.
- .5 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .6 Curing compounds shall not be used on concrete surfaces to receive topping or other type of bonded finish unless approved by the Consultant.

- .7 Protect freshly placed and consolidated concrete against damage or defacement from adverse weather conditions.
- .8 Coat exposed concrete walking surfaces not to receive an integral hardener with curing compound of type that provides permanent seal.
- .9 Do not use curing compound in locations where chemical hardener is to be used.

**3.9 FINISHING AND TREATMENT OF SLAB OR FLOOR SURFACES**

- .1 Refer to Section 03 35 00 for hardened, coloured, waxed concrete floor finishes.
- .2 Provide screed finish where bonded topping is to be applied. Provide required depressions to accommodate bonded.
- .3 Provide swirl-trowelled finish where resilient floor tile and carpet is to be applied.
- .4 Provide swirl-trowelled finish unless otherwise indicated.
- .5 Provide float finish to surfaces to receive roofing or waterproofing membrane. Consolidate and strike off concrete and complete surface with a power float to true plane not exceeding 5 mm in 3 m.
- .6 Slab and floor finish tolerance, unless specified otherwise, in accordance with CAN/CSA-A23.1, straight edge method to following locations:

Floor Slab Location	Finish Tolerance
All Interior Locations	straight edge value of $\pm 3$ mm in 3 meters

- .7 Provide floor level at walls with uniform minimum slope of 1% to floor drain, where applicable.
- .8 Sprinkling of dry cement or a mixture of dry cement and sand over concrete surface is not acceptable.
- .9 Depress floors for ceramic tile, as shown on drawings.

**3.10 BULL FLOATING**

- .1 Achieve flatness for concrete slabs by means of a highway straight edge, minimum 3 m width, in lieu of a standard bull float. Bull float floor surfaces to remove ridges and fill voids immediately after screeding.
- .2 Complete bull floating before any excess moisture or bleed water is visible on the surface.

**3.11 MECHANICAL FLOATING**

- .1 Mechanically float floor surfaces when bleed water has disappeared and surfaces are sufficiently hard to prevent working excess mortar to the surface.
- .2 Continue floating as necessary to produce surfaces of uniform texture, free from hollows, bumps and screed marks.
- .3 For surfaces to be trowelled, continue floating as necessary to embed coarse aggregate particles firmly below surface mortar.
- .4 Hand float in restricted areas, corners, etc.

**3.12 TROWELLING**

- .1 Trowel floor surfaces with mechanical trowelling machines fitted with steel blades.
- .2 Commence trowelling when surface is sufficiently hard to prevent working excess fine material to the surface.
- .3 Perform additional trowelling at intervals so final trowelling is done just before concrete becomes so hard that further trowelling is ineffective.
- .4 Finished trowelled surfaces to be hard, dense, and free from blemishes or other imperfections.
- .5 Hand trowel in restricted areas, corners, etc.

**3.13 TEXTURED SURFACES**

- .1 Final trowelling to be spin trowel or hand swirl finish.
- .2 Immediately after final trowelling, brush or fine broom surfaces with a hair broom.
- .3 Immediately after mechanical floating, broom surfaces with a stiff bristled broom.
- .4 Protect textured floors from damage during construction.

**3.14 FINISHING FORMED SURFACES**

- .1 Upon removal of forms, treat imperfections in formed surfaces in accordance with CSA A23.1 and to Contractor's approval.
- .2 Modify or replace concrete not conforming to the quality, lines, details and elevations specified herein or as shown on drawings.

- .3 Finish all exposed formed concrete surfaces with sack rubbed finish according to CSA A23.1.
- .4 Rough Finish Concrete Surfaces not Exposed to View: Place concrete against forms true and plane. Cut off form ties a minimum of 10 mm below concrete surface. Patch tie holes and defects. Remove fins exceeding 5 mm.
- .5 Smooth Finish Overhead Surfaces Exposed to View: Place concrete against plywood, steel or tempered hardboard. Patch tie holes and defects. Remove fins.

**3.15 GROUT**

- .1 Mix non-shrink grout to consistency specified in part 2 of this Section as required for use intended and apply in accordance with manufacturer's instructions. Install under columns, beams and equipment bases as shown on drawings, in accordance with the manufacturer's recommendations.

**3.16 EQUIPMENT PADS**

- .1 Provide concrete pads for equipment where indicated on drawings. Adjust dimensions of pads to reviewed shop drawings.
- .2 Insert bolts and sleeves and pack with non-shrink grout, in accordance with setting details and templates.
- .3 Steel trowel surfaces smooth. Bullnose edges to smooth radius.

**3.17 SLABS ON FILL**

- .1 Seal punctures and damaged edges of vapour barrier before placing concrete. Use vapour barrier material, lapped over punctures and damaged areas 150 mm in all directions. Seal with tape.
- .2 Place adjustable screeds at suitable locations. Do not pierce vapour barrier.
- .3 Place concrete to required elevations shown on drawings.
- .4 Separate slabs-on-fill from vertical surfaces with a suitable smooth faced bond breaker.

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**3.18 COLD AND HOT WEATHER CONCRETING**

- .1 Conform to the requirements of CSA A23.1.
- .2 Protect slabs being finished during drying conditions above 25° C, and/or during high winds with moisture retention film.

**3.19 CONCRETE MIX SCHEDULE**

- .1 See Drawings

**END OF SECTION**



**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 REFERENCE DOCUMENTS**

- .1 Provide concrete floor finishes in accordance with the following standards (latest revision) except where specified otherwise.
- .2 Alberta Building Code (ABC)
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-A23.1 00 Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CGSB-25.20-95 Surface Sealer for Floors
- .4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD):
  - .1 SCAQMD Rule 1113-04 Architectural Coatings.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination
  - .1 Coordination: Coordinate a meeting between Contractor, Subcontractor responsible for concrete placement, and the Consultant to determine Site Quality Control testing section borders and sample measurement line locations, method of measurement, and accuracy requirements of the measuring devices.
  - .2 Pre-Construction Meetings: Arrange meeting with Contractor, Subcontractor for work of this Section and other Subcontractors affected by work of this Section to discuss effects and issues governing installation of concrete finishing materials; prepare an outline agenda for meeting.

## 1.4 SUBMITTALS

- .1 Product Data
  - .1 Submit for Consultant's action. Furnish manufacturer's literature, specifications and installation instructions describing the general properties of each material and accessory used in the work.
    - .1 Furnish information for each type of cement, aggregate, admixture, curing, finishing, levelling and densifying material.
    - .2 Submit manufacturer's product data for each materials specified including recommended application rates and methods of installation.
    - .3 Include application instructions for hardeners, colouring agents and sealers
    - .4 Submit WHMIS MSDS – Material Safety Data Sheets for each product. Indicate VOC levels.
  - .2 Shop Drawings:
    - .1 Submit for Consultant's action. Furnish shop drawings for the fabrication and installation of the Work. Show the location of construction joints, and the locations of Work required by other trades with details and templates for placement and spacing, including openings, penetrations, depressions, slopes, curbs, equipment pads, sleeves, embedments, inserts and blockouts.
  - .3 Repair Procedures
    - .1 Submit for Consultant's information. Procedural outline of proposed repair work including a description of materials, preparation, and protection.
  - .4 Slab Survey
    - .1 Submit for Consultant's information. Showing slab elevations identifying elevations that exceed the allowable FF and FL. Include procedures for corrective work to correct deficiencies to meet the specified flatness.
  - .5 Sustainable Design Submittals
    - .1 Submit LEED submittal forms verifying products contain less than 100g/l of VOC in accordance with SCAQMD Rule #1113-04.

## 1.5 PROJECT CLOSEOUT SUBMISSIONS

- .1 Operation and Maintenance Data: Submit detailed cleaning and maintenance instructions for concrete densifier products, and instruct Owner in proper care and maintenance of specified floor finishes, including a complete list of floor care products that will be required for on-going maintenance.

- .2 Maintenance Materials: Leave a minimum of one (1) 18.9 L container of maintenance coating, and remaining portion of coating from first treatment, stored on site at location directed by Owner.

**1.6 QUALITY ASSURANCE**

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Installers: Use skilled workmen experienced in concrete finishing methods similar in complexity and extent to that required for the Work of the Contract.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements
  - .1 Deliver materials to site in containers sealed and labeled by manufacturers.
- .2 Storage and Handling Requirements
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding storage, handling and disposal of hazardous materials.

**1.8 SITE CONDITIONS**

- .1 Provide temporary lighting, as required, to provide a minimum of 1200 watt light source, placed 2.5 meters above floor surface, for each 40 m<sup>2</sup> of floor being finished.
- .2 Maintain ambient temperature of 10°C minimum from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .3 Ensure substrate is within moisture limits prescribed by product manufacturers.
- .4 Ventilate enclosed spaces as required during product application and for 48 hours after application.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Concrete Formwork: Refer to Structural Drawings.
- .2 Concrete Materials and Reinforcement: Specified in accordance with Structural Drawings.

**2.2 LEVELING MATERIALS**

- .1 Underlayment: Cementitious, self levelling, single component, polymer modified underlayment and manufacturer's recommended primer, for application thicknesses to a minimum feather edge to 13 mm; acceptable materials as follows:

- .1 ARDEX Engineered Cements; ARDEX V1200
  - .2 MAPEI Canada Inc., Planipatch
  - .3 Sika Canada Ltd., Sikafloor Level 12
  - .4 W.R. Meadows of Canada, Sure-Flo ST
- .2 Underlayment: Cementitious, self levelling, single component, polymer modified overlayment, for application thicknesses to a minimum of 13 mm to 25 mm; acceptable materials as follows:
- .1 ARDEX Engineered Cements; ARDEX K15
  - .2 Sika Canada Ltd., Sikafloor Level 25
  - .3 W.R. Meadows of Canada, Sure-Flo FT 100
  - .4 Cementitious Moisture Reduction Barrier Materials: Two-component, polymer-modified, cementitious based waterproofing slurry topping; formulated to reduce water infiltration; applicable from 2 mm to 4 mm; acceptable materials as follows:
    - .1 ARDEX Engineered Cements; ARDEX MC Rapid
    - .2 MAPEI Canada Inc., Planiseal MRB
    - .3 Sika Canada Ltd., Epocem 81

### 2.3 **HARDENERS / DENSIFIER**

- .1 Liquid Applied Floor Hardener Materials (Concrete Densifier): Water based, sodium silicate type, chemically reactive, permanent treatment, penetrating sealer and hardener, designated as concrete, sealed on the Drawings; non-toxic, non-flammable, surface densification and anti-dusting treatment having less than 0 g/L VOC:
  - .1 Acceptable materials:
    - .1 Curecrete, Ashford Formula
    - .2 Euclid Chemical Company, Euco Diamond Hard
    - .3 L & M Construction Chemicals, Seal Hard
    - .4 MAPEI, Mapecrete Hard SI
    - .5 Sika Canada, Sikafloor 3S
    - .6 W.R. Meadows of Western Canada, Sealtight Liqui-Hard

## 2.4 REHABILITATION OF CONCRETE

- .1 If renovation of slab is required, the following shall provide basis of design materials and workmanship:
  - .1 Thick-bed mortar: Latex additive mixed with Portland cement and sand in accordance with manufacturer's recommendations.
    - .1 "Planicrete 50" by Mapei Canada.
    - .2 Target Products, "Flowcrete".
  - .2 Self-leveling and smoothing underlayment: Performance standard to ASTM C349 (and CGSB 71-GP-30M), Type 2, minimum compressive strength 30 MPa (4400 psi) after 28 days.
    - .1 Ardex K-15.
    - .2 Geistlich International, Inc. - "Teck 2800".
    - .3 Mapei Canada - "Ultra/Plan".
    - .4 Target Products, "Floor Leveller C26 UL".
    - .5 Thoro Products, "Thoro Underlayment".
  - .3 Feather edging: Polymer-modified, cementitious, 2 component, fast setting, trowel applied.
    - .1 ARDEX Engineered Cements; ARDEX SD-P
    - .2 MAPEI Planitop 21
    - .3 SikaTop 121 Plus by Sika Canada
  - .4 Grout for filling core holes.
    - .1 "GenGrout" Non-Shrink Grout "810" by Elsro Construction Products.
    - .2 MAPEI Planigrout 712
    - .3 "Sika Grout 212 HP" by Sika Canada.

## 3. EXECUTION

### 3.1 FINISHING FLOORS AND SLABS

- .1 Finish floors and slabs in accordance with CSA A23.1 and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.

- .2 Float (Initial) Finishing:
  - .1 Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power driven floats.
  - .2 Re-straighten, cut down high spots, and fill low spots.
  - .3 Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
  - .4 Apply float finishing to surfaces receiving trowel finishing.
- .3 Trowel (Final) Finishing:
  - .1 Commence trowel finishing after all bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface.
  - .2 Apply first trowelling and consolidate concrete by hand or power-driven trowel after applying float finishing; continue trowelling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance; repair or smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - .3 Apply a trowel finishing to surfaces exposed to view or to be covered with resilient flooring, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - .4 Finish surfaces to the tolerances indicated in item 1.2.3 above.
- .4 Trowel and Fine Broom Finishing:
  - .1 Apply trowel finishing to surfaces where large format tile is scheduled for installation by either thickset method.
  - .2 Slightly scarify surface with a fine broom While concrete is still plastic.
  - .3 Finish surfaces to the tolerances indicated in item 1.2.3 above.
- .5 Broom Finishing:
  - .1 Apply a broom finishing to exterior concrete platforms, steps, and ramps, and elsewhere as indicated:
  - .2 Slightly roughen trafficked surface by brooming with fibre bristle broom perpendicular to main traffic route immediately after float finishing.
  - .3 Coordinate required final finishing with Consultant before application.

- .6 Moisture Reducing Finish:
  - .1 Prepare floor to ICRI CRP 3 or 4 as directed by manufacturer's written instructions
- .7 Liquid Applied Floor Hardener Finishing (Densification):
  - .1 Apply liquid floor densifier to surfaces in accordance with manufacturer's written instructions after initial floating.
  - .2 Cure concrete in accordance with manufacturer's recommended procedures.

### **3.2 INSTALLATION OF REHABILITATION MATERIALS**

- .1 Basic Treatment
  - .1 The basic treatment to all formed concrete surfaces, exposed or unexposed, is to be to CSA-A23.1/A23.2.
  - .2 Do not repair honeycomb areas until inspected by Consultant. Fill honeycomb in non-structural elements with mortar; repair honeycomb in structural elements in accordance with CSA Standards.
- .2 Filling
  - .1 Apply self-leveling and smoothing underlayment working into all nooks, cracks and spaces to fill flush with top of floor slab. Trowel to a smooth polished surface.
  - .2 Use feathering edging to fill and level depressions up to 19 mm in thickness, to fill cracks, holes, chips etc. where topping must be finished to a feather edge. Apply in strict accordance to manufacturer's instructions.
    - .1 At juncture of resilient flooring and exposed concrete to provide feather edging for a distance of 150 mm from + 3 mm to 0 mm, as indicated.
    - .2 Prepare substrate and install as per manufacturers recommendations, smooth finish.
- .3 Slab Finishes
  - .1 The tops of all floor slabs, are to be brought to an even, level or sloping surface as indicated on the drawings, ready to receive the specified finish, in accordance with CSA-A23.1/A23.2.
  - .2 Depress floor slabs as required for floor finishes.
  - .3 All surfaces shall be true and level to a tolerance in plane of 3 mm in 3 m.
  - .4 Let the leveling coat harden and cure sufficiently before laying specified flooring.

- .4 Expansion and Control Joints
  - .1 Expansion control to areas as indicated on drawings.

### 3.3 SITE QUALITY CONTROL

- .1 Testing and Measurements:
  - .1 Straightedge Measurement: Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 3050 mm long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed values indicated in item 1.2.3 above.
  - .2 CSA A23.1 has no measurement standard for unshored suspended slabs on steel structure; make straightedge measurements in accordance with CSA A23.1 with the following additional requirements:
    - .1 Layout measurement lines at 45° to the framing direction; to avoid taking measurements at points where anticipated deflections are similar.
    - .2 Offset measurement lines a minimum of 600 mm from column locations, and no portion of the measurement line shall fall within 600 mm of the boundary line, except where 25% of test section would be excluded from this measurement criteria.
    - .3 Measurement of FL for suspended slab tolerances shall be within 80% of the values for slabs-on-grade.
    - .4 Measure and record elevation points at every 600 mm along length of test line.
  - .2 Non-Conforming Work: Repair concrete floor slabs where they exceed the tolerances listed in this Section as follows:
    - .1 Floor Level Excess (High Spots): Grind and smooth surface areas that are higher than listed tolerances.
    - .2 Floor Level Deficiency (Bird Baths):
      - .1 Saw-cut perimeter of surface areas that are lower than listed tolerances to a minimum depth of 6 mm.
      - .2 Grind perimeter to a minimum of 6 mm to allow for flush flash patching.
      - .3 Roughen surface of flash patch area to a minimum ICRI CSP 5 – Medium Shotblast.
      - .4 Clean flash patch area and trowel in floor levelling mortar in accordance with manufacturers written instructions.



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.5 Smooth and level surface of flash patch to match adjacent floor surfaces.

.3 Leave floors in ready for floor finishes supplied and installed by other sections.

**3.4 VERIFICATION OF CONDITIONS**

.1 Verify that slabs and surfaces are ready to receive work.

**3.5 CONCRETE SEALER**

.1 Apply surface sealer in accordance with manufacturer's written instructions.

**3.6 CONCRETE FLOOR FINISH SCHEDULE**

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Product	Location	Colour
Metallic floor hardener with non-slip aggregate	Ambulance and Truck Bay	Clear

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**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C5 -10: Standard Specification for Quicklime for Structural Purposes
  - .2 ASTM C91/C91M -12: Standard Specification for Masonry Cement
  - .3 ASTM C94/C94M -14a: Standard Specification for Ready-Mixed Concrete
  - .4 ASTM C144 -11: Standard Specification for Aggregate for Masonry Mortar
  - .5 ASTM C150/C150M -12: Standard Specification for Portland Cement
  - .6 ASTM C199 -84(2011): Standard Test Method for Pier Test for Refractory Mortars
  - .7 ASTM C207 -06(2011): Standard Specification for Hydrated Lime for Masonry Purposes
  - .8 ASTM C270 -12a: Standard Specification for Mortar for Unit Masonry
  - .9 ASTM C387/C387M -11b: Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar
  - .10 ASTM C404 -11: Standard Specification for Aggregates for Masonry Grout
  - .11 ASTM C476 -10: Standard Specification for Grout for Masonry
  - .12 ASTM C595/C595M -13: Standard Specification for Blended Hydraulic Cements
  - .13 ASTM C780 -12a: Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
  - .14 ASTM C979/C979M -10: Standard Specification for Pigments for Integrally Colored Concrete

- .15 ASTM C1019 -13: Standard Test Method for Sampling and Testing Grout
- .16 ASTM C1072 -13: Standard Test Methods for Measurement of Masonry Flexural Bond Strength
- .17 ASTM C1142 -95(2013): Standard Specification for Extended Life Mortar for Unit Masonry
- .18 ASTM C1314 -12: Standard Test Method for Compressive Strength of Masonry Prisms
- .2 Canadian Standards Association (CSA):
  - .1 CSA-A3000 -13: Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014) .
  - .2 CSA A179 -04 (R2009): Mortar and Grout for Unit Masonry, Includes Update No. 1 (2006)
  - .3 CAN/CSA A371 -04 (R2009): Masonry Construction for Buildings

### **1.3 QUALITY CONTROL**

- .1 Perform all work of this Section in accordance with the requirements of CSA A179

### **1.4 SUBMITTALS**

- .1 Submit product literature for curing compound.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Mortar: to CSA A179.
- .2 Portland Cement: Conforming to the requirements of CAN/CSA A5; normal-symbol 10 type.
- .3 Aggregates: Standard masonry type, graded and controlled and conforming to the requirements of CSA A179. Aggregates are to be clean and dry, protected against dampness, freezing and foreign matter. Modified gradation acceptable only if acceptable to the Owner.
- .4 Hydrated Lime: to ASTM C207 type N.
- .5 Water: Potable, Clean and free from injurious amounts of oil, alkali, organic matter or other deleterious material.

- .6 Anti-freeze compounds: do not use any anti-freeze liquid, salts or other substances to lower the freezing point of the mortar.

## **2.2 MORTAR TYPES**

- .1 Non-bearing masonry: Type N based on proportion specification, producing not less than 4 MPa at 28 days. Colour to match adjacent concrete blocks.
- .2 Bearing masonry: Type S based on proportion specification, producing not less than 15 MPa at 28 days.
- .3 Exterior Masonry Veneer: Type N based on property specification, producing not less than 4 MPa at 28 days. Use lime mix, not masonry cement mix. Colour to match existing.
- .4 Exterior Parapet Walls, unprotected walls: Types S based on proportion specification, producing not less than 15 MPa at 28 days.
- .5 Regardless of mortar types and uses specified above, mortar for grouted reinforced masonry: Type S based on proportions specification, producing not less than 15 Mpa at 28 days.
- .6 Lintels: Type S based on proportion specification, producing not less than 20 MPa at 28 days.

## **3. EXECUTION**

### **3.1 MORTAR MIXING**

- .1 Mix mortar in accordance with to CSA A179.
- .2 Provide gauging equipment and ensure that shovel count is accurate.
- .3 Use mechanical mixer of one sack minimum capacity for large batches, mechanically mixing for not less than three minutes and not more than five minutes. Hand mixing may be used for small batches.
- .4 Thoroughly mix ingredients in quantities needed for immediate use.
- .5 Adjust consistency of mortar by adding maximum amount of water consistent with workability to provide maximum tensile bond strength. Air content in mortar to be kept to minimum.
- .6 Mix mortar to an initial flow of 100 to 115, having a flow after suction of not less than 70%.
- .7 For masonry work which has an upward facing horizontal exposure outdoors, air entrain mortar to provide 4 to 6% air content.

- .8 For coloured mortar, mix coloured pigment with 10% to 15% dry cement by weight. Do not use same mixer for regular and coloured mortar.
- .9 Use all mortar within 2 hours of mixing temperatures over 27 C, under o 10oC - 2 1/2 hours.
- .10 Mortar may be retempered within 2 hours of mixing to replace water lost by evaporation. Do not retemper mortar after 2 hours of mixing.
- .11 Apply mortar as specified in Section 04200.
- .12 Comply with cold weather requirements specified in CAN3-A371 Masonry Construction for Buildings.

### **3.2 TESTING OF MORTAR**

- .1 Cooperate with and submit sample to laboratory of mix and water proposed to be used on the project for testing to ensure that the mortar will not produce efflorescence. Do not begin masonry work until proposed mortar mix tests are accepted by the Consultant.
- .2 For mortars based on property specifications, tests will be required from representative batch mixes of mortar, one sample tested for water retention, three 50 mm cubes tested for every 100 m<sup>2</sup> of masonry in area, crushing at 7 and 28 days or as otherwise outlined in CSA A179 for type of mortar specified.
- .3 For mortars based on proportion specifications, tests will be required from representative batch mixes of mortar to ensure that materials ratios are in accordance with CSA A179 for type of mortar specified.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 SECTION INCLUDES**

- .1 Supply and installation of all concrete blocks including special blocks.
- .2 Supply and installation of all brick including special shapes.
- .3 Truss type horizontal wire reinforcing.
- .4 Through wall flashings to masonry.
- .5 Vertical and horizontal metal fire stopping to exterior cavity wall construction.
- .6 Cleaning of all masonry.
- .7 Interior concrete block partitions.
- .8 Brick Veneer masonry.
- .9 Concrete fill in all bond courses, core fills, bearing and lintels.
- .10 Installation of re-bars in horizontal and vertical core fills.
- .11 Cutting and patching of work in this section to accommodate work of other trades and alterations to existing.
- .12 Installation of anchors, bolts, hangers, and connections into masonry work, supplied under other Sections as required for work of other trades.
- .13 Lateral support at wall tops

**1.3 RELATED SECTIONS**

- .1 Reinforcement in grout or concrete filled masonry cavities: Section 03300.
- .2 Custom metal fabrications: Section 05500.

**1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Reinforcement supplied under Section 03300.
- .2 Custom metal fabrications supplied under Section 05500.

**1.5 REFERENCE DOCUMENTS**

- .1 All Standards listed below are to be the most current edition at the time of tender regardless of any older dates that may be listed herein unless specifically noted otherwise. Withdrawn or obsolete standards may still apply unless it has been replaced with a different Standard in which case the new Standard shall apply.
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A641/641M-09a Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .2 ASTM A653M-09 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
  - .3 ASTM C140-09 Sampling and Testing Concrete Masonry Units.
  - .4 ASTM C426-07 Linear Drying Shrinkage of Concrete Masonry Units.
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA A82.1-M87 (R2003) Burned Clay Brick (Solid Masonry Units Made From Clay or Shale)
  - .2 CAN3-A82.8-M78(R2003) Hollow Clay Brick.
  - .3 CSA A165 Series-04 CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3), Includes Update No. 1 (2006)
  - .4 CSA A179-04 Mortar and Grout for Unit Masonry
  - .5 CAN3-S304-M84 (R1997) Masonry Design For Buildings
  - .6 CSA S304.1-04, Design of Masonry Structures
  - .7 CAN/CSA-A370 -04(R2009): Connectors for Masonry.
  - .8 CSA A371-04(R2009) Masonry Construction for Buildings
  - .9 CSA A370 04 Connectors for Masonry
  - .10 CAN/CSA-A3000-08 Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

- .4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD):
  - .1 SCAQMD Rule 1168-05 Adhesives and Sealants Applications.

## **1.6 QUALITY CONTROL**

- .1 Compressive Strength Tests by the Contractor:
  - .1 Engage an independent CSA certified and qualified concrete testing laboratory, with a permit to practice in Alberta, to sample and test bedding grout.
  - .2 Conduct compressive strength test of grout in accordance with CAN/CSA-A23.2-1B.
  - .3 Perform at least 1 strength test, consisting of 3 cubes, for each type of grout placed in any given day.
  - .4 The compressive strength is acceptable if the average of the 3 cubes for each test exceeds the specified value and no individual cube is more than 3.5 MPa below the specified value.

## **1.7 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Coordinate lines, levels and coursing with work of other Sections.
  - .2 Obtain built in items prior to start of this work.

## **1.8 SUBMITTALS**

- .1 Samples:
  - .1 Submit samples in accordance with Submittal Procedures.
  - .2 Provide 5 clay brick and concrete masonry units showing range of colour and texture possible within colour specified.
  - .3 Provide samples of masonry connectors, joint reinforcement, flashings, weeps and vents.
  - .4 Obtain approval from Owner before ordering.
- .2 Test and Evaluation Reports:
  - .1 Comply with requirements of Division 01.
  - .2 Submit copies of test reports by an independent testing agency, accredited for this type of testing by the Standards Council of Canada, demonstrating that:



- .1 Concrete masonry complies with CSA A165 Series and specified requirements.
- .2 Clay brick complies with CSA A82.1 and specified requirements.
- .3 Masonry connectors and their fasteners comply with CSA A370 and specified requirements.

.3 Testing Procedures:

- .1 Owner will appoint and pay for services of a testing agency to perform site quality control testing and inspection.
- .2 Concrete masonry units delivered to the site will be sampled and tested in accordance with CSA A165 Series. Following tests will be performed to verify compliance with specified requirements:

Test	Test Method
Compressive strength	ASTM C140
Linear shrinkage	ASTM C426
Moisture content	ASTM C426

- .3 Sand and cement materials will be inspected and tested to verify compliance with specified requirements.
- .4 Mortar will be tested to verify that compressive strength complies with specified requirements. Method of testing will be in accordance with CSA A179, for job mixed mortars.

**1.9 QUALITY ASSURANCE**

.1 Mock-up:

- .1 Construct a portion of one exterior wall in location agreed upon by Owner to establish a standard of construction, workmanship, and appearance. Show reinforcement, masonry connectors, flashing, jointing, coursing, mortar, and masonry pattern, unit face alignment, texture, and colour.
- .2 Do not continue with work of this Section until Owner has approved mock up.
- .3 Accepted sample installations will become the standard for the project and may be incorporated into the Work. Masonry work which does not match the accepted sample will be rejected, and shall be replaced with masonry work to match accepted sample.

- .2 Pre-Installation Conference
  - .1 Before commencement of masonry work, arrange a pre-installation conference to be attended by the Construction Manager, Subcontractor's Superintendent, representatives of the suppliers of the masonry and representatives of any related Work as deemed necessary by the Consultant. Arrange this meeting only when the representative of the Consultant can attend. Methods of operation, and trade responsibility will be resolved.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver masonry units on pallets, suitably protected from road grime and moisture absorption due to exposure to rain or melting snow.
- .2 Unload and store on dry, level areas.
- .3 Remove plastic wrappings from concrete masonry units and cover with waterproof coverings which will provide protection from the elements but allow for air circulation.
- .4 Protect masonry materials from damage during all phases of delivery, storage and handling.
- .5 Replace exposed units which become stained or chipped and materials which are affected by inadequate protection.
- .6 Do not stack materials to exceed structural design loads of structure or existing structures.

**1.11 PROTECTION**

- .1 Cover top of completed and partially completed walls, not enclosed or sheltered, with waterproof coverings at end of working day. Drape cover and extend 600 mm down both sides. Tie securely in position to prevent lifting under high winds.
- .2 Maintain protective boards at exposed external corners which may be damaged by construction activities. Provide such protection without damaging complete work.
- .3 Provide protection to the work of others from possible damage resulting from the work of this Section.
- .4 Protect adjacent surfaces and work during cleaning of masonry.

**1.12 ENVIRONMENTAL CONDITIONS**

- .1 When temperature drops below 5 C, perform masonry in a heated enclosure, o to maintain air temperature above 5oC.
- .2 Heat units if necessary so that temperature of units at time of laying is minimum 5oC.
- .3 During warm weather protect freshly laid masonry from drying too rapidly, by means of water fog spray, and protection from direct sunshine.

- .4 Conform to weather procedure requirements of CAN3-A371 Masonry Construction of a building.

### 1.13 WINTER CONSTRUCTION

- .1 For masonry work which will be done below 5oC: maintain temperatures as close as possible for successive mortar batches; ensure that mortar temperature never exceeds 50oC (to avoid flash set); use dry masonry units, lay masonry on unfrozen surfaces free from snow or ice; use windbreaks during laying of masonry not protected by enclosures when wind exceeds 25 km/h; provide a high-low registering thermometer where directed on site.
- .2 When the air temperature will fall below 5oC over a 24 hour period but not below 0oC, conduct masonry work as for normal temperature except as follows:
  - .1 Heat water and sand to produce mortar temperatures between 5oC and 50oC.
  - .2 Protect entire constructed masonry by enclosing within weather proof membrane for 48 hours for Type S mortar, 72 hours for Type N mortar.
- .3 When the air temperature will fall below 0 C over a 24 hour period, o but not below -4oC, conduct masonry work as for normal temperatures except as follows:
  - .1 Heat water and sand to produce temperatures between 5oC and 50oC, and maintain temperature of mortar on boards above 0oC.
  - .2 Protect entire constructed masonry by enclosing within weatherproof membrane for 48 hours for Type S mortar, 72 hours for Type N mortar.
- .4 When the air temperature will remain below -4oC, conduct laying of masonry in enclosures heated to maintain air temperature above 0oC. Perform masonry work as for normal temperatures except as follows:
  - .1 Heat water and sand to produce mortar temperatures between 5oC and 50oC.
  - .2 Heat units if necessary so that temperature of units at time of laying is minimum 0oC.
  - .3 Maintain enclosure in position for 48 hours for Type S mortar, 72 hours for Types N mortar and maintain air temperature within enclosure at minimum 0oC.
- .5 If Type 30 cement (high early strength) and Type S hydrated lime is permitted by the Consultant, the above noted protection times may be reduced by 24 hours.

### 1.14 WIND BRACING

- .1 The masonry contractor is responsible for supplying and installing adequate bracing to walls during construction.

- .2 Submit the design drawings of wind bracing to the Engineer under the seal of a Professional Structural Engineer registered in the Province of Alberta for acceptance prior to start of construction.

### **1.15 FIRE RATED CONSTRUCTION**

- .1 Partitions, enclosures, beams, columns, etc. which are shown on the drawings or specified to have a fire resistance rating, erect materials to meet the Authority Having Jurisdiction requirements for the required rating.
- .2 Where a ULC (or other testing laboratory) listing is quoted, ensure that all work and materials comply with the listed requirements, to the approval of the Authority Having Jurisdiction.

### **1.16 SITE MEETINGS**

- .1 Before commencement of work on site, arrange a site meeting to be attended by the Owner, the General Contractor's Superintendent, the Subcontractor's Representative, the Subcontractor's Foreman for this project and the Consultant's Site Representative.
- .2 Specifications and details will be reviewed, including:
  - .1 Sample Installation.
  - .2 Mortar Testing.
  - .3 Masonry vents and locations.
  - .4 Provision for structural deflection at wall tops.
  - .5 Appearance design for exposed block lintels.
  - .6 Reinforcement - corners, wall intersections.
  - .7 Interior crack control measures.
  - .8 Vertical alignment of cores to be filled with concrete.

### **1.17 QUALITY GUIDELINES**

- .1 Use qualified, experienced journeymen masons for cutting and placing of masonry units and to personally direct the execution of all phases of masonry work, including site mortar mixes.

## **2. PRODUCTS**

### **2.1 CLAY BRICK MASONRY UNITS**

- .1 Burned Clay Brick: to CAN/CSA A82.1 and as follows:

- .1 Grade: SW for face brick exposed to weather. SW or MW for face brick not exposed to weather and for back up brick in concealed locations.
  - .2 Type: FBX.
  - .3 Size: standard nominal size, 100 mm x 67 mm x 200 mm
  - .4 Colour and Texture: As per Drawings. Do colour and texture blending prior to delivery.
- .2 Hollow Clay Brick: to CAN3 A82.8 and as follows:
- .1 Classification: Type I(H)
  - .2 Size: As per Drawings.
  - .3 Colour and Texture: As per Drawings.

## 2.2 CONCRETE MASONRY UNITS

- .1 Concrete Masonry: lightweight aggregate block (normal weight to fire rated partitions) conforming to CSA A165 Series-94 and all subsequent revisions. Use smooth faced concrete blocks in all interior locations, unless otherwise indicated. Use Split faced block in all exterior locations (if exterior block is required), unless otherwise indicated. Metric modular size and imperial modular size to match existed where required, and if alternatively indicated on the drawings. Concrete Block Colours are to be as indicated in the room finish schedule. Acceptable manufacturer's as follows:
  - .1 Lafarge.
  - .2 Expocrete
  - .3 Acceptable alternative substitutions will be considered.
- .2 Facet Designation:
  - .1 Exposed units: Hollow concrete blocks to have a facet designation H/15/C/M. Solid concrete block to have facet designation S/15/C/M.
  - .2 Unexposed units: Hollow concrete blocks to have a facet designation H/15/C/O. Solid concrete block to have facet designation S/15/C/O.
- .3 Method of Curing: Autoclave or low pressure steam curing is acceptable, provided that masonry units comply with linear shrinkage and moisture content requirements of CSA A165.1 for type M units at time of delivery to site. Notwithstanding the foregoing, age all units before delivery to site, as follows:
  - .1 Autoclaved units: minimum 7 days.
  - .2 Low pressure steam cured units: minimum 28 days.

- .4 Ensure all blocks are free from cracks, splits, laminations, or other defects which may impair the strength and durability. Ensure face of concrete masonry units are of uniform texture, free from spalled or broken edges.
- .5 Blocks to 2 hour fire rated partitions must incorporate L<sub>1</sub>20S, L<sub>2</sub>20S or L<sub>2</sub>30S aggregates and be acceptable to the Authority having jurisdiction. All other fire rated block walls must incorporate blocks acceptable for use in the fire rated assembly noted, and must be acceptable to the authority having jurisdiction.
- .6 Sizes: as indicated on drawings.
- .7 Special Shapes: Bond beam, lintel beam, corner and other shapes as required or indicated on drawings. Provide external corner units as a single unit, with required architectural face appearance on one side and one end.
- .8 Use special blocks for jambs, lintels, bond beams, sash blocks, base blocks and other special blocks as required. Provide single or double bullnosed blocks to all visible openings exterior corners, wall ends and at 250 mm thick or greater, block wall door jambs and other openings. Where ceramic tile occurs on block walls at corners, wall ends, openings and the like, use square corner blocks. Outside corner blocks to have same finish on exposed ends and on outside face. To off angle block wall corners, site form bullnosed corners to suit wall angles; site formed bullnoses are to match factory formed bullnoses.
- .9 Face Textures, Finishes and Colours: As indicated on drawings:

## 2.3 HORIZONTAL JOINT REINFORCEMENT

- .1 Reinforcement which will also function as masonry connectors:
  - .1 Conventional Continuous Welded Ties/Reinforcing: to CSA A370, in ladder or truss configuration with 50 mm less than the block thickness with minimum 3.66 mm diameter side and cross rods for non-load bearing partitions and 4.76 mm diameter side and cross rods for load bearing partitions and exterior backup walls, galvanized and conforming to ASTM A82 and CSA G30.3; Dur-O-Wall truss or ladder design as manufactured by Dur-O-Wall or preapproved product. Provide prefabricated tee-shaped and 90 corner configurations for use at wall intersections and corners.
- .2 Reinforcement:
  - .1 Steel Wire: to ASTM A641/A641M, hot dip galvanized.
  - .2 Continuous Welded Double Wire Welded Ladder or Truss Type: to CSA A370.
  - .3 Single Wire Type: 4.76 mm diameter.
  - .4 Cavity wall reinforcement: wire to ASTM A82 and CSA G30.3, ladder or truss type. Galvanized, 4.8 mm (3/16") side and cross rods, without moisture drips (extra heavy duty type - for exterior walls with wide cavity); 50 mm less in width than the width of the cavity wall

- .3 For continuous welded ladder or truss type, provide:
  - .1 widths to suit wall widths, and
  - .2 prefabricated tee shaped and 90° corner configurations for use at wall intersections and corners.

## 2.4 MASONRY CONNECTORS

- .1 Select any suitable conventional or non-conventional type as defined by CSA A370, and as follows:
  - .1 Corrosion Protection: level II.
  - .2 Maximum unsupported length of connectors in cavity shall not exceed that permitted by CSA A370 or recommended by connector manufacturer, whichever is the smaller dimension.
  - .3 Connectors selected shall accommodate differential vertical movement of 10 mm between masonry veneer and structural backup.

## 2.5 FASTENERS FOR MASONRY CONNECTORS

- .1 Masonry Veneer wall ties (to sheathing and steel stud back-up and concrete backup): rod adjustable plate tie system, consisting of an "L" shaped 1.52 mm thick galvanized steel plate conforming to ASTM 570, hot dipped galvanized finish, 25 mm long leg at backup attachment wall and wide enough to accommodate insulation thickness indicated, plus 18 mm for perpendicular leg. Provide 2 screw holes at the wall leg and various holes in perpendicular leg, from 12 mm diameter to 25 mm diameter to reduce cold bridging, provide 5 - 5.5 mm diameter holes 6 mm from end of perpendicular leg to accommodate Vee tie. Vee tie to consist of 4.76 mm diameter wire tie of size to accommodate installation conforming to CSA G30.3 with hot dipped galvanized finish. Provide insulation supports manufactured from polyethylene, for each tie. Fasten to backup using stainless steel fasteners of type and size recommended by manufacturer. Note: RAP ties as manufactured by Fero meet the specification.
- .2 Shear Connector Masonry Veneer Ties (for concrete block backup): shear connector plate component, 1.52 mm thick sheet metal conforming to ASTM A570, hot dipped galvanized finish. Length of shear connector plate to accommodate block width, insulation and air space. Provide shear keys and corrugated sections for adequate fixity within the concrete block wythe. Notch plate to ensure proper positioning within the concrete block wythe. Provide holes in plate within the insulation thickness to reduce thermal bridging. Provide a series of 5.5 mm diameter holes to accommodate Vee tie component. Provide a Vee tie component consisting of 4.76 mm diameter wire conforming to CSA G30.3 with hot dipped galvanized finish; lengths to suit masonry veneer. Ties to be Shear connector ties as manufactured by Fero, or preapproved product.

- .3 Screws to ties: stainless steel, type and size as recommended by the tie manufacturer and of sufficient size and holding capacity to withstand all superimposed loading. Submit holding capacities of screws and evidence that the screws will support all superimposed loading, signed and sealed by a Structural Engineer Registered in the Province of Alberta.
- .4 Design Criteria: capable, when installed in specified substrates, of meeting requirements of CSA A370.
- .5 Corrosion Resistance: to requirements of CSA A370.
- .6 Screws: steel, hex washer head, to suit substrate.
- .7 Inserts: drilled in, compression type [with 2 component epoxy adhesive capsule].
- .8 Nails: steel, spiral type, suitable for substrate.
- .9 Provide fastener types as follows:

Substrate	Fastener Type
Steel Studs	Screws
Structural Steel	Screws
Masonry & Standard Aggregate Concrete	Inserts, screws or nails
Concrete with light-weight aggregate	Inserts with adhesive
Wood Studs	Nails or screws

**2.6 ACCESSORIES**

- .1 Control Joint Fillers: Preformed rubber, neoprene or polyvinylchloride, size and profile to suit intended application and as indicated on drawings.
- .2 Cavity Weeps/Vents: Preformed plastic or galvanized steel, 100 mm long.
- .3 Wall Plugs: 0.556 mm thick galvanized steel plugs.
- .4 Rubber control joint: rubber, vinyl or neoprene, solid, custom formed control joint. Cross shape. 'Titewall', manufactured by Blok-Lok, distributed by Steels or preapproved product.
- .5 Masonry vents: Moulded P.V.C. grilles, insect proof; manufactured specifically for cavity vents/weepholes.
- .6 Rubber asphalt caulking: heavy bodied cutback sealing compound of rubber and asphalt with selected fillers and solvents.



- .7 Metal angle support to non-load bearing block partitions: sizes as indicated on the drawings, galvanized steel with Z275 zinc coating.
- .8 Fire safing insulation: mineral wood fibre insulation made from basalt rock and steel slag, conforming to CAN/ULC-S702, type 1; thickness, non-combustible, sized to suit metal stud application, approved by the Authority Having Jurisdiction for use in walls having a fire rating, one of the following materials:
  - .1 "Firebarrier" distributed by A/D Distributors.
  - .2 "Firestop" as manufactured by M.W. McGill and Associates Ltd.
  - .3 "Thermafibre" as manufactured by Owens Corning.
  - .4 "Fibrex Safing Insulation" as manufactured by Fibrex Insulation Inc.
  - .5 "Roxul Safe" as manufactured by Roxul.
  - .6 Acceptable alternative substitutions will be considered
- .9 Reinforcing steel: deformed steel bars to CAN/CSA-G30.18-M. Unless otherwise indicated, 10M bars to be grade 400 (60 ksi), and 15M and larger bars to be grade 400 (60 ksi).
- .10 Concrete for core fills and Lintels: Conforming to CAN/CSA-A23.1, 20 MPa, 175 mm slump, 12 mm maximum aggregate, unless indicated otherwise.

**2.7 MORTAR AND GROUT**

- .1 Mortar: to CSA A179, property specifications, and as follows:

Location	Mortar Type	Maximum Compressive Strength*	Colour
All locations	N	6 MPa	As per Drawings

\*Average of six 50 mm cubes, job prepared, tested @ 28 days.

- .2 Mortar Colour Admixtures: Metallic oxide pigments. Colour will be selected by Owner from manufacturer's standard range. Pigments shall not exceed 10 15% by weight of cement content.
- .3 Masonry cement is not permitted.
- .4 Grout: to CSA A179.

## 2.8 FLASHINGS

- .1 Butyl Rubber Base Flashing: minimum 1.2 mm thick butyl sheet rubber strips.
- .2 Through-wall flashing: one of the following at the option of the contractor:
  - .1 Grace Co. 'Perma-A-Barrier'.
  - .2 Soprema Sopraseal Stick 1100.
  - .3 Note that only one type is to be used throughout the project.
- .3 Primer: bituminous primer, as recommended by the membrane manufacturer.
- .4 Metal Flashing to masonry construction: type and colour as specified in Section 07 60 00; colour as selected by the Consultant.
- .5 Sheet Steel Base Flashing: minimum 0.60 mm thick, to ASTM A653M, formed as detailed, galvanized with Z275 zinc coating.
- .6 Modified Bitumen Base Flashing: SBS modified sheet membrane, minimum 1.0 mm thick self-adhering type or minimum 3.0 mm thick torch-applied type.

## 2.9 CLEANING COMPOUNDS

- .1 Use low VOC products in compliance with SCAQMD Rule 1168

## 3. EXECUTION

### 3.1 EXAMINATION

- .1 Examine work of other Sections upon which work of this Section is dependent. Should discrepancies be found which affect the proper performance of the work of this section, do not commence work until such discrepancies have been resolved.

### 3.2 COLD WEATHER REQUIREMENTS

- .1 For masonry work which will be done below 5°C, measure temperatures of masonry material prior to use; maintain temperatures as close as possible for mortar batches; ensure mortar temperature on mortar boards does not exceed 50°C; use dry masonry units; lay masonry on unfrozen surfaces free from snow and ice; use windbreaks when laying masonry not protected by enclosures; provide a high low registering thermometer where directed on site.
- .2 When mean air temperature will, over a 24 hour period, go below 5°C but not below 0°C, conduct masonry work as for normal temperatures except heat water and sand to produce mortar temperatures between 5°C and 50°C. Protect entire constructed masonry by enclosing within weatherproof membrane for 48 hours.

- .3 When mean air temperature will, over a 24 hour period, go below 0°C but not below 4°C, conduct masonry work as for normal temperatures except heat water and sand to produce mortar temperatures between 5°C and 50°C and maintain temperature of mortar boards above 0°C. Protect entire constructed masonry by enclosing within weatherproof membrane for 48 hours.
- .4 When mean air temperature is below 4°C, conduct laying of masonry in enclosures heated to maintain air temperature above 0°C. Conduct masonry work as for normal temperatures except heat water and sand to produce mortar temperatures between 5°C and 50°C and heat units if necessary so that temperature of units at time of laying is minimum 7°C. Maintain enclosure in position for 48 hours and maintain air temperature within enclosure at minimum 0°C.

### **3.3 MIXING MORTAR**

- .1 Mix mortar in accordance with CSA A179, using maximum amount of water consistent with workability.
- .2 Provide gauging equipment and ensure that shovel count is accurate.
- .3 Use mechanical mixer of one sack minimum capacity for large batches, mechanically mixing for not less than 3 minutes and not more than 5 minutes. Hand mixing may be used for small batches.
- .4 Re temper mortar to replace water lost by evaporation.
- .5 Use and place mortar in final position within 2 hours after mixing.
- .6 For coloured mortar, mix coloured pigment with 10% to 15% dry cement by weight. Do not use same mixer for regular and coloured mortar.

### **3.4 PLACING OF MASONRY, GENERALLY**

- .1 Meet or exceed requirements of CSA A371.
- .2 Where mortar has started to harden at units requiring repositioning, remove and replace with fresh mortar.
- .3 Construct cavity walls using techniques that will minimize mortar dropping in cavity space. This may require the use of batten boards to catch mortar droppings. No mortar shall bridge cavity space or plug cavity vents at bottom of cavity.

### **3.5 PLACING CLAY BRICK MASONRY UNITS**

- .1 Except when outdoor temperature within 24 hours of placing is less than 5°C, and if IRA (Initial Rate of Absorption) exceeds 1.55 g/min/1000 mm<sup>2</sup>, dampen clay brick 3 to 24 hours before installation. Do not saturate. Do not lay until surface is dry.

### 3.6 PLACING CONCRETE MASONRY UNITS

- .1 Do not wet concrete masonry units prior to installation. Cut with dry blade saws.
- .2 Place units in full mortar bedding for horizontal stacking bond.
- .3 Remove excess mortar from cores intended for grouting. Puddle or vibrate grout to completely fill cores.
- .4 Install masonry with exposed faces having straight arises and be free from stains, chips and cracks. Do not use chipped, cracked or deformed units in exposed work. Replace damaged masonry units in exposed work.
- .5 Select and blend coloured masonry units to produce a uniform consistent appearance. Cull out all non typical coloured units and do not use in visible locations.
- .6 Do not incorporate any combustible material, such as wood nailers, into masonry.
- .7 Place all nailing blocks, anchor bolts, ties, flashing, structural bearing plates and other miscellaneous items for doors and windows, accurately as the Work proceeds.
- .8 Lay work from face side, true to line and level.
- .9 Buttering corners of units, throwing mortar droppings into joints and veneer wall air space, deep or excessive furrowing of bed joints, will not be permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply. Do not allow mortar droppings to impair veneer wall air space. Clean out as directed by the Consultant.
- .10 Where stop-off is necessary in horizontal runs of masonry, back one unit in every course, do not tooth.
- .11 Erect adjoining or intersecting walls with no wall more than 1200 mm above the other at any time.
- .12 Where fresh masonry abuts partially or fully set masonry, clean exposed surface and dampen existing surface for best possible bond.
- .13 Where masonry abuts steel columns, use column anchors welded or mechanically fastened to columns at a maximum of 400 mm o.c.
- .14 Where masonry abuts existing concrete, dowel into existing concrete with 15M bars minimum 150 mm into concrete and grout in place; install dowels at 400 mm oc vertically to match block joint spacing.

- .15 Where new doors and frames are installed into existing concrete block, perform all renovations and alterations to concrete block partitions and rebuild around new door frames. Infill, patch and make good existing concrete block to match existing adjacent concrete block. Where indicated, infill around new openings in exterior walls using masonry to match existing as indicated. Ensure joints between new and existing line up with each other.
- .16 Isolate masonry from vertical structural framing members, fill void with compressible filler.
- .17 Extend masonry partitions to underside of slab, deck or structural member above, where indicated. Extend all other block walls to minimum 100 mm above highest adjacent ceiling; use bond beam to top course of block.
- .18 Remove excess mortar and projections. Take care to prevent breaking masonry corners.
- .19 Lay the work from face side to line and level. Accurately space courses. Keep the bond plumb throughout. Install corners and reveals plumb and true. Form uniform size joints. Check work regularly.
- .20 Lay exterior brick walls in running bond as indicated and to match existing. Install row lock and soldier coursing as indicated and to match existing.
- .21 Lay exterior block walls in stack bond to match existing unless otherwise indicated or directed. Lay rowlock and soldier coursing as detailed.
- .22 Lay interior block walls in running bond and stack bonds as indicated on the drawing.
- .23 Patched areas to match existing areas and are to be undistinguishable from the existing adjacent masonry work.
- .24 Use full mortar bedding for all block walls and brick masonry veneer.
- .25 Lay block with webs to align over each other with thick end of webs up. Leave no cells open in exposed work.
- .26 Minimize cutting block. Cut exposed block with high speed power driven abrasive cutting disc or diamond cutting wheel for flush-mounted electrical outlets, grilles, pipes, conduit, leaving 3 mm in maximum clearance. Core block as required to suit mechanical drops. Core block to unexposed surfaces wherever possible. Patch and make good cored block to match adjacent surfaces and to render patched area undistinguishable from adjacent concrete block.
- .27 Dampen without saturating all masonry units immediately before installation. Do not saturate units. Consult manufacturer for length of time and climatic conditions for dampening masonry units.
- .28 Avoid racking and toothing where possible.

- .29 Mortar fill hollow metal door and window frames built in to masonry, except to exterior walls where foam-in-place insulation is specified.
- .30 Where new masonry joins masonry that has set, clean and lightly wet the surface of the set masonry. Remove loose masonry and mortar.
- .31 Use special shaped units where indicated or where required.
- .32 Where applicable, ensure concrete block partitions receiving drywall adhered directly to them, are plumb and true to line, strike joints flush.
- .33 Install solid concrete block sills as detailed on the drawings in full mortar beds.
- .34 Mitre all corners in bullnosed concrete block, around openings, such as between jambs and heads and between jambs and sills. Install bullnosed block to all heads and sills around openings, including around door frames and window frames.

### **3.7 TOLERANCES**

- .1 Tolerances to CSA A371, Paragraph 5.3.2 and as specified in this Section. If there is a discrepancy between the tolerances specified in this Section and those specified in CSA A371, the more stringent tolerance will govern.
- .2 Variation from Mean Plane: 3 mm when measured with a 3 m straight edge.
- .3 Variation from the Plumb: 3 mm on any vertical line up to 3 m high. Tolerances are not cumulative and not be more than 12 mm up to 45 m high.
- .4 Variation in the Sizes of Wall Openings: 6 mm maximum.
- .5 Variation from Grade Levels Stated: 6 mm.
- .6 Variation of Building Lines from Plane: In any bay or 6000 mm - maximum 12 mm. In 12,000 mm or more - 19 mm.

### **3.8 BONDS AND PATTERNS**

- .1 As indicated on drawings

### **3.9 JOINTING**

- .1 Tool mortar joints to a dense, smooth surface, after thumbprint hard.
- .2 As indicated on drawings

### **3.10 MORTAR JOINTING**

- .1 Tooling: When mortar is "thumb-print" hard, tool exposed block joints to a dense smooth surface, to form concave joints or as otherwise required to match existing. For unexposed work, strike joints flush.

- .2 Strike joints flush at the following locations:
  - .1 Concealed in walls.
  - .2 Behind caulking at door frames, window frames, parapets, roof junctures, wall junctures and similar construction.
  - .3 Where walls are to receive gypsum wallboard, air/vapour barrier membrane, insulation, ceramic tile, or other applied materials, except paint and similar thin finish coatings.
  - .4 Vertical joints for one course height up from floor where rubber base or other base is indicated on the finish schedule, and block is exposed, including filling in vertical scores in scored block.
  - .5 Where indicated in details.
- .3 Use sufficient force to press mortar tight against masonry units on both sides of joint. Remove excess material and burrs. Tool exposed joints to a uniform depth.
- .4 Masonry courses to be of uniform height and both vertical and horizontal joints to be of equal and uniform thickness. Where new block walls butt into existing block walls, ensure that joints in new work match joints in existing.
- .5 Course units to bring wall to the required elevations using even horizontal joints.

### **3.11 INSTALLATION OF REINFORCEMENT**

- .1 Install reinforcement in accordance with CSA 371 and as indicated on drawings.
- .2 Place horizontal joint reinforcement in accordance with CSA 371, and as follows:
  - .1 Place in first and second mortar joints above and below openings. Extend reinforcement minimum 600 mm past openings.
  - .2 Place in first and second mortar joints below tops of walls.
  - .3 Stop horizontal reinforcement on each side of control joints.
- .3 Build block reinforcement continuously into masonry bed joints at 400 mm o.c. vertically (every second block joint).
- .4 Place cross rods or additional ties not more than 100 mm from any end, such as a door opening, window opening, or vertical joint.
- .5 Cavity walls and concrete block walls and partitions shall be continuously reinforced and tied together with masonry reinforcing in every second block bed joint.

- .6 Place masonry reinforcing in first and second bed joints above and below openings. Reinforcing in first bed joint shall be continuous. Second bed joint reinforcing shall extend 600 mm beyond each side of opening.
- .7 Lap reinforcing minimum of 150 mm at splices and cut and bend corners.
- .8 Place horizontal reinforcing in first and second mortar joints below tops of walls.
- .9 Install additional reinforcement if so indicated on drawings.
- .10 Do not extend reinforcement through control joints except where noted on the Drawings.
- .11 Use pre-formed or continuous formed corner reinforcement.
- .12 At masonry walls abutting or passing concrete, install anchors at 400 mm o.c. vertically.
- .13 Provide minimum 16 mm mortar coverage at exterior face and 12 mm at interior faces.
- .14 Field Bending:
  - .1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.
  - .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
  - .3 Replace bars and connectors which develop cracks or splits.

### **3.12 INSTALLATION OF MASONRY CONNECTORS**

- .1 Install masonry connectors in accordance with CSA A370.
- .2 Comply with fastener manufacturer's recommendations for edge distance in applicable substrates. Do not fasten into mortar joints of masonry backup.
- .3 Install top row of masonry connectors not more than one-half of typical tie spacing below top of veneer panels.
- .4 Ensure that connectors installed over or through sheathing are adequately fastened to studs or other structural framing.

### **3.13 INSTALLATION OF MASONRY VENEER ANCHORS**

- .1 Install the first row masonry veneer anchorage 200 mm above ledger angle or sill. Install the next row 400 mm above the first row of masonry veneer anchorage. Install the next row and all succeeding rows, except for the top rows of masonry veneer anchorage, at 600 mm oc vertically. Install the top row of masonry veneer anchorage at 200 mm below the top row of masonry veneer and 400 mm above the second to last row of masonry veneer anchorage. Install the rest of the masonry veneer anchorage at 600 mm or 800 mm oc horizontally.



- .2 To masonry veneer walls (masonry veneer facing with concrete block back-up), install shear connector ties in concrete block backup, at spacings noted above. Set into mortar bed in accordance with manufacturer's instructions.
- .3 Install RAP ties to face of sheathing and steel stud backup and concrete backup, after air/vapour barrier has been installed. Install ties using stainless steel screws, 2 screws per tie, with the screws penetrating through air/vapour barrier and sheathing into steel studs or into concrete backup minimum 38 mm. Seal around screw holes as required to maintain air barrier. Install ties at spacings noted above.
- .4 After insulation has been installed, install insulation retaining polyethylene insulation supports by slipping them over the end of the tie and pressing them firmly into insulation. Install vee ties through holes to match level of masonry veneer joint.
- .5 Use Vee ties of proper length to ensure that the turned out ends of the tie are located in the centre of the masonry + 13 mm. Use more than one length of Vee tie as required.
- .6 Install corrugated ties to interior locations where masonry veneer is installed directly in front of concrete block. Install at 400 mm oc each way.
- .7 Place additional masonry ties so that there is a tie not more than 100 mm from edge of wall panel or openings.
- .8 Where masonry veneer occurs on both sides of concrete block back-up, stagger anchors on either side of wall so that they occur at least one vertical block joint apart.

### **3.14 INSTALLATION OF FLASHING**

- .1 Install flashing under exterior masonry walls and as indicated on drawings.
- .2 Extend flashings through brick veneer, turn up minimum 200 mm on back up substrate.
- .3 Secure butyl rubber flashing to back up substrate with adhesive [as detailed on drawings].
- .4 Lap joints 150 mm and seal with adhesive.

### **3.15 INSTALLATION OF ACCESSORIES**

- .1 Control Joints: install continuous control joint fillers as indicated on drawings.
- .2 Cavity Vents:
  - .1 Install vents in vertical joints immediately over flashing and near tops of walls, in exterior wythes of cavity wall construction at 600 mm o.c. horizontally.
  - .2 Do not install vent tubes in control or expansion joints. Refer to Section 07 92 00 for venting of control and expansion joints.

**3.16 BOND BEAMS**

- .1 Form full length bond beams (tie beams) to the top of all concrete block walls and elsewhere as indicated. Unless otherwise indicated, form with bond beam block units, 200 mm high. Fill with concrete and reinforce as as noted on the structural drawings.
- .2 Reinforcement: use two 15M bars unless otherwise indicated. Continue reinforcement around corners. (Bend bars, or use 600 x 600 mm corner bars). Lap bars 300 mm minimum.
- .3 Form bond beam under bearing to all block bearing walls.
- .4 Install ring beams to elevator shafts as detailed.

**3.17 VERTICAL CORE FILL**

- .1 Concrete fill cores of concrete blocks, where indicated. Concrete fill all cores of concrete blocks, in walls over 3 metres in height and all reinforced cores of concrete block walls under 3 metres in height. Concrete-fill all cores at parapets; trowel tops smooth and flush with top of block, to provide solid backing for air/vapour barrier membrane.
- .2 Fill voids in concrete block with concrete solid to foundation where bearing for steel, concrete beams or lintels occur; reinforce as detailed.
- .3 Include reinforcement as indicated.
- .4 Where core fill and reinforcement is indicated, the cores must be in acceptable vertical alignment. Obtain Consultant's acceptance prior to construction.
- .5 Use full mortar bedding of the cross webs of the cores to be filled, when webs are in line vertically.
- .6 Fill cores in lifts of 1.2 m maximum. If a lift of more than 1.2 m is approved, provide clean-out openings. If cores contain reinforcement, do any core filling which is more than 2.4 m in height in 1.2 m maximum lifts, unless approved otherwise.
- .7 Provide clean-outs at the bottom of each lift for all cells being filled. The inside of these cells are to be free of all debris or obstructions. Clean-outs not permitted where both faces of wall are visible.
- .8 Consolidate the core fill during placing by vibration or puddling. Repeat after excess moisture has been absorbed, while fill is still plastic.
- .9 Fix reinforcement rigidly in position in centre of cores or with 19 mm cover to sides and face of bars.
- .10 Secure vertical reinforcement in position at top and bottom, and at intervals of 200 diameters of the steel.
- .11 Stop concrete fill 50 mm below top surface of lift wherever filling is stopped for more than one hour.

- .12 Provide 1-15M vertical reinforcing at the following locations:
  - .1 At ends of walls, including where walls butt into dissimilar walls or columns.
  - .2 At each side of openings, extending minimum 200 mm beyond opening.
  - .3 All corners under plates requiring bearing.
  - .4 At each side of control joints.
  - .5 At 1200 mm oc along the length of all non-load bearing walls under 3 metres in height.
  - .6 Where otherwise shown on the Drawings.
- .13 Provide 1-15M reinforcing and core fill where all fixings for fixtures and other work built into and fixed to block work, including brackets, bearers, bolts and inserts and all other cells containing reinforcing bars.. Support all horizontal concrete filled cores with expanded metal or other acceptable grout stop in bed joints below.
- .14 Core fill behind recessed mounted items to maintain integrity of fire separations to the satisfaction of the Authority Having Jurisdiction.

### **3.18 REINFORCED LINTELS**

- .1 Form concrete block lintels over openings as shown and where required, using lintel blocks. Provide lintels with a minimum bearing equal to their depth on walls at ends, where not otherwise detailed. Support rigidly during construction. Fill with concrete.
- .2 Refer to structural drawings for reinforcement sizes and placement.
- .3 Where not shown otherwise, reinforce lintels as follows:
  - .1 Openings up to 1200 mm Depth 200 mm - 2 - # 15M bottom.
  - .2 Openings 1200 mm to 2400 mm Depth 400 mm - 2 - # 15M top & bottom.
  - .3 Openings 2400 mm to 3600 mm Depth 600 mm - 2 - # 15M top & bottom.
  - .4 Openings 3600 mm to 4400 mm Depth 800 mm - 2 - # 20M top & bottom.
  - .5 Extend all lintels, reinforcement and concrete 400 mm past edge of openings (both sides).

### **3.19 MORTAR FILL FOR ANCHORS AND TIES**

- .1 Where RAP tiles or welded anchors are required to tie masonry walls to concrete or steel columns or to concrete block back up, fill cores solid with mortar so that ties and anchors are fully bedded.

### 3.20 THROUGH-WALL FLASHING

- .1 Install where indicated.
- .2 Install over all door and window heads to exterior walls, masonry veneer support angles, and concrete ledges.
- .3 At openings, extend flashing 200 mm beyond jambs.
- .4 Apply continuous membrane flashing over all ledger angles or supporting sills, extending flashing up behind exterior sheathing membrane, and up vertical surface minimum 200 mm. Coordinate installation of flashing with installation of air/vapour barrier membrane specified in Section 07 27 13, so that sheathing membrane weather laps over membrane flashing to provide a weather tight installation and to maintain continuity of the membrane. Extend flashing horizontally over ledger angle or supporting sill, stopping maximum 10 mm from horizontal leg of ledger angle or supporting sill.
- .5 Install sheet metal membrane support for through wall flashing at locations where flashing is not supported on solid backing; coordinate with Section 07 27 13.
- .6 Use a manufacturer's approved primer to locations where flashing is to be adhered.
- .7 Where through-wall flashing occurs at the location of an adjacent roof flashing, leave a continuous 200 mm wide strip hanging out from joint to act as roof membrane counter flashing.
- .8 Lap and fully adhere all joints and cuts. Use an approved primer where required. Add adhered 'patches' at cuts at changes of direction, or lap separate pieces.
- .9 At locations where flashing will not be covered or built in within two weeks, temporarily secure the flashings which are to hang out as counter-flashings.
- .10 Install metal flashing to masonry veneer work as detailed on the drawings, brakeformed to shapes as specified in Section 07 62 00. Continuously overlap metal flashing with membrane flashing minimum 50 mm and seal membrane flashing to metal flashing.
- .11 Ensure that membrane flashing is not visible in the completed construction.

### 3.21 CONTROL JOINTS (EXTERIOR)

- .1 Where 'control joint' is noted on the drawings, including around knock-out panels form a complete vertical break through the whole wall (backing and facing). Install rubber control joint (see Part 2) in grooves of sash block.
- .2 Where joints are not indicated on the drawings, obtain joint layout from the Consultant.
- .3 Stop control joint at bond beams (tie beams). Stop horizontal reinforcement at control joints.
- .4 Form exposed joints free of mortar.

- .5 Form joints to same width as regular jointing.

### **3.22 CONTROL JOINTS (INTERIOR)**

- .1 Form interior control joints at 10 m maximum apart to unbroken walls more than 12 m long (walls continuing over door heads are 'unbroken'). Use cross shape rubber insert in grooved-end block, concrete-filled joint core with bond break membrane to one side, or other method acceptable to the Consultant.
- .2 Confirm with Consultant for locations, if they are not identified on the drawings.

### **3.23 INSTALLATION OF METAL SUPPORT ANGLES**

- .1 Install lateral support to each side of non-load bearing concrete block where partition abuts underside of structure above, as detailed on the structural drawings.
- .2 Use screw type fasteners at 300 mm o.c. for fixing into structure above.
- .3 Allow 25 mm live load deflection space between top of non-load bearing block and structure above, or as indicated on drawing.
- .4 Fill deflection space with firestop and smoke seal as specified in Section 07 84 00, as required to maintain fire rating of wall. To non rated walls, install 'fire safing insulation' in deflection space.

### **3.24 CUTTING AND FITTING**

- .1 Fit and cut chases for piping, conduits, ducts, and sleeves. Install grounds, blocking, inserts, etc., as required.
- .2 Cut, fit, drill, patch and repair disrupted finishes for other trades.
- .3 Cut and fit block around structural framing leaving 25 mm space all around. In fire rated walls, fill space with fire stopping and smoke seal as specified in Section 07 84 00. In all other walls, fill space with fire safing insulation.
- .4 Obtain Consultant's acceptance before cutting any part which may impair appearance or strength of the work.

### **3.25 MASONRY VENEER WORK**

- .1 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.
- .2 Point all exposed work. Select units at site for matching texture, colour, appearance, size and bond; with no exposed cut-faces, spalls, chips, cracks, cavities or other defects; with no mortar stains, and to match accepted sample panel.
- .3 All joints to be in straight lines, level, 10 mm thick.

- .4 Keep cavity free from mortar droppings. Remove excessive mortar blockages as directed by the Consultant.
- .5 Masonry Veneer vents:
  - .1 Provide masonry veneer vents at top and bottom of cavity, at 600 mm o.c.
  - .2 Locate vents at 600 mm on centre above foundation walls, ledger angles, loose lintels, and wherever flashings occur. These vents act also as weep holes.
- .6 Leave a 5 mm space under masonry veneer support ledger angles. Leave space and joint clear of mortar, for caulking.
- .7 Install concrete block types, textures and colours as noted on the drawings.

### **3.26 CAVITY DIVISIONS**

- .1 Form vertical cavity divisions at corners, and 3000 mm from each outer corner. Construct divisions airtight.
- .2 Install cavity division rod to completely seal void between insulation and back side of masonry veneer. Install continuously between masonry veneer shelf angles or base of masonry veneer and underside of shelf angles above.
- .3 Alternatively, apply 100 mm wide strip of the cavity wall rigid insulation using compatible adhesive, to seal cavity. As the masonry veneer facing is built, use mortar to complete the seal between the masonry veneer and the insulation as necessary.
- .4 Cavity divisions are required to maintain still air in the cavity under high wind conditions.

### **3.27 EXISTING WORK ALTERATIONS**

- .1 Provide for making good and patching of work in existing building including cutting and patching for Mechanical and Electrical trades, whenever required, in accordance with good workmanship. Use materials to match existing.
- .2 Refer to Section 01 73 50 and take into account all items which usually fall under the scope of work of this Section.

### **3.28 PROVISIONS FOR OTHER TRADES**

- .1 Provide openings in masonry walls where required or indicated.
- .2 Locate chases and openings, and neatly finish to required sizes.
- .3 Where masonry encloses conduit or piping, do not cover any pipe or conduit chases or enclosures until advised that work has been inspected and tested.

**3.29 BUILT IN WORK**

- .1 Build in frames, steel lintels, sleeves, anchor bolts, anchors, nailing strips and other items to be built into masonry.
- .2 Bed anchors of frames in mortar and completely fill frame voids with mortar as wall is erected. To exterior walls, fill voids with foam-in-place insulation as specified in Section 07 21 19.
- .3 Build in access panels supplied by Mechanical and Electrical Contractor in locations directed by them. Install plumb and square.
- .4 Be responsible for protection and maintenance of built-in items supplied by others.

**3.30 CUTTING AND FITTING**

- .1 Fit and cut chases for piping, conduits, ducts, and sleeves. Install grounds, blocking, inserts, etc., as required.
- .2 Do all cutting, fitting, drilling, patching and making good for other trades.
- .3 Obtain the Owner's approval before cutting any part which may impair appearance or strength of the work.

**3.31 CLEANING**

- .1 Remove excess mortar and smears that remain, using wood paddles or scrapers. Leave interior areas broom clean.
- .2 Clean and wash masonry surfaces with masonry manufacturer's approved solution using only fibre brushes. Clean a trial area and obtain Owner's approval before proceeding.
- .3 Where block is to be painted, prepare suitable surface.
- .4 Remove mortar droppings, broken units, and debris resulting from the work of this Section, from the site as work proceeds.
- .5 Point or replace defective mortar to match adjacent work.
- .6 Clean and wash surfaces using a non-acid cleaning solution of type which will not harm constructed masonry. Use non-metallic tools (preferably fibre brushes) in cleaning operations. Clean a trial test area and obtain approval from the Consultant before proceeding.
- .7 In accordance with Section 01 74 19, Waste Management and Disposal, promptly remove from job site and divert from landfill mortar droppings, broken units, and waste resulting from work of this Section.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 Installation of anchor bolts for column base plates: Section 03300.
- .2 Finish painting of structural steel: Section 09912.

**1.3 REFERENCE DOCUMENTS**

- .1 Provide metal fabrications in accordance with the following standards (latest revision) except where specified otherwise.
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A108-07 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  - .2 ASTM F1554-07 Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength
  - .3 ASTM A325-10 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - .4 ASTM A490-11 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA):
  - .1 CISC/CPMA 1-73a A Quick Drying One-Coat Paint for use on Structural Steel
  - .2 CISC/CPMA 2-75 A Quick Drying Primer for use on Structural Steel
- .4 Canadian Standards Association (CSA):
  - .1 CAN/CSA-G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels



- .2 CAN/CSA-G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
- .3 CAN/CSA-S16-09 Design of Steel Structures
- .4 CSA S136-07 Design of Cold-Formed Steel Structural Members
- .5 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures
- .6 CSA W59-03 (R2008) Welded Steel Construction (Metal Arc Welding)
- .5 Master Painters Institute:
  - .1 Master Painters Institute Green Performance Standard GPS-1-08
- .6 The Society for Protective Coatings (SSPC):
  - .1 SSPC SP 3-2004 Power Tool Cleaning
  - .2 SSPC SP-6-2007 Commercial Blast Cleaning

#### **1.4 DESIGN CRITERIA**

- .1 Design connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with requirements of Alberta Building Code, CAN/CSA S16 and CSA S136.

#### **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Where structural steel is scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Division 09, Painting and Finishing Schedules, and product meets MPI GPS-1-08 standard for maximum allowable VOC content.

#### **1.6 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and data sheet in accordance with Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings and product data prior to commencement of fabrication.

- .2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
- .3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a specialty structural engineer registered in the Province of Alberta.

.3 **Manufacturer Reports:**

- .1 Submit three copies of certified mill test reports for the materials used.

**1.7 QUALITY ASSURANCE**

- .1 Comply with applicable requirements of CAN/CSA S16 and CAN/CSA S136.
- .2 Do welding in accordance with CSA W59.
- .3 Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

**1.8 QUALIFICATIONS**

- .1 Structural steel fabricator shall have minimum five (5) years experience in the fabrication of structural steel.
- .2 Structural steel erector shall have minimum five (5) years experience in the erection of structural steel.
- .3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
- .4 Welding procedures, welders, and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

**1.9 EXAMINATIONS**

- .1 Examine and verify all measurements and dimensions critical to the work of this contract.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Steel: Structural quality, to CAN/CSA G40.20.
- .2 Rolled Structural Steel Sections: to CAN/CSA G40.21, Type W, grade 350 shop primed

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- .3 Hollow Structural Steel Sections: to CAN/CSA G40.21, Type W, grade350 shop primed
- .4 Cold Rolled Sections: Conforming to CAN/CSA S136 with yield strength of 380 Mpa.
- .5 Bolts: to ASTM A325
- .6 Anchor Bolts: Conforming to ASTM F1554
- .7 Welding Materials: Conforming to CSA W59.
- .8 Shear Stud Connectors: to ASTM A108.
- .9 Galvanizing: Conforming to CSA G164; minimum 600 grams per square metre coating.
- .10 Shop Paint Primer: to CISC/CPMA 2-75 meeting requirements of MPI GPS-1-08 standard for VOC content.
- .11 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GS-11, Paints and Coatings, for VOC content to be less than 250 g/l.

## **2.2 DESIGN**

- .1 Unless otherwise noted, connections and trusses shall be designed by the Specialty Structural Engineer to the reference Standards.
- .2 Connections of the type and detail shown on the drawings shall be used. Modifications to the specified connection types and details will not be permitted without prior approval from the Owner.
- .3 The following connections, and any connections so noted on the structural drawings, shall be designed as slip critical and shall be pre-tensioned:
  - .1 Trusses.
  - .2 Elements resisting crane loads.
  - .3 Connections for supports of running machines or other live loads that produce impact or cyclic loads.
  - .4 Connections where bolts are subject to repeated tensile loads.
  - .5 Connections using slotted holes in the direction of the load or oversize holes unless specifically designed to accommodate movement.
- .4 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections, but shall be pre-tensioned.

- .5 Other bolted connections may be snug tight.
- .6 Use standard connection types where connections are not detailed on the structural drawings.
- .7 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. Provide a minimum of two (2) 19 mm (3/4") diameter A325 bolts or an equivalent weld for all beam to girder and beam to column connections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.
- .8 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Owner. The cost for such testing shall be borne by the Contractor.
- .9 Provide stiffeners in beam webs at all locations where beams pass over supports. Unless noted otherwise in the structural drawings, web stiffeners shall be 10 mm minimum.
- .10 Provide separators for all double members in accordance with CSA S16.

### **2.3 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA S16 and CSA S136.
- .2 Camber steel members as indicated on drawings.
- .3 Shop weld shear stud connectors with automatic stud welding equipment. Thoroughly clean surface to which studs are to be welded. Ensure stud stem is perpendicular to surface to which it is attached.

### **2.4 SURFACE PREPARATION AND SHOP PRIMING**

- .1 Where structural steel is scheduled to be finish painted, prepare surfaces in accordance with Steel Structures Painting Council, SP-3 – Power Tool Cleaning
- .2 Apply shop paint primer in accordance with CAN/CSA S16 and manufacturer's instructions to a dry film thickness of 50 to 75 micrometers.

## **3. EXECUTION**

### **3.1 ERECTION**

- .1 Erect structural steel in accordance with CAN/CSA S16, CSA W59, and CSA S136.
- .2 Structural steel erector is fully responsible for erection methods, equipment, workmanship, and safety precautions.

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- .3 Obtain Owner's approval prior to field cutting or altering of members.
- .4 Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

**1.3 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A108-07 Standard Specifications for Steel Bars, Carbon, Cold-Finished, Standard Quality
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers' Association (CPMA)CISC/CPMA 2-75A quick Drying Primer for use on Structural Steel.
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steels
  - .2 CAN/CSA-S16-09 Design of Steel Structures
  - .3 CSA S136-07 Design of Cold-Formed Steel Structural Members
  - .4 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures
  - .5 CSA W59-03 (R2008) Welded Steel Construction (Metal Arc Welding)
- .4 Master Painters Institute:
  - .1 Master Painters Institute Green Performance Standard GPS-1-08
- .5 The Society for Protective Coatings (SSPC):
  - .1 SSPC SP -3-2004 Power Tool Cleaning
  - .2 SSPC SP-6 Commercial Blast Cleaning

**1.4 DESIGN CRITERIA**

- .1 Design members, connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with dimensions [and loadings] indicated on drawings, and requirements of Alberta Building Code, CAN/CSA S16 and CSA S136, the Canadian Institute of Steel Construction (CISC) “Code of Standard Practice for Buildings” and “Steel Joist Facts”.
- .2 The deflection due to live load shall not exceed 1/360 of the span unless noted otherwise on the drawings.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Where structural steel is scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Division 09, Painting and Finishing Schedules, and product meets MPI GPS-1-08 standard for maximum allowable VOC content.

**1.6 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings and product data prior to commencement of fabrication.
  - .2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
  - .3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a professional engineer registered in the Province of Alberta.
- .3 Test and Evaluation Reports
  - .1 Owner may appoint and pay for services of testing agency to perform testing and inspection of work of this Section.
  - .2 Notify Owner prior to commencement of fabrication work so that testing and inspection may be properly scheduled.
  - .3 When defects are revealed, Owner may request additional testing and inspection at Contractor's expense.

- .4 Manufacturer Reports:
  - .1 Submit three copies of certified mill test reports for the materials used.

**1.7 QUALITY ASSURANCE**

- .1 Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

**1.8 QUALIFICATIONS**

- .1 Open web steel joist fabricator shall have minimum five (5) years experience in the fabrication of open web steel joists.
- .2 Steel Joist erector shall have minimum five (5) years experience in the erection of open web steel joists.
- .3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
- .4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

**1.9 EXAMINATIONS**

- .1 Examine and verify all measurements critical to the work of this contract.

**1.10 SUBMITTALS**

- .1 The Contractor shall submit, before starting work, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.
- .2 The Contractor shall submit, before starting work, written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.
- .3 When requested, submit copies of mill test reports properly correlated to the materials used on the project.
- .4 Provide a schedule of fabrication to the Owner and Testing Agency prior to the commencement of the fabrication.

**1.11 SHOP DRAWINGS**

- .1 Submit shop drawings and product data prior to commencement of fabrication.
- .2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.



- .3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a specialty structural engineer registered in the Province of Alberta.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Steel: structural quality to CAN/CSA G40.20 and CAN/CSA G40.21.
- .2 Welding Materials: to CSA W59.
- .3 Shop Paint Primer: to CISC/CPMA 2-75 meeting requirements of MPI GPS-1-08 standard for VOC content.
- .4 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GS-11, for VOC content to be less than 250 g/l.

### **2.2 DESIGN**

- .1 Unless otherwise noted open web steel joists shall be designed by the Specialty Structural Engineer to the reference Standards.
- .2 Design joists of the depth and spacing shown on the drawings to carry the loads shown on the drawings in accordance with CSA S16.
- .3 Design of bridging for steel joists shall conform to the requirements of CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.
- .4 Joists shall have a live load deflection of less than  $1/360$  of the span unless noted otherwise.
- .5 Line up openings and webs in adjacent joists to allow for passage of pipe, ducts, conduits, etc. Make allowance in joist design for support of pipes, ducts, conduits, etc.
- .6 Where joists frame into both sides of a support, extend the top chord of the joists to the center of the support, unless shown otherwise.
- .7 Where joists frame into one side of a support, extend the top chord of the joists to the far side of the support, unless shown otherwise.

### **2.3 FABRICATION**

- .1 Fabricate steel joists and accessories in accordance with CAN/CSA S16 and CSA S136.
- .2 Camber joists to dead load deflection indicated on drawings.
- .3 Drill holes in chords where necessary for attachment of wood nailers. Weld threaded studs to top chord for attachment of wood nailers. Make allowance for the reduction in cross sectional area of tension flanges.

- .4 Fabricate top and bottom chord extensions where indicated. Provide ceiling support extensions to bottom chord as required to support ceiling construction.

**2.4 SURFACE PREPARATION AND SHOP PRIMING**

- .1 Where steel joists are scheduled to be finish painted, prepare surfaces in accordance with Steel Structures Painting Council, SP-3 Power Tool Cleaning
- .2 Apply shop paint primer in accordance with CAN/CSA S16 and manufacturer's instructions to a dry film thickness of 50 to 75 micrometers.

**3. EXECUTION**

**3.1 ERECTION**

- .1 The steel joist erector is fully responsible for erection methods, equipment, workmanship and safety precautions.
- .2 Steel joists shall bear on beams as per section 2.2, but in no case shall be less than 65 mm on supporting steel members. Connect to supporting steel with a 5 mm x 30 mm long fillet weld at each side. Secure to bearing plates on masonry walls in the same manner, bearing 100 mm minimum.
- .3 Erect steel joists and bridging in accordance with CAN/CSA S16, CSA W59 and CSA S136.
- .4 Obtain Owner's approval prior to field cutting or altering of joists or bridging.
- .5 Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 Structural Steel Framing - Section 05120.
- .2 Open Web Steel Joists - Section 05210.

**1.3 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A653/A653M 09 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .2 Canadian Standards Association (CSA):
  - .1 CAN/CSA-S16-01 Consolidation (R2007) Limit States Design of Steel Structures (Includes Update No. 3, August 2006), and Supplement No. 1 (2005)
  - .2 CSA W47.1-03 (R2008) Certification of Companies for Fusion Welding of Steel Structures
  - .3 CSA W59-M1989 (R2008) Welded Steel Construction (Metal Arc Welding)

**1.4 REQUIREMENTS**

- .1 Comply with applicable requirements of CSA S136.
- .2 Except where otherwise specified, comply with applicable requirements of Canadian Sheet Steel Building Institute standards.
- .3 Do welding in accordance with CSA W59.

**1.5 DESIGN CRITERIA**

- .1 Design of metal decking shall be in accordance with CSA S136.
- .2 Design deck to safely support loads shown on drawings.

- .3 Deck units shall be continuous over three or more spans where possible.
- .4 Live load deflection shall not exceed 1/360 of span for roofs and 1/360 of span for floors.

## **1.6 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Submittal Procedures.
- .2 Shop drawings:
  - .1 Indicate decking plan, joints, anchorages, supports, projections, opening and reinforcement, details and accessories.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Sheet Steel: to ASTM A653M, zinc coated to Z275 coating designation.
- .2 Touch-Up Primer for Galvanized Steel: zinc-rich, organic, ready mixed, to CAN/CGSB 1.181-99
- .3 Acoustic Insulation: fibrous type, profiled to suit deck flutes.
- .4 Acoustic Closures: 25 mm tick, closed cell foam rubber, profiled to deck corrugations.

### **2.2 DECK AND RELATED ACCESSORIES**

- .1 Roof Deck: 0.91 mm thickness base sheet steel Z275 zinc coating, 38 mm deep profile.
- .2 Floor Deck: 0.91 mm thickness base sheet steel, Z275 zinc coating, 38 mm deep profile, ribbed vertical webs.
- .3 Closure Strips, Flashing, Cover Plates: 0.76 mm minimum thickness base sheet steel, Z275 zinc coating, or required profiles and sizes.

## **3. EXECUTION**

### **3.1 FABRICATION**

- .1 Fabricate deck sections to CSA S136, Canadian Sheet Steel Building Institute (CSSBI) and to dimensions indicated on drawings.
- .2 Provide a male and female lip for each section of steel deck.

### **3.2 INSTALLATION - GENERAL**

- .1 Reinforce steel deck openings shown on the drawings unless otherwise noted.
- .2 Reinforce openings up to 450 mm in any dimension with 50 x 50 x 6 mm steel angles. Place angles at right angles to ribs and weld to a minimum of two flutes each side of opening.
- .3 Install decking according to design sheet widths and depths. Correct sheet spread during installations.
- .4 Locate all end joints over support. Lap all end joints on non-cellular deck 50 mm minimum.
- .5 Minimum end bearing on steel supports shall be equal to the depth of the deck.
- .6 Wire brush, clean and touch-up welds and scarred areas on top surface of metal decking with touch-up primer.

### **3.3 ROOF DECK INSTALLATION**

- .1 Fasten roof deck to all supports as per drawings
- .2 Mechanically fasten side laps as per drawings.
- .3 Install 150 mm minimum width continuous cover plates where deck changes direction. Weld or screw in place at 300 mm on centre maximum.
- .4 Install angle or channel closures full length on all deck edges at perimeter, walls and openings.
- .5 Install acoustical closures over walls and partitions.
- .6 Fasten deck to provide structural diaphragm in accordance with requirements shown on drawings.

### **3.4 FLOOR AND DECK INSTALLATION**

- .1 Lap end joints on non-cellular deck 50 mm minimum. Butt ends of cellular deck. Install steel cover plates over open joints greater than 3 mm.
- .2 Fasten to all supports as per drawings.
- .3 Mechanically fasten sidelaps as per drawings.
- .4 Install angles, closure strips and flashing, extended to top concrete slab to contain wet concrete, at all deck edges around perimeter, at openings, at columns, etc. Use adequate metal thickness to maintain wet concrete in place without distortion.
- .5 Install acoustical closures over all walls and partitions.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 REFERENCE DOCUMENTS**

- .1 Meet or exceed requirements of:
  - .1 CSA S136-94, Cold Formed Steel Structural Members, and
  - .2 CAN/CGSB-7.1-M86, Cold Formed Steel Framing Components.

**1.3 DESCRIPTION OF SYSTEM**

- .1 Provide wall stud framing system consisting of the following components:
  - .1 Studs.
  - .2 Top and bottom tracks.
  - .3 Bridging and bracing.
  - .4 Top and bottom track connections to main structure, including fabrications to accommodate main structure deflections.
  - .5 Head, sill and jamb members at wall openings.
  - .6 Framing component connections.

**1.4 SUBMITTALS**

- .1 Comply with requirements of Division 1.
- .2 Submit certified copies of mill reports covering chemical and mechanical properties, and coating designation of steel used for this project.
- .3 Submit shop drawings detailing anchorage and framing connections. Indicate type, size and spacing of fastening devices.

- .4 Submit product data for mechanical fasteners, indicating sizes, shear, and pull-over loading capacity where applicable. Provide data indicating thickness and type of corrosion protection coating.
- .5 Submit product data indicating suitability of explosive powder actuated fasteners for application.
- .6 Submit evidence of welder qualifications specified in this Section.

**1.5 WELDER QUALIFICATIONS**

- .1 Welding shall be by company certified by the Canadian Welding Bureau to CSA W47.1-92, Certification of Companies for Fusion Welding of Steel Structures.

**1.6 INSPECTION BY CONSULTANT**

- .1 Provide minimum 72 hours notice to Consultant prior to commencement of work of this Section.
- .2 Do not conceal stud system until inspected by Consultant.

**2. PRODUCTS**

**2.1 FRAMING MEMBERS**

- .1 Cold-formed Sheet Steel: to ASTM A653M-96. Thicknesses of framing members specified or indicated on drawings is exclusive of galvanized coating.
- .2 Configuration and Cutouts: to CAN/CGSB-7.1-M86, centres of cutouts shall be minimum 300 mm from stud ends.
- .3 Galvanized Zinc Coating: to ASTM A653M-96, minimum Z275 coating.
- .4 Bridging and Bracing: as indicated on drawings.
- .5 Colour Coding: in accordance with Lightweight Steel Framing Manual, published by Canadian Sheet Steel Building Institute, 1988 edition.
- .6 Stud Sizes and Spacing: as indicated in Stud Schedule at end of this Section.
- .7 Bottom Track Sizes: as indicated in Track Schedule at end of this Section.
- .8 Top Track Sizes: as indicated in Track Schedule at end of this Section.

**2.2 ANCHORING DEVICES**

- .1 Drilled Inserts: steel, cadmium plated or hot-dip galvanized, sizes as indicated on drawings.

- .2 Bolts and nuts: to ASTM A307-94, sizes as indicated on drawings, with large flat type steel washers, sized to suit fasteners, hot-dip galvanized.
- .3 Explosive Powder Actuated Fasteners: as recommended by manufacturer for the application, subject to approval by Consultant.

### **2.3 FRAMING CONNECTION DEVICES**

- .1 Screws: self-drilling and tapping, sizes as indicated on drawings, and as follows:
  - .1 Material: stainless steel or steel with minimum 0.008 mm cadmium or zinc coating.
  - .2 Head Profile: hex, pan, and low-profile type.
  - .3 Length: adequate to penetrate not less than 3 fully exposed threads beyond joined materials.
- .2 Welding Electrodes: minimum tensile strength series of 480 MPa, suitable for material being welded.

### **2.4 ACCESSORIES**

- .1 Touch-up Paint: zinc-rich, to CAN/CGSB-1.181-92.

## **3. EXECUTION**

### **3.1 ERECTION**

- .1 Provide continuous top and bottom tracks.
- .2 Space studs at 600 mm on centres as indicated in Metal Stud System Schedule. Coordinate spacing with panel products to be applied against framing.
- .3 Cut members using saw or shear. Flame cutting is not permitted.
- .4 Except as indicated otherwise on drawings, provide double studs at wall openings greater than stud space in width, and at door and window jambs. Locate studs not more than 50 mm from each side of openings.
- .5 Provide minimum of two studs at corners.
- .6 Provide cross-studs secured to studs, and additional framing as required for support of fixtures mounted to walls.
- .7 After erection, refinish damaged finishes, welds, fastener heads and nuts with zinc-rich paint, in accordance with paint manufacturer's instructions.



**3.2 ANCHORAGE AND CONNECTIONS**

- .1 Securely anchor metal stud systems to main structure with fasteners spaced at maximum 600 mm on center, and located not more than 50 mm from track ends. Unless otherwise indicated, anchor components as follows:
  - .1 To concrete with drilled inserts.
  - .2 To steel with screws, welds, explosive powder actuated fasteners, or bolts as detailed on drawings.
- .2 Install powder actuated fasteners in accordance with manufacturer's instructions, strictly observing minimum recommended edge distances for the applicable substrate.
- .3 Connect framing members using bolts, screws or welds, and as detailed on drawings.
- .4 Use wafer head screws or welds where panel products will be installed against fastening devices.
- .5 Do welding in accordance with ANSI/AWS D1.3-89 - Structural Welding Code - Sheet Steel.

**3.3 ERECTION TOLERANCES**

- .1 Out of Plumb: maximum 1/500 of member length.
- .2 Track Camber: maximum 1/1000 of member length.
- .3 Gap Between End of Studs and Web of Tracks: maximum 4 mm.
- .4 Stud Spacing: plus or minus 3 mm from specified spacing. Cumulative error in spacing shall not exceed requirements for applied panel products.

**3.4 STUD SCHEDULE**

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Location	Designation	Yield Fy (MPa)	Stud Spacing (mm)
Interior Walls	600 S162-43	230	600 or as identified on drawings

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**3.5 TRACK SCHEDULE**

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Location	Bottom Track	Top Track
Interior Walls	600 T162-43 (Fy= 230 MPa)	600 MST162-43 (Fy= 230 MPa)

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**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 Masonry connectors: Section 04200.
- .2 Steel fabrications: Section 05500.

**1.3 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A53/A53M-07 Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
  - .2 ASTM A269-08 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - .3 ASTM 307-07b Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - .4 ASTM A108 Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
  - .5 ASTM A276 Specification for Stainless Steel Bars and Shapes
  - .6 ASTM A325M Specification for High-Strength Bolts for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.105-M91 Quick-Drying Primer
  - .2 CAN/CGSB 1.40-97 Anti corrosive Structural Steel Alkyd Primer
  - .3 CAN/CGSB 1.181-99 Ready Mixed, Organic Zinc Rich Coating

- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-G40.20/ G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels
  - .2 CAN/CSA G164-M92(R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
  - .3 CAN/CSA S16.1-94 (R2000) Limit States Design of Steel Structures
  - .4 CSA W48 06 Filler Metals and Allied Materials for Metal Arc Welding (Developed in co operation with the Canadian Welding Bureau)
  - .5 CSA W55.3-08 Certification of companies for resistance welding of steel and aluminum
  - .6 CSA W59-03(R2008) Welded Steel Construction (Metal Arc Welding) (Imperial Version)
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA):
  - .1 CISC/CPMA 2-75 A Quick Drying Primer for use on Structural Steel
- .5 Master Painters Institute:
  - .1 Master Painters Institute Green Performance Standard GPS-1-08
- .6 The Society for Protective Coatings (SSPC):
  - .1 SSPC SP 6 / NACE No. 3 [00] Commercial Blast Cleaning
- .7 Steel Structures Painting Council:
  - .1 Surface Preparation Standards, latest editions

**1.4 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION**

- .1 Supply following products for installation under other Sections:
  - .1 Anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support of fabricated steel components.
  - .2 Fabricated steel components to be built into concrete and masonry.
- .2 Supply instructions and templates as required for accurate setting of inserts and components.

**1.5 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures clearly indicating:
    - .1 Components
    - .2 Core metal thicknesses
    - .3 Finishes
    - .4 Dimensions
    - .5 Fabrication details
    - .6 Installation details
  - .2 Certificates:
    - .1 Submit Certificate of welder qualifications specified in this Section. .3 Details of CSA welding certification of the fabricator at least 30 days prior to fabrication.

**1.6 DESIGN**

- .1 Design details and connections and fabricate in accordance with the requirements of CAN/CSA-S16 to resist forces, moments and shears as indicated. Fabricate work of this Section using a fabricator certified in accordance with CSA W47.1.
- .2 Where forces, moments and shears are not indicated, design connections for not less than 50% of the resistance of the member.
- .3 For standard connections, select details from CISC Handbook of Steel Construction to ensure adequacy, unless detailed otherwise.
- .4 Design and fabricate stairs, landings handrails and balustrades to conform with the requirements of the Alberta Building Code.

**1.7 COORDINATION WITH OTHER TRADES**

- .1 Supply necessary instructions, templates and drawings to other trades for setting anchor bolts and other members that are to be built in with Work of other trades. Assist in placing. Supply necessary materials before building in, at the correct time.

**1.8 FIELD QUALITY CONTROL**

- .1 If considered necessary by the Consultant, an independent testing laboratory will carry out inspection and testing of the materials and workmanship as designated by the Consultant.

**1.9 QUALITY ASSURANCE**

- .1 Qualifications of Welders:
  - .1 Welding of load supporting components shall be performed by companies certified by Canadian Welding Bureau in accordance with CSA W47.1.
  - .2 Welders shall be qualified by Canadian Welding Bureau for classification of Work being performed.
- .2 Workmanship Standards:
  - .1 Resistance Welding: to CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .2 Fusion welding: to CSA W59, Welded Steel Construction (Metal Arc Welding).

**1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Inspect each shipment of material and timely replace any damaged materials.
- .2 Unload, handle, and store materials in accordance with the manufacturer's written instructions. Do not damage the metal fabrications or shop-applied coatings. Do not store metal fabrications in direct contact with the ground.
- .3 Delivery and Acceptance Requirements:
  - .1 Schedule delivery of components to site to coincide with installation of this work.
- .4 Storage and Handling Requirements:
  - .1 Store components to prevent damage and distortion.
  - .2 Protect finishes from scratches and soiling.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21-04, Grade 300W.
- .2 Deformed steel bars: of billet steel to CSA G30.18-04, grade 300.
- .3 Bolts and nuts: to ASTM A307, hot dip galvanized.
- .4 Shop Paint Primer: to CISC/CPMA 2-75 or CAN/CGSB-1.105 meeting requirements of MPI GPS-1-08 standard for VOC content.

- .5 Zinc rich paint on exterior applications: to CAN/CGSB-1.181 meeting requirements of MPI GPS-1-08 standard for VOC content.
- .6 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GC-03, for VOC content to be less than 250 g/l.
- .7 Isolation coating: acid and alkali resistant asphaltic paint.

**2.2 FABRICATION**

- .1 Employ a fabricator certified by the Canadian Welding Bureau in accordance with CSA-W47.1, Division 3, unless specified otherwise.
- .2 Fabricate in accordance with CAN/CSA-S16. Perform welding in accordance with CSA-W59 using welding electrodes in accordance with CSA-W48. Control and minimize distortion, and include stress relief measures to minimize residual stresses.
- .3 Do not conduct welding operations when the ambient temperature is below 0°C, or when the base metal temperature is below 0°C. Preheat and maintain the base metal at a minimum temperature of 25°C during welding.
- .4 Accurately fabricate metal fabrications true to line and free from warps, twists, bends, and open joints. Reject metal fabrications that have sharp kinks or bends.
- .5 Use approved dies or bending rolls for bends. When heating is required, avoid overheating the metal and use cooling methods that do not alter the original properties of the metal.
- .6 Do not carry out metal fabrications with welds other than those specified in the Contract Documents unless authorized by the Minister.
- .7 Structural steel may be gas-cut in accordance with the applicable portions of CAN/CSA-S16. Do not flame-cut any material without the authorization of the Minister.
- .8 Provide bolted connections in accordance with the applicable clauses of CAN/CSA S16.
- .9 Provide holes for fasteners that are not more than 2 mm larger than the nominal diameter of bolts unless otherwise specified in the Contract Documents. Where the thickness of the material is greater than the nominal diameter of the bolt, sub-punch and ream or sub-drill and ream, or drill the holes for the fasteners. Poor matching of holes will be cause for rejection of the item of work.
- .10 Shop fabricate components where possible.
- .11 Fabricate components square, straight, true, free from warpage and other defects. Accurately cut, machine, file and fit joints, corners, copes and mitres.
- .12 Exposed joints and connections shall be tight, flush and smooth unless otherwise indicated.

- .13 Where work of other Sections is to be attached to work of this Section, prepare work by drilling and tapping holes as required to facilitate installation of such work.
- .14 Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation.

**2.3 SURFACE PREPARATION**

- .1 Thoroughly clean and suitably pretreat steel prior to finishing.
- .2 Remove loose mill scale, rust, oil, grease, dirt and other foreign matter using one or more of the following methods: SSPC-SP No. 6 Commercial Blast Cleaning. Followed by SSPC-SPN01, Solvent Cleaning.
- .3 Grind smooth sharp projections.

**2.4 FINISHES**

- .1 Refer to "Schedule of Components" for component finishes. Unless otherwise indicated apply prime paint finish to unscheduled components.
- .2 Prime Paint:
  - .1 Shop apply one coat of prime paint to components prior to assembly.
  - .2 Apply primer to properly prepared surfaces at temperature above 7° C to a dry film thickness of 50 to 75 micrometers.
  - .3 Leave surfaces to be welded unpainted.
- .3 Galvanized:
  - .1 Hot-dip galvanize metal fabrications, except stainless steel and aluminium items and steel items completely encased in concrete, in accordance with CAN/CSA-G164. Employ measures to minimize distortions due to galvanizing. Locate vent holes so they are not readily visible after the item is installed. Galvanize all items after fabrication, except parts that are bolted together are to be galvanized before final assembly.
  - .2 Minimum zinc coating of 600 g/m<sup>2</sup>
  - .3 Where size permits galvanize components after assembly.
- .4 Zinc Rich Paint:
  - .1 Clean metal in accordance with surface preparation requirements of CAN/CGSB 1.181.



- .2 Apply one coat of zinc rich paint to all surfaces exposed after assembly to minimum dry film thickness of 60 micrometres. Apply coating immediately after cleaning.

.5 Isolation Coating:

- .1 Apply an isolation coating to contact surfaces of following components in contact with cementitious materials and dissimilar metals except stainless steel: (1) exterior components (2) interior components exposed to high humidity conditions.

**2.5 ANGLE LINTELS**

- .1 Provide angle lintels and ledger angles with anchors or bolts, as indicated.

**2.6 HANDRAILS AND GUARDRAILS**

- .1 Fabricate and install all steel handrails, guardrails and balustrades as detailed, including to ramps and stairs and elsewhere as indicated. Accurately and uniform fabricate all components. Fabricate all handrails, guard rails and balustrades to Alberta Building Code requirements.
- .2 Attach railing to the top of balustrades as detailed.
- .3 Where wall-mounted handrails are indicated, provide handrails and/or brackets as detailed.
- .4 Cap ends of tube rails with 3 mm steel plate, welded and grind smooth.

**2.7 ANCHOR BOLTS, LAG SCREWS, ETC.**

- .1 Provide anchor bolts, bolts, bolt washers and nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, etc. where required and where indicated.

**2.8 MISCELLANEOUS ITEMS**

- .1 Fabricate and install all metal fabrications in connection with elevator.
- .2 Fabricate all other metal fabrication items or miscellaneous metal items required to complete the project.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Do not tack weld to aid fabrication or installation without authorization from the Minister
- .2 Perform repairs to welds or base metal by grinding or arc-air gouging followed by grinding. Do not use flame gouging or oxygen gouging.

- .3 Shop assemble matching parts of metal fabrications to verify the correctness of fabrication and matching of component parts. If required by the Minister, assemble the component parts at the Site prior to installation.
- .4 Accurately align and install metalwork true to the lines, grades, slopes, and elevations specified in the Contract Documents, and obtain proper matching of adjacent surfaces.
- .5 Install anchors and anchor bolts such that, after placement of the concrete, their position is within 3 mm of their specified location, and within 2 mm of their specified location with respect to other anchors and anchor bolts, which are to be subsequently connected to the same piece of metalwork. Provide templates for proper location of anchor bolts for equipment.
- .6 Securely anchor components in place. Unless otherwise indicated, anchor components as follows:
  - .1 To concrete and solid masonry with expansion shields and bolts.
  - .2 To hollow construction with toggle bolts.
  - .3 To thin metal with screws or bolts.
  - .4 To thick metal with bolts or by welding.
  - .5 To wood with bolts for heavy and medium duty fastenings; with screws for light duty fastenings.
- .7 After installation, site clean and refinish damaged finishes, welds, bolt heads and nuts. Refinish with primer or zinc rich paint to match original finish.

### **3.2 REPAIR OF DAMAGED GALVANIZED COATING**

- .1 Repair damaged galvanized surfaces with a zinc-rich paint that is in accordance with CAN/CGSB-1.181.
- .2 Power tool clean surfaces to be repaired to a bright metal surface. Apply multiple coats of zinc-rich paint in accordance with the manufacturer's written instructions to obtain a minimum dry film thickness of 50 microns or greater where required by the paint manufacturer.

### **3.3 LOCATIONS**

- .1 A comprehensive schedule of items is not included. Check Architectural and Structural drawings and specification to obtain all items and quantities.

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions of the Contract and all Sections of Division 00 and 01, shall form an integral part of the requirements of this Section.
- .2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.
- .3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other sections.

**1.2 RELATED SECTIONS**

- .1 Setting anchor bolts in concrete forms: Section 03300.
- .2 Concrete fill in landing and stair pans: Section 03300.

**1.3 DESIGN**

- .1 All stairs and landing sections, attachments and connections, except where members are specifically sized on the drawings shall be designed to support a minimum live load of 4.8kN/m<sup>2</sup>.
- .2 The design, detailing and fabrication shall be in accordance with CAN/CSA-S16.1.

**1.4 REQUIREMENTS**

- .1 Do welding work to CSA W59. Provide and make available on site a copy of referenced standard

**1.5 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A53/A53M-07 Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
  - .2 ASTM A269-08 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - .3 ASTM A307-07b Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.105-M91 Quick-Drying Primer
  - .2 CAN/CGSB 1.40-97 Anti corrosive Structural Steel Alkyd Primer

- .3 CAN/CGSB 1.181-99 Ready Mixed, Organic Zinc Rich Coating
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-G40.20/ G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels
  - .2 CAN/CSA S16.1-94 (R2000) Limit States Design of Steel Structures
  - .3 CSA W59-03(R2008) Welded Steel Construction (Metal Arc Welding) (Imperial Version)
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA):
  - .1 CISC/CPMA 2-75 A Quick Drying Primer for use on Structural Steel
- .5 Master Painters Institute:
  - .1 Master Painters Institute Green Performance Standard GPS-1-08
- .6 The Society for Protective Coatings (SSPC):
  - .1 SSPC SP 6/NACE No. 3 [00] Commercial Blast Cleaning

## 1.6 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Clearly indicate construction details, sizes of steel sections, thickness or guage of steel sheet, profiles, attachments, dimensions and field joints.

## 2. PRODUCTS

### 2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA G40.21 Type 300W.
- .2 Welding materials: to CSA W59.
- .3 Shop Paint Primer:[to CISC/CPMA 2-75 or CAN/CGSB-1.105 meeting requirements of MPI GPS-1-08 standard for VOC content.
- .4 Zinc rich paint on exterior applications: to CAN/CGSB-1.181 meeting requirements of MPI GPS-1-08 standard for VOC content.
- .5 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GC-03, for VOC content to be less than 250 g/l.

**2.2 FABRICATION**

- .1 Weld or bolt all connections.
- .2 Accurately form connections with exposed faces flush, mitres and joints tight.
- .3 Grind or file exposed welds and steel sections smooth.

**2.3 STEEL PAN STAIRS**

- .1 Stair shall be closed riser steel pan construction.
- .2 Form treads and risers from 3 mm steel plate. Secure treads and risers to angle chairs vertically and horizontally, which in turn are welded to stringers.
- .3 Provide clip angles for fastening of furring channels, where an applied finish is indicated for soffits.

**2.4 SHOP PAINTING**

- .1 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7°C.
- .2 Surfaces to be embedded in concrete shall not be painted.
- .3 Apply two coats of primer to parts inaccessible after final assembly. Apply one coat of primer to exposed stair surfaces.

**3. EXECUTION**

**3.1 INSTALLATION OF STAIRS**

- .1 Install staircases plumb and true in exact locations, using welded connections wherever possible to provide a rigid structure.
- .2 Provide all necessary anchors, bolts and plates as required for connecting stairs to the structure.
- .3 Touchup and make good any damage to priming coat.
- .4 Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SUMMARY**

- .1 Provide shop fabricated architectural woodwork in accordance with requirements of the Contract Documents.

### **1.2 REFERENCE STANDARDS**

- .1 Architectural Woodwork Standards referenced in this Section form the basis of the quality standards for materials and installation; materials standards and grading authorities referenced in this Section and listed in the Architectural Woodwork Standard are applicable where specifically referenced and are considered to form a part of and be applicable to this Section.
- .2 Architectural Woodwork Manufacturing Association of Canada (AWMAC):
  - .1 AWMAC Architectural Woodwork Standards, 1<sup>st</sup> Edition

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Architectural woodwork Trade Contractor and the Construction Manager are jointly responsible for the following items:
  - .1 Coordinate delivery of shop drawings to local AWMAC Chapter Office for review before starting any work of this Section as required by Guaranteed Inspection Service (GIS); incorporate review comments into shop drawings submitted to Consultant.
  - .2 Coordinate delivery of casework components at a time when building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in moisture content.
  - .3 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that interior casework can be supported and installed including; but not limited to, the following:
    - .1 Metal support brackets and fittings that are part of building structure
    - .2 Plumbing, electrical fixtures and telephone equipment

### **1.4 SUBMITTALS**

- .1 Product Data: Submit for Consultant's action. Furnish each type of product including hardware and panel accessories, adhesive materials, laminates, veneers and accessories to be used in the Work.
  - .1 Submit product data for each type of product indicated including, but not limited to, the following:

- .1 Cabinet hardware and accessories
  - .2 Finishing materials and processes
  - .3 Manufactured hardboard, medium density fibreboard
  - .4 High pressure decorative laminate and adhesive for bonding decorative laminate
  - .5 Low pressure decorative laminate
- .2 Shop Drawings: Submit for Consultant's action. Furnish shop drawings indicating location of each item referenced to actual site dimensions, dimensioned plans and elevations, large scale detailed and thickness of materials, attachment devices, scribe strip locations, locations of exposed fastenings and other components as applicable to work of this section.
- .3 Samples: Submit for Consultant's action. Submit two (2) samples prior to fabrication of casework as follows; accepted samples will form the standard of acceptance for the remainder of the work:
- .1 High Pressure Decorative Laminate Clad Panel Products: Laid-up on specified core material, 300 mm x 300 mm for each type, colour, pattern, and surface finish.
  - .2 Low Pressure Decorative Overlay (Melamine) Surfaced Panel Products: Laid-up on specified core material, 300 mm x 300mm for each type, colour, pattern and surface finish.
  - .3 Exposed Cabinet Fasteners, Hardware and Accessories: One unit for each type.
- .4 Certificates: Submit for Consultant's information. Furnish certified test reports for the following.
- .5 Project Closeout Submissions: Submit for Consultant's action. Submit three (3) copies of Project Record Sheet identifying the following:
- .1 Project title and address
  - .2 Owner, Consultant, Construction Manager, and casework Trade Contractor
  - .3 Materials and finishes used for casework and whether shop finished or site finished and by whom
  - .4 Type and source of cabinet hardware and any specialty items used under casework

- .6 Quality Control Submittals: Submit for Consultant's action. Provide proof of qualifications:
  - .1 Project Quality Standard: Architectural Woodwork Standard (AWS) published by the Architectural Woodwork Manufacturers Association of Canada, together with authorized additions and amendments will be used as a reference standard and forms part of this project specification, and as follows:
    - .1 Modifications made in this Section that change the requirements of the AWS will govern in case of conflict.
    - .2 References to Economy, Custom or Premium Grade in this specification are as defined in the AWS; any item not given a specific quality grade will be Premium Grade as defined in the AWS.
    - .3 Provide a copy of the AWS for reference purposes on the job site.
    - .4 References in this specification to part and item numbers mean those parts and items contained within the AWS.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver woodwork materials only when building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy level during the remainder of the construction period, as follows:
  - .1 Deliver, store, and handle casework in accordance with AWS Section 2 Care and Storage
  - .2 Delivered materials that are damaged in any way or do not comply with these specifications will be rejected by the Consultant; remove rejected materials from job site and replace with acceptable materials.

## 1.6 SITE CONDITIONS

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.
- .2 Established Dimensions: Establish dimensions and proceed with fabricating casework without confirmed site measurements where site measurements cannot be made without delaying the Work; coordinate with the construction to ensure that actual dimensions correspond to establish dimensions; allow for trimming and fitting.



- .3 Ambient Conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWS for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.

## 1.7 WARRANTY

- .1 Term of Special Warranty: Provide a two (2) year Maintenance Bond or an AWMAC Guaranty Certificate as follows:
  - .1 Maintenance Bond: Provide a maintenance bond to the full value of the casework for this Project, certifying that the casework has been manufactured and installed in accordance with the standards incorporated in the AWS.
  - .2 Guaranty Certificate: Owner will accept the AWMAC guaranty certificate from AWMAC members in good standing at the time of bidding through to Project completion instead of the maintenance bond.
  - .3 The maintenance bond or guaranty certificate shall cover replacing, reworking or refinishing to make good defects in casework arising from faulty workmanship or defective materials supplied that become apparent during a two (2) year period following the date of Substantial Performance for the Project.

## 1.8 MAINTENANCE

- .1 Maintenance Manuals: Submit for Owner's documentation. Furnish complete manuals describing the materials, and procedures to be followed in cleaning and maintaining the Work. Include manufacturer's brochures and lists describing actual materials used in the Work, including metal alloys, finishes, hardware and other major component.

## 2 PRODUCT

### 2.1 MATERIALS

- .1 Use clean stock for each type of woodwork and quality grade specified in accordance with AWS.
- .2 Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 8% moisture content
- .3 Anchors: Select material, type, size, and finish required for each substrate for secure anchorage:
  - .1 Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

- .2 Provide toothed steel or lead expansion sleeves for drilled-in-place anchors.
- .4 Panel Materials: Provide panel materials meeting requirements for moisture content and Premium Grade in accordance with AWS Section 4, and as follows:
  - .1 Industrial Particleboard: Meeting ANSI 208.1 Grade M-2 for interior use, minimum 720 kg/m<sup>3</sup> density; clearly mark panels with grade mark in visible location; extruded particleboard having loose cores with voids will not be permitted; having no added urea formaldehyde. **Particleboard is only permitted for use in cabinet doors. Veneer to be A1 quality white birch.**
  - .2 Decorative Hardwood: Birch, cut and finish as indicated for clear finish.
  - .3 Medium Density Fibreboard (MDF): Meeting ASTM D1037 and ANSI A208.2, Premium Grade for interior use, minimum 700 kg/m<sup>3</sup> density; formaldehyde emissions shall be 0.30 µm or less per 0.424 m<sup>2</sup>/m<sup>3</sup> of room volume.
  - .4 Hardboard: Meeting CAN/CGSB-11.3, Type 2, minimum density 500 kg/m<sup>3</sup>, tempered hardboard (Masonite), 6mm nominal thickness unless noted otherwise, one face smooth finish; colour as selected by Consultant from manufacturer's full range.
  - .5 Softwood Plywood to applicable CSA standards referenced in AWMAC Manual, G2S.
  - .6 Hardwood Plywood to CSA-O11, Graded in Accordance with the Official Grading Rules for Canadian Hardwood Plywood.
- .5 Decorative Laminate Finishes: Grades and applications in accordance with AWS Section 4, and as follows:
  - .1 High Pressure Decorative Laminate (HPDL): Meeting CAN3 A172 or ANSI/NEMA LD3 composed of phenolic resin impregnated Kraft paper filler stock for Class 1 Decorative Laminate of Grade required by woodwork quality standard; Colour indicated as PLAM-2 on Interior Materials Finish Legend on Drawing A1402 and as follows:
    - .1 Self-Edging Work: General Purpose Grade, HGS standard duty.
    - .2 Liner Sheet Work: Same as for self-edging work.
    - .3 Backing Sheet Work: BKL backing material, thickness as recommended by manufacturer to prevent warpage of surfaces, sanded on one side; furniture finish, colour as selected by Consultant.
  - .2 Adhesives:
    - .1 Decorative laminate: polyvinyl acetate or aliphatic resin in accordance with manufacturer's recommendation for curing under pressure for bonding to wood cores, water resistant type.
    - .2 Edge banding: Thermoplastic hot melt, synthetic resin suitable for applying thin veneer wood edge banding and film overlays.

## 2.2 ACCESSORIES

- .1 Casework Hardware: Provide cabinet hardware described in this Section in quantity required, with necessary screws, bolts, washers for complete installation.
  - .1 Fasteners:
    - .1 Draw Bolt Fasteners: Mitre butt joint fastener, adjustable and requiring no special tools for installation, galvanized.
    - .2 Non-exposed Fasteners: Fabricators choice consistent with quality level specified.
    - .3 Exposed Fasteners: Architectural appearance, material, finish and fasteners tool type as selected by Consultant; coordinate sample submittals before ordering materials.
  - .2 Pulls:
    - .1 Wire Pulls: stainless steel wire pulls with nominal 100 mm centres and back plates to prevent pull out:
      - .1 Acceptable Materials:
        - .1 CBH 220-101
        - .2 Häfele America Co. 115.61.601
        - .3 Hettich Canada LP Columbus 41, 1170 122 40€320
        - .4 Richelieu, Collection BP 33205170
        - .5 Stanley 4484 x 101
  - .3 Drawer Slides: Following list of drawer slides is provided to indicate general conformance requirements only; notify the Consultant where drawer width, height or intended use differs from that indicated in the general descriptions and the requirements of the manufacturer; coordinate sample submittals before ordering materials:
    - .1 Low Height Drawers ( $\leq 150\text{mm}$ ): 3/4 extension, rail mount, length to suit drawer box, 406mm maximum drawer width, 22 kg capacity, side mounting with positive stop and hold-in detent features, black finish:
      - .1 Acceptable Materials:
        - .1 Accuride 2037
        - .2 Hettich Canada LP KA3434
        - .3 Häfele America Co.
        - .4 Knappe & Vogt 8150
      - .2 High Height Drawers ( $\geq 150\text{mm}$ ,  $\leq 305\text{mm}$ ): Full extension, length to suit drawer box; 406mm maximum drawer width, 45 kg capacity, side mounting with positive stop, self-closing, hold-in detent and silencer features, zinc finish:
        - .1 Acceptable Materials:
          - .1 Accuride 3834
          - .2 Hettich Canada LP KA5632

- .3 Knappe & Vogt 8400
- .3 Lateral File Drawers: Heavy duty type, 25mm over-travel extension, sequential sliding, hand-rail lift-off disconnect, length to suit drawer box; side mounted, 1067mm maximum drawer width, 91 kg capacity, rating based on 50,000 cycle test; clear zinc finish:
  - .1 Acceptable Materials:
    - .1 Accuride 3640
    - .2 Hettich Canada LP KA4620
    - .3 Knappe & Vogt 8805
- .4 Hinges:
  - .1 Typical Cabinet Doors: Concealed, euro-style hinge with cover caps; fully adjustable for overlay, depth, height and closing force; opening angle of 100°; self-closing feature; nickel plated steel construction; overlay and half overlay mounting, size and profile to suit cabinet construction:
    - .1 Basis of Design: Hettich Canada LP Selektta 2000 series
    - .2 Include soft-close hardware add-ons.
- .5 Shelf Rests:
  - .1 Recessed mounted pilaster with clips: Nickel plated, surface mounted steel standards mounted 150mm from top & bottom, one support for each 305mm of standard
    - .1 Acceptable Materials
      - .1 Knappe & Vogt 255/256
      - .2 Richelieu 2552G/CP2562G
      - .3 Hettich Canada LP 00120
- .2 Locks: Cabinet locks, keyed alike within each room.
- .3 Door Catches: on pairs of locked cabinet doors, magnetic not acceptable.
- .4 Sealant: 1 part silicone to CAN/CGSB-19.13, non-staining, mold and mildew resistant, colour: to match plastic laminate, refer to Section 07900.
- .5 Steel Supports: Refer to Section 05500 and as detailed.
- .6 Hardware: Bolts, nuts, washers, screws, etc., hot-dip heavy zinc-coated.

### 2.3 CASEWORK FABRICATION

- .1 Fabricate casework in accordance with requirements of Section 10 of AWS as applicable and as modified by this Section and Drawings.
- .2 Casework for clear Finish:
  - .1 AWMAC Quality Grade Custom
  - .2 Exposed Exterior Parts:
    - .1 Core: A1 White Birch Plywood
    - .2 Finish: clear, prefinished

- .3 Exposed Interior Parts:
    - .1 Core: A1 White Birch Plywood
    - .2 Finish: clear, same as for exposed exterior parts
  - .4 Semi-Exposed Parts:
    - .1 Core: A1 White Birch Plywood
    - .2 Finish: clear, prefinished
  - .5 Concealed Parts:
    - .1 Core: A1 White Birch Plywood
    - .2 Finish: clear, prefinished
  - .6 Edge Banding for Shelves: Finished on all four (4) edges; PVC Banding: 3mm PVC banding with exposed edges and corners machine profiled to 3mm radius; colour to match with surface finish
  - .7 Edge Banding for Doors, Drawers and False Fronts: Finished on all four (4) edges PVC Banding: 3 mm PVC banding with exposed edges and corners machine profiled to 3mm radius; colour to match with surface finish
  - .8 Edge Banding Adhesive: Thermoplastic hot melt, synthetic resin suitable for applying thin veneer wood edge banding and film overlays. PVC edging for visible edges.
- .3 Fabricate doors and drawer fronts using flush overlay; fabricate drawers in accordance with AWS requirements for Grade and Species.
- .4 Casework for High and Low Pressure Decorative Laminate Finish:
- .1 AWMAC Quality Grade Custom
  - .2 Exposed Exterior Parts:
    - .1 Core: Plywood
    - .2 Finish: HPDL
  - .3 Exposed Interior Parts:
    - .1 Core: Plywood
    - .2 Finish: Same as for exposed exterior parts
  - .4 Semi-Exposed Parts:
    - .1 Core: Plywood
    - .2 Finish: at option of fabricator for balanced finish
  - .5 Concealed Parts:
    - .1 Core: Same as Semi-Exposed Parts
    - .2 Finish: Backer Grade HPDL at option of fabricator for balanced finish
  - .6 Edge Banding for Shelves: Finished on all four (4) edges; PVC Banding: 3mm PVC banding with exposed edges and corners machine profiled to 3mm radius; colour to match with surface finish
  - .7 Edge Banding for Doors, Drawers and False Fronts: Finished on all four (4) edges PVC Banding: 3mm PVC banding with exposed edges and corners machine profiled to 3mm radius; colour to match with surface finish

- .8 Edge Banding Adhesive: Thermoplastic hot melt, synthetic resin suitable for applying thin veneer wood edge banding and film overlays. PVC edging for visible edges.
- .5 Laminate Countertops and Backsplashes: Construct countertops and backsplashes in accordance with requirements of Section 11 AWS and as follows:
  - .1 Core: Plywood with non-telegraphing grain, except that countertops and backsplashes at sinks and wet areas have water resistant plywood cores; no exceptions in accordance with CSA A172.
  - .2 Backsplash Edge Style: as detailed.
- .6 Construct casework using minimum core thickness for materials listed in this section; adjust thickness of shelves to allow for uniformly distributed loading of 90 kg with a concentrated load of 23 kg and length for maximum of L/140 deflection in full use:
  - .1 Assemble casework with flush butt hairline corners and joints; make cut outs for services on site during installation
  - .2 Carefully fit, cope or mitre joints and glue with no end wood visible on finished surfaces; unless specifically detailed on Drawings as decorative exposed plywood cores
  - .3 Make blocking, framing, web frames from solid lumber
  - .4 Provide solid wood edge strips in doors and cases to receive hardware; rebate and pressure glue to core
  - .5 Cut and adapt casework to receive hardware; install finishing hardware and fittings in shop, except that fittings that may be susceptible for damage during shipping and installation may be installed after casework is installed on site
- .7 Glue, dowel, mortise, lock joint or dado casework; do not use staples; nailing and screws are acceptable; do not surface nail or screw through countertops:
  - .1 Set nail heads in finished surfaces; countersink screws and bolts; unless specifically detailed on Drawings as being exposed; fill holes with edge grain

### 3 EXECUTION

#### 3.1 EXAMINATION

- .1 Visit site and note state of completion within various areas in which casework is being installed; verify that surfaces are ready to receive work of this Section and that other work is finished and painted before being built-over or covered in any way by installed casework:
  - .1 Verify that areas in which casework is scheduled area finished and ready to accept work of this Section; with walls painted, ceilings finished, overhead services completed, tested and accepted.
  - .2 Starting work will be considered as acceptance of conditions.

### 3.2 PREPARATION

- .1 Confirm access is sufficient for large pieces of casework, and that they can be transported easily and safely to final installation location.
- .2 Protect adjacent finished surfaces and materials from damage by work of this Section.
- .3 Back prime casework immediately after delivery to site.

### 3.3 INSTALLATION

- .1 Install casework plumb, level and true to locations indicated on Drawings and in accordance with AWS.
- .2 Anchor to floor, walls or ceiling using fastening devices and hardware consistent with materials being fastened into and quality of finish, and as follows:
  - .1 Do not use wood plugs
  - .2 Do not use plastic plugs for ceiling or walls
  - .3 Provide wall cleats fastened to wall blocking as required
  - .4 Shim level and square in relation to adjoining surfaces
  - .5 Scribe accurately to adjacent work
  - .6 Provide allowance for finish flooring installation to base by related sections of work
  - .7 Set on steel support framing; coordinate fabrication requirements with Section 05500
- .3 Scribe neatly and accurately to smooth snug fit with adjoining surfaces and materials to align work properly; mitre corners accurately.
- .4 Perform cutting, fitting, repairing in woodwork as required by other trades where their Work is connected to or part of this Work.
- .5 Cut out openings for mechanical and electrical fittings and fixtures; coordinate and cooperate with mechanical and electrical work and obtain required templates, cutting locations and dimensions.
- .6 Apply neat bead of sealant between plumbing fixtures countertops and adjoining walls and casework; seal edges of cut out core material before fixtures installed with moisture resistant compound.
- .7 Install any finishing hardware shipped loose.
- .8 Install countertop to casework units; coordinate schedule and delivery requirements to meet the construction schedule.

**3.4 CLOSEOUT ACTIVITIES**

- .1 Deficient Work: Replace, rework or refinish work that does not meet AWS requirements as directed by Consultant and as required to obtain AWMAC GIS at no additional cost to Owner.
- .2 Adjusting: Adjust hardware and operating parts during and after installation to provide smooth and proper operation of casework components.
- .3 Cleaning: Clean casework, cabinets, countertops, shelves and fixtures, and remove marks, scratches or marring on exposed and semi-exposed surfaces after work of this Section is complete and prior to Substantial Performance for the project.

**END OF SECTION**



**1. GENERAL**

**1.1 LEED REQUIREMENTS**

- .1 No requirements for this project.

**1.2 DESIGN REQUIREMENTS**

- .1 Conform to listed requirements to maintain the continuity of fire separations whether or not shown on the drawings.
- .2 Do not support non-combustible construction on or from combustible construction.
- .3 Firestop all openings and joints in fire rated construction with non-combustible material specified in Section 07 84 00 where a fire separation or assembly is required to be of non-combustible construction and terminates at the exterior wall, the underside of floor, ceiling, or roof structures, and at floors.
- .4 Do not use combustible members, fastenings, and similar items to anchor fixtures to fire separations.
- .5 Firestop openings for non-combustible pipes and ducts to prevent the passage of smoke and flame; Subcontractors shall be responsible for installing firestopping where their work passes through a fire separation, the opening shall be plugged with ULC labelled and approved firestopping sealant, insulation or other material approved by local Authorities Having Jurisdiction to maintain the integrity of the fire separations.
- .6 Do not pierce fire separations with electrical or similar service outlets except in accordance with the Building Code.
- .7 Existing fire separations must be maintained as such, and any cutting must be sealed to retain the separation's assembly rating.
- .8 Refer to the technical sections for specific requirements for sealing penetrations and joints of smoke and fire separations.

**1.3 FIRE TEST RESPONSE CHARACTERISTICS**

- .1 Provide materials and construction identical to those tested in assembly indicated according to CAN/ULC S101 for assemblies or materials having fire resistance ratings, as verified by an independent testing and inspecting agency acceptable to Authorities Having Jurisdiction for fire resistance ratings of specific assemblies indicated on drawings.

- .2 Fire resistance rated assemblies and materials shall bear a label and proof of acceptance as indicated by design designations from ULC List of Equipment and Materials or Warnock Hersey-Intertek Directory of Listed Products. Where no design designation is provided, use only time assigned to materials listed in the Building Code.
  
- .3 Fire resistance rated assemblies and materials will only be accepted from an organization recognized by the Authority Having Jurisdiction as being capable of conducting testing and providing labelling for materials, assemblies and systems that include, but are not limited to, the following organizations:
  - .1 Underwriters Laboratories of Canada (ULC).
  - .2 Underwriters Laboratories Inc. (UL).
  - .3 Intertek-Warnock Hersey (I/WH) ETL Semko
  - .4 Acceptance of UL or WHI labels are subject to the following conditions:
    - .1 Fire resistance rated assemblies and materials bearing an Underwriter's Laboratories Inc. (UL) or Intertek-Warnock Hersey (I/WH) label will be acceptable for use on this project provided that the label indicates acceptance under Underwriters Laboratories of Canada (ULC) and having either a cUL, cULus, cI/WH or cI/WHus marking.
    - .2 Materials that only have a UL, ULus, I/WH or I/WHus marking will not be acceptable.
  
  - .5 Examples of acceptable marks from Recognized Testing Authorities.

**END OF SECTION**

**1. GENERAL**

1.1 Provide building insulation in accordance with requirements of the Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C1303, Standard Test Method for Estimating the Long-Term Change in the Thermal Resistance of Unfaced Rigid Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions
  - .2 ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  - .3 ASTM D2842, Standard Test Methods for Water Absorption of Rigid Cellular Plastics
  - .4 ASTM D5113, Standard Test Method for Determining Adhesive Attack on Rigid Cellular Polystyrene Foam
- .2 Canadian General Standards Board (CGSB):
  - .1 CGSB 71-GP-24M, Adhesive, Flexible, for Bonding Cellular Polystyrene
- .3 Underwriters Laboratories Canada (ULC):
  - .1 CAN/ULC S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - .2 CAN/ULC S114, Test for Determination of Non-Combustibility in Building Materials
  - .3 CAN/ULC S129, Standard Method of Test for Smoulder Resistance of Insulation (Basket Method)
  - .4 CAN/ULC S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering
  - .5 CAN/ULC S702.2, Thermal Insulation, Mineral Fibre, for Buildings
  - .6 CAN/ULC S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced
  - .7 CAN/ULC S770, Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams
  - .8 CAN/ULC S773, Thermal Insulation Terminology

**1.3 SUBMITTALS**

- .1 Product Data: Submit for Consultant's action. Furnish each type of product and accessories to be used in the Work; before starting work of this section.
- .2 Manufacturer's literature, specifications and installation instructions describing general properties of each material and accessory used in the Work.

## 1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: Provide insulation products that meet or contain less than the regulated limits for Ozone Depletion Potential compounds listed in the Montreal Protocol adopted by the United Nations Environmental Program.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Handling Requirements:
  - .1 Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

## 2. PRODUCTS

### 2.1 MATERIALS - PLASTIC INSULATION

- .1 Wall Insulation: Extruded Polystyrene Board: ASTM C578, Type IV. Rigid closed-cell polystyrene foam board. ASTM C518, thermal conductivity of "k" = 0.20 Btu in./hr. ft.<sup>2</sup> degrees F (0.029 W/m oC) at 75 degrees F (24 degrees C), when fully aged at 5 years. ASTM D1621, 25 psi (172 kPa) compressive strength. ASTM E96/E96M water vapor permeance rating of maximum 1.1 perm (57.2 ng/Pa s m<sup>2</sup>). Provide manufacturer's standard sizes in thickness and thermal resistance "R" values indicated.
  - .1 Acceptable Materials:
    - .1 Dow Chemical Co. "Styrofoam Cavitymate Plus or Square Edge"
    - .2 Owens-Corning "Foamular 250"
  - .2 Foundation Wall Insulation: Polystyrene, extruded type, in accordance with CAN/ULC S701, Type 4, thermal resistance not less than RSI 0.87/25 mm; square edges, board size 610 mm x 2440 mm x thickness indicated on Drawings; minimum compressive strength 170 kPa at 10% deformation in accordance with ASTM D1621, water absorption (% by volume) maximum 0.7% in conformation with ASTM D2842:
    - .1 Dow Styrofoam SM
    - .2 Owens-Corning Foamular 250
  - .3 Load Bearing Insulation: Polystyrene, high density extruded type in accordance with CAN/ULC S701, Type 4, thermal resistance not less than RSI 0.87/25 mm; square edges, board size 610 mm x 2440 mm x thickness as indicated on Drawings; minimum compressive strength 410 kPa at 5% deformation in accordance with ASTM D1621, water absorption (% by volume) maximum 0.7% in conformation with ASTM D2842:
    - .1 Dow Styrofoam, Hiload 40
    - .2 Owens-Corning, Foamular 400

## 2.2 MATERIALS - CONCRETE FACED PLASTIC INSULATION

- .1 Concrete-Faced Extruded Polystyrene Board: ASTM C578, Type VI. Rigid closed-cell polystyrene foam board with tongue-and-groove edges and integral protective topping of nominal 25 mm thick latex modified concrete, specifically manufactured for use in protected membrane roofing systems. Nominal 54 kg/m<sup>2</sup> weight. Insulation rated for ASTM C518 thermal conductivity of “k”= 0.20 Btu in./hr. ft.<sup>2</sup> F (0.029 W/m C) at 75F (24 C), when fully aged at 5 years, ASTM D1621, 276 kPa compressive strength, and ASTM E96 water vapour permeance rating of maximum 1.1 perm (57.2 ng/Pa s m<sup>2</sup>). Nominal 610 x 1220 x 150 mm or largest practical size.
  - .1 Hydrotech Membrane Corp. “HeavyHydroguard”
  - .2 T. Clear Corp. “HeavyGuard”

## 2.3 MATERIALS – WALL INSULATION

- .1 Fibrous Mineral Wall Insulation: Unfaced, preformed rigid fibrous mineral slag board insulation in accordance with CAN/ULC S702, Type 1, thermal resistance not less than RSI 0.76/25 mm; rated non-combustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 72 kg/m<sup>3</sup>; square edges, board size 406 mm x 1220 mm x thickness indicated on Drawings:
  - .1 Acceptable Materials:
    - .1 Fibrex CWB 45
    - .2 Roxul CavityRock

## 2.4 MATERIALS – SPRAY INSULATION

- .1 Spray Applied Polyurethane Foam Insulation: two-component, spray-applied polyurethane foam that creates a seamless, monolithic barrier against water vapour and air, and allows for use on substrates as low as -1°C (30°F). Meets ULC S705.1 and ULC S705.2; Air Leakage Rate: Maximum 0.02 L/s-m<sup>2</sup> at 75 Pa; Thermal Resistance: Nominal RSI 1.15/25 mm in accordance with ASTM C177 and ULC S770; Density: ASTM D1622 Nominal 42 kg/m<sup>3</sup>; Open Cell Content: 6% in accordance with ASTM 6226; Ozone Depletion Potential: Zero
  - .1 Dow STYROFOAM Brand SPF CA Insulation

## 2.5 MATERIALS – POLYISOCYANURATE INSULATION

- .1 Polyisocyanurate Wall Insulation: Foil faced polyisocyanurate, preformed rigid insulation in accordance with CAN/ULC S704, Type 1, Class 2 having LTTR

- .2 RSI  $\geq 1.05/25$  mm; with Flame Spread/Smoke Density Classification  $<100/<450$  in accordance with CAN/ULC S102; square edges, board size to manufacturers maximum standard x thickness indicated on Drawings:
  - .1 Atlas Energy Shield
  - .2 IKO Enerfoil ISO
  - .3 Johns Mansville AP Foil Faced

## **2.6 MATERIALS IN OTHER SECTIONS**

- .1 Roof Insulation: Refer to roofing section, insulation types specific to roofing are specified as a part of roof system requirements.

## **2.7 ACCESSORIES**

- .1 Insulation Fasteners:
  - .1 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38 mm diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate, and as follows:
    - .1 Basis-of-Design Materials: Ucan Fastening Systems, Insulation Fasteners; alternates will be considered for this material.
    - .2 Perimeter Insulation Fasteners: Concrete faced insulation manufacturer's standard concealed fasteners with groove mounting plate and fastening spline.
  - .2 Insulation Adhesive:
    - .1 Trowelable Polystyrene Insulation Adhesive: Trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation in accordance with CGSB 71-GP-24M; suitable for application to temperature of  $-10$  C or lower:
      - .1 Basis-of-Design Materials: Bakor, 230-21 Rigid Insulation Adhesive; alternates will be considered for this material.
  - .3 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07620.
  - .4 Adhesive for Bonding Insulation: Provide type recommended by the insulation manufacturer to suit conditions of each application.
  - .5 Vapor Barrier Tape: Aluminum foil reinforced tape with pressure sensitive resilient adhesive, specially designed for sealing joints of foil faced insulation. ULC tested, flame spread 25, smoke developed 25, or less.
    - .1 3M Company
    - .2 Polyken Div./Kendall Co.
    - .3 Venture Tape Corp.
  - .6 Supports and Anchors for Insulation: Provide type shown and as recommended by insulation manufacturer. Provide galvanized steel skewers or mechanically attached clips as recommended by the insulation manufacturer when insulation is applied to metal construction.

- .7 Adhesive–Applied Clips: Metal clips consisting of a square, perforated, galvanized steel base plate and prong. Provide accessories and adhesive as recommended by manufacturer for the intended application.
  - .1 AGM Industries Inc. “Tactoo Insul–Hangers”
  - .2 Gemco “Insulation Hangers”
  - .3 Midwest Fasteners Inc. “Insulation Fasteners”

### **3. EXECUTION**

#### **3.1 SITE CONDITIONS**

- .1 Weather Conditions: Do not proceed with the exterior exposed Work during inclement weather nor when weather forecasts are unfavorable, unless the Work will proceed in accordance with the manufacturer’s requirements and instructions and any agreements or restrictions of the Pre–Construction Conference.

#### **3.2 EXAMINATION**

- .1 Examine substrates and conditions for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- .2 Verify that all surfaces which are to receive rigid insulation are clean, free of deleterious matter and are sufficiently level to allow the proper installation of insulation.
- .3 Verify that all flashings provided under other Sections are installed and that they divert moisture to exterior of insulated systems.

#### **3.3 PREPARATION**

- .1 Clean substrates of substances harmful to insulations; remove projections that interfere with insulation attachment.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.4 INSTALLATION**

- .1 General: Install the insulation materials in accordance with the manufacturers’ instructions, except where more stringent requirements are shown or specified. Extend insulation full thickness over entire area to be covered unless otherwise shown. Cut and fit or form insulation tightly around all obstructions and penetrations so that no voids exist in the insulation course.
- .2 Insulation in Fire–Rated Systems: Refer to Section 078400, FIRESTOPPING, for materials to be used in fire rated construction for through–penetrations, firestop joints, and perimeter fire containment systems.

- .3 Mechanical Attachment: Provide type and spacing of mechanical anchoring devices as shown and as recommended by the insulation manufacturer for the thickness and condition of use shown.
- .4 Adhesively Applied Clips and Skewers: Provide adhesive and spacing of clips or skewers as recommended by the manufacturer for the condition and substrate indicated.
- .5 Vapor Barrier Tape: Where insulation has aluminum foil vapor barrier, apply vapor barrier tape to all seams, joints, penetrations and terminations of the insulation so as to obtain full integrity of the vapor barrier.
- .6 Masonry Cavity Insulation: Provide a single layer of extruded polystyrene board insulation in thickness indicated. Install in the cavity as the laying of the wall progresses. Press courses of insulation firmly between wall ties, with edges butted tightly both ways. Bond insulation to inside wythe with adhesive as recommended by insulation manufacturer, and press into place so that entire board is bonded. Seal around cutouts with adhesive or mastic.
- .7 Application of Perimeter Foundation Insulation: Coordinate with foundation waterproofing system. Apply a single layer of extruded polystyrene board insulation in thickness as indicated. Bond insulation to substrate with adhesive as recommended by insulation manufacturer, and press into place so that entire board is bonded. Support insulation temporarily until adhesive bond is sufficient to hold weight of insulation.
- .8 Concrete Faced Perimeter Insulation: Install in accordance with manufacturer's written instructions, and as follows:
  - .1 Fasten board insulation using manufacturer recommended fastening system
  - .2 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00
  - .3 Install boards vertically in accordance with manufacturers written instructions.

### **3.5 PROTECTION**

- .1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- .2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION**



**1 GENERAL**

**.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

.1	Cast-In-Place Concrete	Division 3
.2	Precast Concrete Wall Panels	Division 3
.3	Sheet Air Vapour Barriers	Section 07271.
.4	Sealants	Section 07900.
.5	Gypsum Wallboard	Section 09260.
.6	Mechanical	Division 15
.7	Electrical	Division 16

**.2 QUALITY ASSURANCE**

- .1 Applicator shall be licensed by the manufacturer of fireproofing materials.
- .2 Conform to flame and temperature ratings established by ULC S115M and ASTM E-814.
- .3 Submit manufacturer's certification that materials meet or exceed specified requirements.
- .4 Maintain flame and temperature ratings equal to surrounding materials.

**.3 SUBMITTALS**

- .1 Submit samples in accordance with Division 1.
- .2 Submit samples of each type of firestop and smoke-seal materials and accessories.

**.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.
- .2 Store materials off ground, under cover, and away from damp surfaces.

**.5 JOB CONDITIONS**

- .1 Do not apply materials when temperature of substrate material is below 4°C and surrounding air temperature is below 4°C, for 24 hours prior to application.

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**2 PRODUCTS**

**.1 MATERIALS**

- .1 Mortar: single component, mill mixed, medium density cementitious matrix, blended for even texture, and meeting the following requirements:
  - .1 Bears UL or ULC label and confirmation of compliance with ASTM E-814.
  - .2 Bond Strength: 300 KPa when set and dry.
  - .3 Compressive strength: minimum 1500 Kpa.
- .2 Caulking: single component silicone sealant, non-slump, self-levelling, designed to inhibit the spread of smoke and flame, and meeting the following requirements:
  - .1 Bears UL or ULC label and confirmation of compliance with ASTM E-814.
  - .2 Bond strength: 655 KPa when cured.
  - .3 Remains flexible indefinitely.
- .3 Water: clean and potable.
- .4 Accessories: as recommended by manufacturer.

**3 EXECUTION**

**.1 PROTECTION**

- .1 Mask adjacent work as necessary to avoid spillage onto adjoining surfaces; remove stains on adjacent surfaces as required.

**.2 PREPARATION**

- .1 Examine sizes and conditions to establish correct thickness and installation of backup materials. All surfaces to be dry and frost free.
- .2 Clean bonding surfaces of deleterious substances including dust, paint, rust, oil, grease and other foreign matter which may otherwise impair effective bonding.
- .3 Do not apply firestops and smoke-seals to surfaces previously painted or treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Prepare surfaces in accordance with manufacturer's instructions.

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- .5 Priming and sealing: Prime surfaces in accordance with manufacturer's instructions.

**.3 APPLICATION**

- .1 Mix materials in accordance with manufacturer's written instructions.
- .2 Apply in strict accordance with manufacturer's recommendations to provide a temperature and flame rated seal equal as a minimum to the rating of the wall or floor surrounding.
- .3 Apply to mechanical and electrical service through-penetrations to formed, sleeved, or cored openings in smoke and fire rated masonry or drywall stud walls and structural floors and ceilings.
- .4 Apply to head of smoke and fire rated masonry or drywall stud wall abutting underside of structure (concrete or metal deck).
- .5 Apply to control joints in rated masonry or stud walls, floors and ceilings.
- .6 Apply firestop and smoke-seal materials in accordance with manufacturer's directions, with sufficient pressure to properly fill and seal openings.
- .7 Tool or trowel exposed surfaces.
- .8 Remove excess compound promptly as work progresses and upon completion.

**.4 INSPECTION**

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping and smoke-seals materials and service penetration assemblies.

**.5 CURING**

- .1 Cure materials in accordance with manufacturer's instructions.
- .2 Do not cover up materials until proper curing has taken place.

**.6 CLEAN-UP**

- .1 Clean adjacent surfaces immediately and leave work neat and clean.
- .2 Remove excess materials using recommended procedures, as work progresses.

- .3 Remove dams after initial set of firestops and smoke seals as required.
- .4 Correct staining and discolouring of adjacent surfaces as directed.
- .5 Remove all debris and excess materials entirely from the site and leave the work in a neat and tidy condition.

**END OF SECTION**

**1 GENERAL**

**1.1 SCOPE**

- .1 Provide an air/vapour retarder system to ensure that air and air borne water vapour are prevented from exfiltration and infiltration between interior and exterior of building through exterior wall and roof construction under all conditions of air pressure differentials.
- .2 Provide an air/vapour retarder membrane flashing at penetrations of the building envelope and at the junction of exterior floor wall and roof construction as detailed on drawings.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Cast-In-Place Concrete: Division 3
- .2 Insulated Precast Concrete Panels Division 3
- .3 Sealant Section 07900.
- .4 Steel Doors and Frames Section 08110.

**1.3 SECTION INCLUDES**

- .1 Flexible sheet membranes and galvanized sheet steel designed and installed so that they function as the air and vapour seal component of building envelope or portion of building.

**1.4 PERFORMANCE REQUIRMENTS**

- .1 The installed air and vapour barriers shall meet the following requirements:
  - .1 There must be no air or water vapour movement through the building envelope except through ducts and doors.
  - .2 The air vapour barrier must be continuous throughout the building envelope. The air and vapour barrier material of the wall must be continuous with the air and vapour barrier of the roof and be connected to the air and vapour barrier material of door and window frames.
  - .3 The air barrier system must be supported to resist a peak wind load, a sustained stack effect or pressurization from ventilation equipment; it must be sufficiently rigid to resist displacement.
  - .4 The materials and configuration of the air barrier assembly must resist the highest expected air pressure load, inward and outward without rupturing or detaching from the support.
  - .5 The assembly must not creep away from a substrate or part at a joint under sustained pressure difference.

.6 The deflection of the air barrier materials between supports must be minimized to prevent the displacement of other materials.

.2 Design and reinforce galvanized sheet metal air barrier back up to withstand acceptable deflection limitations, their own weight, the insulation weight and design loads.

## **1.5 QUALITY ASSURANCE**

.1 The Contractor is responsible for establishing that sealing work as indicated and specified, is carried out correctly and in accordance with the overall intent of this Section and as specified in other Sections.

## **1.6 PRE-INSTALLATION CONFERENCE**

.1 Convene 1 week prior to commencement of work of this Section.

## **1.7 DELIVER, STORAGE AND HANDLING**

.1 Protect all materials stored on site, do not store membrane more than two pallets high off the ground. Do not store in temperature above 32°C for prolonged periods of time. Store in a dry area away from high heat, open flame or spark.

## **2 PRODUCTS**

### **2.1 MATERIALS**

.1 Polyethylene vapour barrier: 0.15mm thick clear conforming to CAN/CGSB-51.34-M86 and sealing tape as specified in Section 06100.

.2 Acceptable polyethylene vapour barrier materials:

.1 Merlund Plastics Ltd.

.2 Layfield Plastics Ltd.

.3 Tape for sealing joints in ply vapour barrier: Venture Tape Co. "1585 CW-P2/48001" sheathing tape.

.4 Metal air barrier back up: galvanized sheet steel, 24 gauge thickness, commercial quality to ASTM A446-80, Grade A, Z275 designation zinc coating.

- .5 Sealant tape for installation of metal air barrier back up: extruded, ribbon-shaped, non-drying, non-skinning, non-oxidizing, reinforced, black polyisobutylene tape of sufficient width and thickness, 6 Weatherband Ribbon Sealer by 3M.
- .6 Isolation coating: alkali resistant, bituminous paint.
- .7 Sealant: for bedding poly at studs, head and sill stud track, for lap joints between metal air barrier/vapour barrier sheets, between metal air barrier/vapour barriers and adjacent constructions and metal air barrier/vapour barrier fasteners shall be gun grade butyl complying to CGSB 19-GP-14M.

## 2.2 FABRICATION

- .1 Insofar as practical execute fitting and assembly of metal air barrier back up in the shop with the various parts or assemblies ready for erection at the building site.
- .2 Take field measurements required to verify or supplement those shown on the drawings for the proper layout and installation of the work. Co-ordinate dimensional tolerances in adjacent building elements and confirm prior to commencement of the work.
- .3 Brake form metal air barrier back up from sheet metal to permit assembly using self-tapping, self-drilling screws. Form 13mm hem on edges.
- .4 Make provisions in metal back-up design to accommodate movement resulting from thermal change and form structural deflection.
- .5 Cut, fit, trim and form metal air/vapour barriers as required to accommodate framing connections.

## 3 EXECUTION

### 3.1 INSTALLATION – METAL AIR BARRIER BACK-UP

- .1 Prior to installation apply a heavy protective coating of alkaline resistant bituminous paint to concealed surfaces of galvanized sheet, which will come in direct contact with structural steel or other dissimilar metal, concrete or masonry.
- .2 Overlap metal air barrier back up with adjoining substrates and securely attached with fasteners appropriate for the substrate encountered (structural steel, cast-in-place concrete or concrete unit masonry). Set overlap on continuous sealant tape. Fasten through metal and tape at maximum 300mm o.c.

- .4 Overlap abutting sheets of metal air barrier back-up minimum 50mm. Pop rivet overlap at 300mm o.c. Seal overlap, edges and pop rivets with butyl sealant for air seal.
- .5 Gun apply a continuous 6mm bead of sealant to all joints and barrier junctions with adjacent constructions. Liberally butter screw fastenings with sealant.

### **3.2 PREPARATORY STRIPS OF SHEET MEMBRANE AIR BARRIER**

- .1 Adhere preparatory strips of sheet air barrier membrane material for tying into window and doorframes, exterior louvres, between roof membrane and poly, etc. Lap minimum 150mm onto gypsum board sheathing, poly, concrete unit masonry or concrete surfaces to perimeter of openings to form a continuous air/vapour seal between interior and exterior of the building envelope. Refer to related Sections for attachment of sheet air barrier membrane material.
- .2 Coordinate with other trades supplying and installing components in the building envelope. Install after installation of exterior windows and doors but before installation of balance of the wall vapour barrier membrane.
- .3 Before installing membrane to substrate in final position allow the membrane to relax. Position membrane without stretching.
- .4 Inspect air seal for continuity. Pay particular attention to change in direction bends, such as window head/sill to jamb intersections. Repair tears, punctures, rips, with pieces of membrane.
- .5 Carefully plan the installation in advance to avoid excessive layering of the membrane at laps and change in direction bends that will compromise the proper installation of the later materials and components.
- .6 Where punctures and tears are extensive, replace entire damaged sections.
- .7 Cooperate with other trades to ensure continuity of the membrane to achieve a complete air seal. Leave sufficient membrane hanging loose for interface with other air/vapour barriers and other building components.
- .8 Seal all mechanical and electrical penetrations of the building envelope as detailed. Caulked penetrations will be rejected.

### **3.3 INSTALLATION OF POLY SHEET AIR/VAPOUR BARRIER**

- .1 Install poly air/vapour barrier so that building air/vapour barrier is continuous.



- .2 Install poly air/vapour barrier to lap under sill tracks and overhead tracks and embed in specified sealant.
- .3 All side laps shall be minimum 100mm and taped with specified tape.
- .4 Tie into all other air/vapour barriers and door and window frames with stripes of “peel and stick” membrane.

**END OF SECTION**

**1 GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- |    |                              |                |
|----|------------------------------|----------------|
| .1 | Air/Vapour Barrier           | Section 07190. |
| .2 | Loose Fill Insulation        | Section 07211. |
| .3 | Rigid Insulation             | Section 07212. |
| .4 | Non-Rigid Fibrous Insulation | Section 07213. |
| .5 | Steel Doors and Frames       | Section 08110. |

**1.2 TEST REPORTS**

- .1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification.

**1.3 STORAGE**

- .1 All materials shall be delivered to the job site in unopened new containers bearing the manufacturers original label. All materials will be stacked in a neat and orderly fashion by type and component. Empty containers will be removed from project.

**1.4 ENVIRONMENTAL REQUIREMENTS**

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturer's prescribed limits.
- .2 Safety: Comply with requirements or Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal or hazardous materials.

**2 PRODUCTS**

**2.1 PRODUCT OPTIONS**

- .1 Contractor shall select from one of the following:
- .1 Provide spray applied polyurethane foam containing integral fire inhibitors. An additional, separate thermal barrier is not required.
  - .2 Provide spray applied polyurethane without fire inhibitors. An additional, separate thermal barrier is required.

## 2.2            **SPRAY APPLIED POLYURETHANE FOAM**

- .1        Spray Applied Poly Urethane Foam: Rigid, cellular thermal insulation with the following properties when applied:
  - .1        Density-ASTM D1622, 10kg/m<sup>3</sup>-42 kg/m<sup>3</sup> max
  - .2        Compressive Strength-ASTM D1621, 104 kPa with max. 10% deformation.
  - .3        Tensile Strength- ASTM 1623, 138 kPa
  - .4        Response to Thermal and Humidity Aging-ASTM D2126. 12% mx volume change
  - .5        Water Absorption-ASTM D2842, 5% by volume max.
  - .6        Water Vapour Barrier-ASTM E96E96M, 180ng/Pa.s.m<sup>2</sup> (Core), 60 ng/Pa.s.m<sup>2</sup> (Skins)
  
- .2        Spray Applied Polyurethane Foam Containing Integral Fire Inhibitors: same properties as specified in 2.1.2, with the following additional fire hazard classification properties when tested to CAN/ULC-S102 or ASTRM E96E96M:
  - .1        Flame Spread: max 10
  - .2        Smoke developed: max 500
  - .3        Fuel Contributed:0.

## 3                **EXECUTION**

### 3.1              **APPLICATION**

- .1        Apply insulation to clean dry surfaces.
- .2        Conforming to Canadian Standards ULC S705.2-98 (supersedes CGSB 51.39-92).
- .3        To be completed by a factory approved applicator certified by CUFCA.
- .4        Barrier system shall be applied to the entire exterior wall surface.
- .5        Before applying barrier, all “Z-Bars” and all mechanical wall fasteners and bridging strips shall be in place, and substrate clean and dry.
- .6        Barrier to be installed to achieve thermal resistivity of RSI 2.1.
- .7        Care shall be taken to achieve the best possible surface texture.
- .8        Application shall not commence during inclement weather, when precipitation is imminent or when the surface of substrate is not free of dew, frost, or water. When wind velocity exceeds 25 kph application shall not proceed without the use of an effective wind barrier
- .9        Employ due care to avoid overspraying the building or surroundings.
- .10       Protect adjacent surfaces from overspray and dusting.
- .11       Temporarily brace frames as may be required to prevent possible bowing of frames due to over expansion of the foam-in-place insulation.
- .12       Fill exterior hollow metal door frames 75% full with foam-in-place insulation prior to installation of frames. Fill the remainder of the frame after installation, through the gap between the frame and the wall construction.

- .13 Install foam-in-place insulation around all exterior window frames to maintain continuity of the thermal barrier, after air barrier has been installed and sealed to windows.
- .14 Install foam-in-place insulation around all protrusions through the exterior building envelope to achieve and maintain continuity of air/vapour seal.

**3.2 INSULATION AIR BARRIER**

- .1 Apply to primed surface, to cover 200 mm minimum either side of joist or material change being covered.

**3.3 CLEAN-UP**

- .1 At conclusion of work, clean up remnants and debris and remove same from job site.

**3.4 R.S.I. VALUES**

- .1 As shown on drawings

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
  
- .2 Sections of work which may have requirements related to this Section include, but are not limited to:
  - .1 Unit Masonry: Section 04200
  - .2 Metal Steel Stud Systems: Section 05410
  - .3 Sheet Air Vapour Barrier: Section 07271
  - .4 Spray Foam Air Barrier: Section 07273
  - .5 Metal Cladding: Section 07645
  - .6 Metal Flashings: Section 07620
  - .7 Sealants: Section 07900
  - .8 Hollow Metal Doors & Frames: Section 08110
  - .9 Overhead Sectional Doors: Section 08301
  - .10 Aluminum Windows: Section 08511

**1.2 REFERENCE STANDARDS**

- .1 Alberta Building Code (ABC), 2006.
  
- .2 American Aluminum Manufacturers Association (AAMA):
  - .1 AA-C22-A41: Clear Coatings.
  - .2 AA-C22-A42: Integral Colour Coatings.
  - .3 AAMA #605: Voluntary Specification for High Performance Organic Coatings on Architectural Panels.
    - .1 4.3 Dry film thickness.
    - .2 7.1 Colour Uniformity.
    - .3 7.2 60 degree gloss, ASTM D523.
    - .4 7.3 Hardness - Berol Turquoise Pencil.
    - .5 7.4 Adhesion - crosshatch 1.6 mm wet & dry.
    - .6 7.5 Direct impact 2.54 mm distortion.
    - .7 7.6 Abrasion resistance ASTM D968.
    - .8 7.7 Acid resistance 10% muriatic acid spot test.
    - .9 7.7 Alkali resistance mortar pat test.
    - .10 7.7 Detergent resistance (3%) immersion @ 37.8°C.
    - .11 7.8 Salt spray resistance 100% RH @ 37.8°C.

- .12 7.9 Weathering - colour retention ASTM D2244.
  - .13 7.9 Chalk resistance ASTM D4214.
  - .14 7.9 Erosion.
  - .15 7.10 Compatibility with commercial sealants and glazing putties.
- .3 ASTM International (ASTM):
- .1 ASTM B117-11: Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - .2 ASTM D523-14: Standard Test Method for Specular Gloss.
  - .3 ASTM D822/D822M-13: Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
  - .4 ASTM D968-05(2010): Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
  - .5 ASTM D1308-02(2013): Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
  - .6 ASTM D1654-08: Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
  - .7 ASTM D1735-14: Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus.
  - .8 ASTM D1781-98(2012): Standard Test Method for Climbing Drum Peel for Adhesives.
  - .9 ASTM D1929-14: Standard Test Method for Determining Ignition Temperature of Plastics.
  - .10 ASTM D2244-15: Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  - .11 ASTM D2247-11: Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
  - .12 ASTM D2794-93(2010): Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
  - .13 ASTM D3359-09e2: Standard Test Methods for Measuring Adhesion by Tape Test.
  - .14 ASTM D3363-05(2011)e2: Standard Test Method for Film Hardness by Pencil Test.
  - .15 ASTM D4214-07: Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
  - .16 ASTM E84-15: Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .17 ASTM E162-13: Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
  - .18 ASTM E283-04(2012): Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and doors Under Specified Pressure Differences Across the Specimen.
  - .19 ASTM E330/E330M-14: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

- .4 Federal Test Method Standards (FSC 8010):
  - .1 141A/6152: Accelerated Weathering (Enclosed ARC Apparatus).
  - .2 141A/6160: Conducting Exterior Exposure Tests of Painting on Metals.
  
- .5 National Coil Coaters Association (NCCA):
  - .1 NCCA II-6: Test Method for Measurement of Impact Resistance of Painted Aluminum, Steel and Galvanized Steel.
  - .2 NCCA II-12: Specification for Determination of Relative Pencil Hardness.
  - .3 NCCA II-16: Test Method for Determination of Film Adhesion by "Crosshatch" Tape Test After Reverse Impacting.
  
- .6 Uniform Building Code:
  - .1 17-5: Room Fire Test Standard for Interior of Foam Plastic Systems.
  - .2 17-3: Thermal Barrier Evaluation for an Exposed Wall Interior.

**1.3 QUALITY ASSURANCE**

- .1 Ensure that the composite metal panel manufacturer has a minimum of five (5) years experience.
  
- .2 Use only fabricators who are acceptable to the composite metal panel manufacturer.
  
- .3 When possible, take field measurements prior to commencement of shop drawings and shop manufacturing and finishing.
  
- .4 Perform work of this Section by a company which specializes in the type of manufactured composite metal wall panel systems work required for this Project, with a minimum of five (5) years of documented successful experience and using skilled workmen thoroughly experienced in the necessary crafts.
  
- .5 Use Manufacturer who specializes in manufacturing the type of manufactured composite wall panels specified in this Section, with a minimum of five (5) years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.
  
- .6 Installer Qualifications: Use an experienced installer who has completed a minimum of three (3) projects utilizing composite metal wall panel systems similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance of not less than 10 years.
  - .1 Installer's responsibilities include engineering, fabricating, and installing dimension composite metal panel systems including anchors and back up structure.

- .1 Information on drawings and in Specifications establishes requirements for both aesthetic effects and performance of the composite metal panels.
  - .1 Aesthetic effects relative to formal characteristics are indicated by dimensions, arrangement, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction.
  - .2 Performance is indicated by criteria subject to verification either by preconstruction or field test, if applicable, or by in-service experience.
  
- .2 Do not modify intended aesthetic effects, as judged solely by the Consultant, except with Consultant's acceptance and only to the extent exclusively needed to comply with performance requirements.
  - .1 Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
  
- .2 Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional structural engineer.
  
- .7 Professional Structural Engineer Qualifications: A professional structural engineer who is legally qualified to practice in jurisdiction where the Project is located and who is experienced in providing composite metal wall panel systems engineering services of the kind indicated.
  
- .8 Source Limitation: Furnish all panel types by a single manufacturer.
  
- .9 Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
  
- .10 Meet with Owner, Consultant, testing and inspecting agency representative, composite metal panel installer, composite metal panel manufacturer's representative, structural support installer, and installers whose work interfaces with or affects metal wall panels.
  - .1 Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - .2 Review methods and procedures related to composite metal panel installation, including manufacturer's written instructions.
  - .3 Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - .4 Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect composite metal panels.
  - .5 Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.



- .6 Review temporary protection requirements for composite metal panel assembly during and after installation.
- .7 Review composite metal panel observation and repair procedures after composite wall panel installation.
- .8 Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
  
- .11 Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
  - .1 Evidence of "Patching" after removal of tags or marks is not acceptable.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01330.
  
- .2 Clearly indicate thickness and dimensions of all parts, fastenings and anchoring types and methods, arrangement of sheets and joints, assembly and installation details and methods and special shapes. Verify all dimensions with job conditions before fabricating.
  - .1 Show details of all flashings and closures.
  - .2 Show isometric views of joining and fastening of sheet metal at all conditions where surfaces intersect of change plane.
  - .3 Ensure all shop drawing submitted, are signed and sealed by qualified professional engineer registered in the Province of Alberta.
  
- .3 Submit affidavits certifying material meets requirements specified.
  
- .4 Provide two (2) copies of manufacturer's literature for panel material.

**1.5 SAMPLES**

- .1 Submit samples in accordance with Section 01330.
  
- .2 Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - .1 Composite Metal Panels: 300 mm x 300 mm, in each colour selected.
    - .1 Include fasteners, closures, and other metal wall panel accessories.
      - .1 Include four-way joint for composite panels.
    - .2 Trim and Closures: 300 mm long.
      - .1 Include fasteners and other exposed accessories.
    - .3 Accessories: 300-mm long Samples for each type of accessory.
    - .4 Exposed Gaskets: 300 mm long.

- .3 Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience.
  - .1 Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
  - .2 Material Certificates: For exterior sheathing membrane, signed by manufacturer.
- .4 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
  - .1 Composite Metal Panels: Include reports for air infiltration, water penetration, thermal performance, and structural performance.
  - .2 Insulation and Air/Vapour Barriers: Include reports for thermal resistance, firetest-response characteristics, water-vapour transmission, and water absorption.
  - .3 Research/Evaluation Reports: For metal-faced composite panels.
  - .4 Maintenance Data: clearly indicate manufacturer’s printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions and precautions against materials and methods which may be detrimental to finishes and performances.

**1.6 SAMPLE AREA**

- .1 Construct a mock-up of the exterior wall in accordance with Section 01340.
- .2 Construct on the project, a typical full sample installation of exterior composite metal panels, for review before proceeding with the remainder of the installation.
- .3 Sample installations must indicate materials, sizes, colours, shades, graining, joints, fastening system and level of workmanship.
- .4 Location of sample installations to be as directed by the Consultant.
- .5 Adjust sample installations as required to conform with the referenced standards, the drawings, and this specification, and to gain acceptance by the Consultant, at no additional cost to the Owner.
- .6 Accepted sample installations will become the standard for the project and may be incorporated into the Work.

**1.7 DESIGN REQUIREMENTS**

- .1 Maximum deviation from vertical and horizontal alignment of erected panels: 6 mm in 6m.

- .2 Space fastenings to secure Sub Girts to structure to withstand the positive and negative wind loads as outlined in the Alberta Building Code for the Lethbridge area. Submit calculations with shop drawings.

**1.8 SYSTEM PERFORMANCE**

- .1 Provide manufactured composite metal panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- .2 Test wall and panel assemblies as follows:
  - .1 Water Penetration: to ASTM E331, no uncontrolled water infiltration at 30 lbs/ft<sup>2</sup> Wall Incorporate into the wall design, drainage to exterior face of wall design of water at joints and any condensation that may occur within the construction.
    - .1 Make provisions to drain to the exterior face of the wall, water entering at joints or condensation occurring within the assembly.
    - .2 Provide flashings and gutters for exterior walls and for the connection of contiguous work.
  - .2 Wind Load Testing: to ASTM E330, design exterior wall panels and anchorage for a minimum positive and negative wind loading at 30 lbs/ft<sup>2</sup> with a maximum allowable deflection of L/60 or a maximum 19 mm deflection, whichever is less.
- .3 Thermal Movement: Provide manufactured composite metal panel system, including anchorage, that accommodates building and thermal movements of system and supporting elements resulting from the following maximum change in ambient and surface temperatures without buckling, damaging loads on fasteners, noise or vibration and other detrimental effects.
  - .1 Temperature change: -28°C to +82°C ambient on material surfaces.
  - .2 Buckling, opening of joints, undue stress on fasteners or other detrimental effects due to thermal movement of components will not be permitted.
  - .3 Use fabrication, assembly and erection procedures which take into account the ambient temperature range at the time of respective operation.

**1.9 PROTECTION**

- .1 Protect work of other trades from damage resulting from work of this Section. Make good all damage to work of other trades resulting from work of this Section.

**1.10 PRODUCT HANDLING**

- .1 Protect materials from inclement weather.

- .2 Handle sheets with due respect for the quality and beauty of the material. Imperfections such as holes, dents, creases or crinkles will be cause for rejection.

**1.11 STORAGE OF MATERIALS ON SITE**

- .1 Deliver Composite metal panels to the job site as required for erection. If delivered early, store inside the building if possible.
- .2 If outside storage is necessary, stack bundles clear of the ground and tilted slightly to ensure that no water is allowed to lie. Take precautions to avoid storage stain or damage to the surface finish of the material.

**1.12 WARRANTY**

- .1 Provide a ten (10) year warranty for work of this Section commencing on the date of Substantial Performance of the Work, to repair or replace specified materials or work that has failed within the warranty period, at no cost to the Owner. Failures include, but are not limited to the following:
  - .1 Abnormal deterioration, aging, or weathering of the Work.
  - .2 Failure of anchorage metals due to oxidization, electrolytic damage and deterioration of protective coatings.
  - .3 Loose or missing parts.
  - .4 Leakage or water or air exceeding specified limits.
  - .5 Failure of frames and gaskets.
  - .6 Failure to conform to manufacturer's recommendations and industry standards as they apply to the various composite metal panel system components.
  - .7 Staining of composite metal panel surfaces caused by incompatibility of adjacent materials.
  - .8 Objectionable appearance or performance resulting from either defective or nonconforming material or workmanship.
  - .9 Structural failure.
  - .10 Uncharacteristic discolouration of panels – ie – 5-10 panels in field are faded while the rest are not.
- .2 Special Warranty: manufacturer's standard form in which manufacturer agrees to repair or replace components of composite metal panel assemblies that fail in materials or workmanship within the specified warranty period.
  - .1 Failures include, but are not limited to, the following:
    - .1 Structural failures, including rupturing, cracking or puncturing.
    - .2 Deterioration of metals, metal finishes and other materials beyond normal weathering.

- .2 Warranty period: two (2) years from the date of Substantial Performance of the Work.
  
- .3 Special Warranty on Panel Finishes: manufacturer's standard form in which manufacturer agrees to repair finish or replace composite metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - .1 Fluoropolymer Finish: deterioration includes, but is not limited to:
    - .1 Colour fading more than 5 Hunter units when tested according to ASTM D2244.
    - .2 Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - .3 Cracking, checking, peeling or failure of paint to adhere to bare metal.
  
  - .2 Finish Warranty Period: 20 years from the date of Substantial Performance of the Work.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Composite Metal Panels: consisting of two sheets of 0.51 mm nominal thickness aluminum and a low density polyethylene core for normal composite panels and moderately expanded polyvinylchloride core for fire rated panels produced in various core thicknesses in a continuous process.
  
- .2 Engineering Properties (4 mm thick non-fire rated panels):
  - .1 Weight: 5.47 kg/m<sup>2</sup>
  - .2 Tensile Yield ASTM D638: 42.7 N/mm<sup>2</sup>
  - .3 ULT Tensile ASTM D638: 41.6 N/mm<sup>2</sup>
  - .4 Elongation ASTM D638: 19%
  - .5 Tensile Modulus ASTM D638: 9,527 N/mm<sup>2</sup>
  - .6 Flatwise Tensile ASTM C297: 12.6 N/mm<sup>2</sup>
  - .7 Ult.Flexural ASTM D790: 100.2 N/mm<sup>2</sup>
  - .8 Flex. Modulus ASTM D790: 11,459 N/mm<sup>2</sup>
  - .9 Flatwise Compression ASTM C365: 14.0 N/mm<sup>2</sup>
  - .10 Coefficient of Expansion ASTM D696: 2.07 x 10<sup>-5</sup> K<sup>-1</sup>
  - .11 Flatwise Shear ASTM C273: 6.35 N/mm<sup>2</sup>
  - .12 Deflection Temperature ASTM D648: 260OC
  - .13 Water Absorption ASTM C272: Nil
  - .14 Thermal Conductivity C177: 116.4 W/m<sup>2</sup>K
  - .15 Thermal Resistance: 8.59 x 10<sup>-3</sup> m<sup>2</sup>K/W
  - .16 Sound Transmission ASTM E90: 28
  
- .3 Face Sheet: aluminum, alloy 3000 Series, 0.51 mm thick.

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- .4 Thickness: 4 mm.
  
- .5 Tolerances:
  - .1 Panel Bow: maximum 0.8% of panel dimension in width and length in any 1828mm panel dimension.
  - .2 Panel fabrication tolerances for length and width: maximum of +/- 1 mm and the variation from theoretical diagonal dimension to finished panel to be 3 mm.
  - .3 Do not vary more than 5% in joint dimensioned with at any location along the full joint length. Wavy joints, out of line or of joints of different widths from panel to panel are unacceptable.
  - .4 Maximum deviation from vertical and horizontal alignment of erected panels: 6mm in 6 m, non-accumulative
  
- .6 Panel dimensions: Allowance for field adjustments, as recommended by the manufacturer, where final dimensions cannot be established by field measurement before completion of panel manufacturing.
  
- .7 Finishes:
  - .1 Coil coated 70% Kynar 500 or Hylar 5000 based polyvinylidene fluoride (PVDF) resin or Fluoro Ethylene - Alkyl Vinyl Ether (FEVE) resin in conformance the following general requirements of AAMA 2605: Duranar XL coating or Valspar Floropon® Classic® II, colour as indicated on the drawings or as otherwise selected by the Consultant from the manufacturer's standard range.
    - .1 Coating thickness: 0.025 mm + 0.005 mm; AAMA #605-4.3.
    - .2 Hardness: ASTM D3363; F minimum using Eagle Turquoise Pencil.
    - .3 Impact:
      - .1 Test Method ASTM D2794 Gardner Variable Impact Tester with 16 mm mandrel.
      - .2 Coating must withstand direct and reverse impact of 0.0173 kg m (1.5 in-lbs) per mill substrate thickness.
      - .3 Coating must adhere tightly to metal when subjected to #600 Scotch Tape Pick-off Test. Slight micro-cracking permissible. No removal of film to substrate.
  
  - .4 Adhesion:
    - .1 Test Method: ASTM D3359.
    - .2 Coating must not pick-off when subjected to 279 mm x 279 mm x 1.6 mm grid and taped and taped with #600 scotch tape.
  
  - .5 Humidity Resistance:
    - .1 Test method ASTM D2247.
    - .2 No formation of blisters when subjected to condensing water fog at 100% relative humidity at 38OC for 4000 hours.

- .6 Weather Exposure:
  - .1 Outdoor:
    - .1 Ten year exposure at 45° angle facing south Florida exposure.
    - .2 Maximum colour change of 5 Delta E units as calculated in accordance with ASTM D2244.
    - .3 Maximum chalk rating of 8 in accordance with ASTM D4214.
    - .4 No checking, crazing or adhesion loss.
  - .7 Chemical Resistance:
    - .1 Test method ASTM D1308, UTILIZING 10% muriatic acid, for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by an unaided eye,
    - .2 Test Method ASTM D1308 utilizing 20% sulfuric acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by an unaided eye.
- .8 Composite metal panels:
  - .1 Alucobond for non fire rated panels and Alucobond Plus for fire rated panels, AP300 Rain Screen System, as distributed by Thermal Systems KWC Ltd.
  - .2 Reynobond as distributed by Custom Metal Contracting Ltd.
  - .3 Accumet as distributed by Flynn Canada Ltd.
  - .4 Alpolic as distributed by Vicwest.

## **2.2 FIRE RESISTANCE**

- .1 Non fire rated panels:
  - .1 Must meet the criteria of ASTM E84 (UBC Standard No. 42-1) Surface burning characteristics of Building Materials, and achieving a building materials surface burning classification NFPA Class A and UBC Class 1.
  - .2 Material must not burn when tested in accordance with ASTM E162 Surface Flammability of Materials Using a Radiant Heat Energy Source.
  - .3 4 mm thick panels must not contribute to vertical or horizontal flame spread when tested in accordance with ASTM E108 Surface Flame Spread of Exterior Walls.
  - .4 Must meet criteria acceptance for test procedure UBC Standard No. 17-5 Room Fire Test Standard for Interior of Foam Plastic Systems.
- .2 Accessories
  - .1 Fasteners: concealed, non-corrosive type as recommended by the panel manufacturer.
  - .2 Sub Girts: minimum 1.22 mm base metal thickness, Z275 galvanized steel per manufacturer's requirements for panel attachment.
  - .3 Panel Clips: as recommended by the manufacturer.

- .4 Panel Joints: Extruded aluminum with integral weatherstripping as detailed on the drawings.
- .5 Gaskets: within panel system to be per manufacturer's standards.
- .6 Aluminum Flashing: plain, 2.1 mm minimum thickness; finish to match adjacent composite metal panels.
  
- .3 Fabrication
  - .1 Fabricate panels in accordance with reviewed shop drawings.
  - .2 All panels must be fabricated by the supplier.
  - .3 Fabricate panel lines, breaks and angles, sharp, true and surfaces free from warp or buckle.
  - .4 Factory fabricate panels for field application.
  - .5 Apply specified finishes to conformance with manufacturer's standards and according to coating manufacturer's instructions. Ensure 'grain' of finish all runs in one direction for the entire project.
  - .6 Fabricate changes in plane, parallel or transverse to longitudinal axis as detailed on the drawings and reviewed shop drawings.
  - .7 Break form flashings to shapes as detailed on the drawings and reviewed shop drawings in maximum lengths of 3000 mm.
  - .8 Fabricate all panels for concealed fastenings. Provide complete perimeter extrusions.
  - .9 Design, fabricate and install composite metal panels to accommodate structural deflection.
  - .10 Drill 9 mm diameter weep holes at 600 mm o.c., in bottom edge of all wall panels and return edges that may retain water.

**3. EXECUTION**

**3.1 SURFACE EXAMINATION**

- .1 Examine all surfaces to receive composite metal panels which are to be installed under this Section for defects.
- .2 Ensure surfaces are even, smooth, sound, clean, dry and free from defects detrimental to Work.
- .3 Notify the Consultant of surfaces which are considered unacceptable to receive the work of this Section. Commencement of work implies unconditional acceptance of the surfaces.



**3.2 SUB GIRTS**

- .1 Ensure exterior sheathing membrane specified in Section 07 25 00 is installed and has been reviewed and accepted by the Consultant, prior to installation of Z girt framing.
- .2 At locations where cladding is installed over steel studs and gypsum sheathing and concrete block and other backing as indicated, install Z bar furring horizontally and fasten through exterior sheathing membrane and gypsum sheathing and into steel studs at all locations where Z bars cross studs. Ensure Z bar ends occur over firm bearing.

**3.3 INSTALLATION**

- .1 Install in accordance with manufacturer's specifications and reviewed shop drawings.
- .2 Installation must be approved by the panel fabricator and manufacturer to comply with the warranty requirements.
- .3 Before installation, check wall and window alignment.
- .4 Install fire rated panels to locations indicated, non-fire rated panels to all other exterior locations.
- .5 Erect panels plumb, level and true to line.
- .6 Compartmentalize system in accordance with NRC "Rainscreen principals" and reviewed shop drawings. Provide through wall flashings at each floor level to provide horizontal compartmentalization, allow for deflection and drain moisture to the exterior.
- .7 Install panel joints of extruded aluminum with integral weather stripping as detailed on the reviewed shop drawings.
- .8 Anchor panels securely in place in accordance with the manufacturer's recommendations and in accordance with the reviewed shop drawings. Use concealed fasteners.
- .9 Install all flashings as detailed on the drawings and reviewed shop drawings. Caulk all joints between flashing sections to form a complete watertight installation.
- .10 Coordinate the installation of flashing of this Section with roofing work and other flashing work which ties into flashing work of this Section, such as flashing for curtain wall and roofing.

- .11 Fabricate and install attachment system to allow for free noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -28°C to +82°C. Fabricate and install panel system to be free of bulking of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement. In the fabrication, assembly and erection procedure, take into account the ambient temperature at the time of the respective operation.
- .12 Separate dissimilar metals and use gasketed fasteners where required to eliminate the possibility of corrosive or electrolytic action between metals.
- .13 Baffle junctions between composite metal panels and adjacent materials with flashings wherever possible, as indicated on the reviewed shop drawings. Do not seal joints between composite metal panels; these joints are to be as detailed and per manufacturer's standard dry joint assembly as detailed on the reviewed shop drawings.

**3.4 ADJUSTING AND CLEANING**

- .1 Remove and replace panels damaged or deteriorated beyond repair.
- .2 Repair panels with minor damage.
- .3 Remove protective film from panels as soon as possible after installation. Ensure weep holes and drainage channels are unobstructed.
- .4 Clean exposed panel surfaces promptly after completion of installation in accordance with recommendations of panel and coating manufacturer.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SUMMARY**

- .1 Provide Polyvinyl Chloride membrane roofing system in accordance with requirements of the Contract Documents.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM D4434, Standard Specification for Poly Vinyl Sheet Roofing.
  - .2 ASTM D751, Standard Specification for Breaking Strength, Elongation, Seam Strength and Tear Strength using the Grab Method.
  - .3 ASTM D570, Standards for Water Absorption.
  - .4 ASTM C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.33, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .3 Alberta Roofing Contractors Association (ARCA)
  - .1 Roofing Applications Standards Manual.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA A123.21, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems
  - .2 CSA O151, Canadian Softwood Plywood.
- .5 Health Canada/ Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Underwriters Laboratories' of Canada (ULC)
  - .1 CAN/ULC-S704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with roofing contractor's representative and Consultant to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## 1.4 SUBMITTALS

- .1 Product Data: Submit for Consultant's action. Furnish each type of product and accessories to be used in the Work; before starting work of this section.
  - .1 Furnish technical data describing the quality and performance of each material component or system to be used in the Work, e.g., the fire classification, U value or other such characteristics as required by the drawings or specifications.
  - .2 Submit copies of the most current technical data sheets describing physical properties of materials, and explanations about product installation, including installation techniques, restrictions, limitations and other manufacturer recommendations.
  - .3 Submit membrane manufacturer's standard details that will be utilized for this project, indicate changes that must be made to make the details project specific for review by the Consultant.
- .2 Shop Drawings: Submit for Consultant's action. Indicate tapered insulation details. Provide layout for tapered insulation.
- .3 Informational Submittals: Submit for Consultant's action
  - .1 Certificates:
    - .1 Manufacturer's Certificate; certify that products meet or exceed specified requirements.
    - .2 Submit certification indicating that components used in the roof system are supplied and warranted by a single source manufacturer.
- .4 Quality Control Submittals: Submit for Consultant's action.
  - .1 Submit maintenance instructions and specified warranty.
  - .2 Maintenance and Operating Manuals: Submit for Owner's documentation. Furnish complete manuals describing the materials, devices and procedures to be followed for the care and maintenance of the Work. Include manufacturer's brochures and lists describing the actual materials used in the Work, including membrane and flashings, insulation.
- .5 Quality Assurance Submittals: Submit for Consultant's Action:
  - .1 Installer qualifications: company or person specializing in application of PVC roofing systems with five (5) years experience approved by manufacturer.
  - .2 At least one member of the roofing crew is to be a 'journeyman roofer' and is to be on site at all times.

## 1.5 FIRE PROTECTION

- .1 Fire Extinguishers:
  - .1 Maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle.

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.2 ULC labelled for A, B and C class protection.

.2 Maintain fire watch for a minimum of two (2) hours after each day's seaming operations cease with trained, and properly equipped fire watch personnel.

### **1.6 DELIVERY, STORAGE AND HANDLING**

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store adhesives and sealants at +20°C minimum.

.7 Store insulation protected from weather and deleterious materials.

### **1.6 FIELD CONDITIONS**

.1 Ambient Conditions

.1 Do not install roofing when temperature is below -10°C, or to manufacturer's recommendations.

.2 Minimum temperature for solvent-based adhesive is -10°C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

### **1.8 WARRANTY**

.1 Materials and their application must conform as outlined in the Manual of Good Roofing Practice and Accepted Roofing Systems.

.2 Provide a manufacturer's 15 year warranty on materials and installation.

**2 PRODUCT****2.1 PERFORMANCE CRITERIA**

- .1 Compatibility between components of roofing system is essential. Provide written declaration to independent building envelope inspector stating that materials and components, as assembled in system, meet this requirement.

**2.2 ACCEPTABLE MANUFACTURER'S / SYSTEMS**

- .1 Manufacturers: All membrane components to be supplied by a single manufacturer where possible. Submit complete proposed material list for all roof membrane assembly components to the independent building envelop inspector for review and approval prior to the roofing project start-up meeting.

**2.3 VAPOUR RETARDER**

- .1 Vapour Retarder- A self-adhered vapour barrier membrane composed of SBS modified bitumen membrane with a non-slip surface. Acceptable products:
  - .1 Tradesmen SBS Glass Base SA (SIPLAST)
  - .2 SOPREMA SOPRAVAP'R
  - .3 IKO MVP

**2.4 BOARD INSULATION**

- .1 Flat and Sloped Insulation: Polyisocyanurate Insulation: to CAN/ULC-S704.
  - .1 Facer to be acrylic-coated and glass fibre reinforced compatible with roofing system components.
  - .2 Total thickness of flat stock insulation to be 200mm. Install flat stock insulation panels in four (4) 50mm layers.
  - .3 All insulation supplied to this project shall have 3<sup>rd</sup> party certification that it meets the requirements of CAN/ULC-S704 Type 3, Class 2.
  - .4 Maximum board size to be 12440 mm x 1220 mm.
  - .5 Cupped, curled or otherwise damaged boards as deemed by the third party building envelope inspector will not be accepted.
  - .6 All insulation shall be stamped with date stamp on date of manufacture and be fully factory cured prior to shipping to distributor and project.
  - .7 Acceptable products:
    - .1 H Shield GC by Hunter
    - .2 IKO Therm III by IKO
    - .3 "AC Foam-III" by Atlas Energy Products.
    - .4 "Energy 3" by Johns Manville.
    - .5 SopraISO Plus by Soprema

- .2 Sloped Insulation alternate (top 50mm of sloped insulation must be polyiso at all times) Moulded expanded polystyrene (MEPS) rigid board roof insulation consisting of largest panels practical, having square edges minimum LTTR RSI 0.73/25 mm, total thickness as indicated on Drawings, sloped to a minimum 2% perpendicular from edge of roof to a minimum thickness of 50mm; conforming to ULC S701, Type II, to a tolerance not exceeding 3mm from nominal size in any dimension.

## 2.5 MEMBRANE

- .1 Field Cap Sheet
  - .1 50mil PVC membrane incorporating a weft-inserted, knitted scrim within PVC films. PVC must contain integral plasticizers, stabilizers, biocides, flame retardants and U.V absorbents. Colour: White.
  - .2 Acceptable products:
    - .1 Durolast Duro-Fleece 50 mil Membrane

## 2.6 INSULATION OVERLAY BOARDS

- .1 Insulation Overlay Board: Mechanically fastened application:
- .2 Adhere insulation cover board over new coated, glass-faced, flat stock polyisocyanurate (ISO) insulation with low-rise foam adhesive according to adhesive Manufacturer guidelines. Stagger end joints of insulation overlay board a minimum of 1220mm.
- .3 Approved coverboard products include
  - .1 Densdeck,
  - .2 Securock
  - .3 Everboard
  - .4 Dexcell

## 2.7 SYSTEM ACCESSORIES.

- .1 All membrane components to be warranted by a single manufacturer. Submit complete proposed material list for all roof membrane components to the independent building envelope inspector for review and approval prior to the project start-up meeting.

## 2.8 CONCRETE PAVERS

- .1 Concrete Pavers: High density hydraulic pressed pavers, as approved by membrane supplier, standard color palate.

### **3 EXECUTION**

#### **3.1 QUALITY OF WORK**

- .1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and ARCA Roofing Applications Standards Manual.
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.

#### **3.2 EXAMINATION OF EXISTING CONDITIONS**

- .1 Contractor is to ensure that all materials and equipment on the roof are secured to prevent wind blow-off.
- .2 Contractor is to coordinate with local fire authorities to create a fire safety plan dealing with hot works on the roof. Contractor is to ensure that plan follows guidelines laid out by local authorities.
- .3 Contractor is to follow applicable federal, provincial and local statutes, regulations, and ordinances as required for the transportation of combustible gases.
- .4 Verification of Conditions:
  - .1 Inspect with independent building envelope inspector deck conditions including parapets, construction joints, roof drains, plumbing vent and ventilation outlets to determine readiness to proceed.
- .5 Evaluation and Assessment:
  - .1 Prior to beginning of work ensure:
    - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
    - .2 Curbs have been built.
    - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
    - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.
  - .2 Do not install roofing materials during rain or snowfall.

#### **3.3 PROTECTION OF IN-PLACE CONDITIONS**

- .1 Cover walls, walks and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.



- .3 Clean off drips and smears of bituminous material immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by the independent building envelope inspector. Remove and replaced damaged roof assembly components at no additional cost to the Owner.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Metal connectors and decking will be treated with rust proofing or galvanization.
- .8 Contractor to ensure that all materials and equipment are prevented from falling or blowing off from the roof during wind events.

### 3.4 VAPOUR RETARDER

- .1 Install primer and fire prevention tape at all deck levelling board butt joints, transitions and roof penetration curbs prior to installation of the vapour retarder.
- .2 Beginning at the bottom of the slope, without permanently installing the vapour retarder membrane, unroll onto the substrate for alignment.
- .3 Align the vapour retarder roll parallel to the direction of the deck ensuring the vapour retarder membrane overlaps are supported along their entire length.
- .4 If the vapour retarder membrane is not properly aligned, do not try to adjust it. Instead cut the roll and start again, making sure it is properly aligned and that it overlaps the end of the misaligned piece by 150mm.
- .5 Overlap adjacent vapour retarder membranes by a minimum of 75mm. Overlap end laps by 150mm. Stagger end laps a minimum of 300mm.
- .6 Install new self-adhered SBS modified bituminous vapour retarder extensions up the vertical faces of parapet walls and roof penetration curbs to provide a sealed connection to the new self-adhered base stripping.

### 3.5 SUBSTRATE PREPARATION

- .1 Membrane to be adhered directly to approved roof decks while insulation or cover boards must be used on others to provide a proper substrate. The surface being adhered to must be properly prepared as outlined in this section. In all cases the substrate onto which the PVC membrane is to be adhered must be smooth and level without significant surface irregularities or depressions. It must be clean, dry and free of grease, moisture, dust and loose debris. The contractor is responsible for providing a properly prepared surface for the installation of the membrane and any insulation and/or cover board used. Contractor is also responsible for ensuring that the roofing system is watertight at the end of the work day or the onset of inclement weather.
- .2 Steel Decking. Carefully examine deck for loose or high fasteners. These must be repaired or replaced so that they are flush with the surface of the wood.

### **3.6 INSULATION INSTALLATION**

- .1 Install taper-cut, insulation over the vapour retarder in stripes/ribbons of low-rise foam adhesive according to the rood plan drawing and in strict accordance with the adhesive Manufacturer's requirements. Install only as much insulation as can be covered in same day.
- .2 Contractor must submit tapered insulation shop drawings to the independent building envelope inspector for review prior to fabrication and installation.
- .3 Install four (4) layer of 50mm coated, glass-faced, flat stock, polyisocyanurate insulation panels over the vapour retarder and taper-cut, insulation in stripes/ribbons of low-rise foam adhesive according to the adhesive Manufacturer's requirements for a total overall thickness of 200mm. Stagger adhered flat stock ISO insulation panels a minimum of 200mm from underlying taper-cut insulation panels and successive layers of polyisocyanurate panels. Install only as much insulation as can be covered and sealed in the same day.

### **3.7 MEMBRANE MECHANICALLY ATTACHED TO WALLS**

- .1 When mechanically attaching the membrane to a perimeter wall a termination bar must be used at the roof-to-wall transition to secure the membrane that is adhered to the roof deck. Termination bar is only required at the base of perimeter walls.

### **3.8 ROOF PENETRATIONS**

- .1 A minimum of one mechanical fastener is required at all roof penetrations. These include, but are not limited to, pipes, drains, curbs, pitch pans, and expansion joints.
- .2 The pullout resistance of the fasteners determines the fastener spacing of the transition points and large penetrations. To determine the spacing, as per manufacturer's

### **3.9 FLASHINGS**

- .1 The PVC membrane must not contact surfaces which maintain or exceed temperatures of 120 °F including insulated chimney pipes, exhaust pipes, and combustible fuel pipes.
- .2 All flashings must be terminated at a minimum of (203 mm) above the roof surface.

**3.10            CLEANING**

- .1     Remove bituminous markings from finished surfaces.
- .2     In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .3     Repair or replace defaced or disfigured finishes caused by work of this section.
- .4     Remove waste from site daily.
- .5     Ensure that all materials are secured to roof to prevent wind blow-off.

**END OF SECTION**

**1 GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- |    |                              |                 |
|----|------------------------------|-----------------|
| .1 | Precast Concrete Wall Panels | Division 3      |
| .2 | Air/Vapour Barriers          | Section 072710. |
| .3 | Sheet Metal Cladding         | Section 07645.  |
| .4 | Steel Doors and Frames       | Section 08110.  |
| .5 | Mechanical                   | Division 15     |

**1.2 QUALIFICATIONS**

- .1 Only competent and qualified tradesmen shall execute the work of this Section, using adequate plant and equipment.

**1.3 REFERENCE STANDARD**

- .1 The ARCA "Manual of Good Roofing Practice" is a consensus of the ARCA membership of what constitutes good roofing practice in Alberta. In the context of the APWSS specifications for roofing, flashing and general construction upon which roofing and flashing must depend for proper performance (eg. roof decks, walls, roof mounted equipment, etc.) the recommendations contained in the ARCA "Manual of Good Roofing Practice" shall be read as specification requirements, and wherever the word "should" is used, is shall be read as "shall".
- .2 In the event the reference stand is not defined by the ARCA standard, the "Architectural Sheet Metal Manual" Seventh Edition issued by the Sheet Metal and Air Conditioning Contractors' National Association, Inc shall govern.

**1.4 DELIVERY/STORAGE**

- .1 Store off ground and under cover in a dry, well ventilated enclosure.
- .2 Stack pre-formed material in a manner to prevent twisting, bending and rubbing.
- .3 Provide protection for galvanized or pre-painted surfaces.
- .4 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements.

**1.5 PROTECTIONS**

- .1 Protect the work of other Sections from damage by the work of this Section.
- .2 Place protection to the requirements and satisfaction of this Section before performing work of other Sections.

**1.6 EXAMINATION OF SURFACES**

- .1 Examine all surfaces to receive flashings.
- .2 Notify the Consultant of surfaces which are considered unacceptable to receive the work of this Section.
- .3 The commencement of flashing work will imply unconditional acceptance of the surfaces and substrate to which the flashing is to be affixed.
- .4 Plywood and lumber nailer plates to walls and parapets shall be located and installed as detailed.
- .5 Control joints shall be located and installed as detailed.

**1.7 GALVANIZED SHEET GAUGE NUMBERS AND THICKNESSES**

Galvanized Sheet Gauge No.	Thickness Equivalent ASTM A525	Tolerance ± mm
22	0.8534mm	0.1mm
24	0.7010mm	0.1mm
26	0.5512mm	0.08mm

**2 PRODUCTS**

**2.1 MATERIALS**

- .1 Galvanized steel sheet: commercial quality sheet to ASTM A526-80, with Z275 designation zinc coating to ASTM A525M-80.
- .2 Pre-painted galvanized steel: commercial quality to ASTM A526-80 with Z275 zinc coating to ASTM A525M-80, pre-painted with baked on enamel with colours of proven durability for exterior exposure, to CSSBI Technical Bulletin No. 7, 5000 series to match Medium Bronze Aluminium colour.
- .3 Solder: 50% pig lead and 50% block tin.
- .4 Flux: commercial quality as recommended by sheet metal manufacturer.
- .5 Flashing nails: #12 hot dipped zinc coated, annular ringed.
- .6 Bituminous paint: CGSB 1-GP-108M, type II.
- .7 Sheet metal screws: cadmium plated, self tapping, pan head.
- .8 Plastic cement: CGSB 37-GP-5Ma.
- .9 Sealing compound: rubber-asphalt to CGSB 37-GP-29M.
- .10 Sealant compound: one component, polysulphide base, chemical curing, CAN2-19.13-M82.
- .11 Flashing anchor clips: 0.85mm ±0.1mm galvanized steel.
- .12 Industrial standard rainwater goods.

## 2.2 FABRICATION

- .1 Fabricate sheet steel, cap-flashings, copings and fascias, exposed to the elements, using 0.70mm  $\pm$  0.1mm pre-painted galvanized steel.
- .2 Form sheet steel roof drain sleeves, air-stops, etc. from 0.70mm  $\pm$  0.1mm galvanized steel.
- .3 Construct flashing joints to allow for flashing movement, using flat "S" lock seams. Maintain minimum of 22mm lap on all joints. Maintain anchor projection of the "S" lock to 25mm. At inside and outside corners, mitre the joint, and use upstanding seams, 25mm minimum height and 22mm minimum lap.
- .4 Maintain 1:5 minimum slope on horizontal surfaces of all flashings, parapets and control joints.
- .5 Hem exposed edges on underside of all flashings.
- .6 Fabricate cap flashings to have a drip leg, minimum 110mm high.
- .7 Fabricate cap flashings to lap 100mm over base flashings.
- .8 Form gum boxes from 0.70mm  $\pm$  0.1mm galvanized steel, with 75mm minimum upstand and 100mm one piece flanges. Solder joints. Make pans wider than member passing through roof membrane by 50mm minimum all sides.

## 3 EXECUTION

### 3.1 WORKMANSHIP

- .1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .2 Wipe and wash clean soldered joints to remove traces of flux, immediately after soldering.
- .3 Use exposed fastenings in approved locations.
- .4 Backpaint sheet metal with bituminous paint on surfaces in contact with concrete, masonry cementitious materials, or dissimilar metal.

### 3.2 INSTALLATION

- .1 Install flashings not later than seven days after installation of the membrane on any particular section of the roof.
- .2 Install flashings so maximum distances between joints is 1200mm for parapet face flashings, 1200mm for cap flashings 300mm wide or greater on the top surface, and 2400mm for all other flashings.
- .3 Install flashings using 0.85mm  $\pm$  0.1mm x 150mm long anchor clips on the fascia face, and screws or annular ringed nails on the opposite face.
- .4 Install anchors using annular ringed nails.

- .5 Fasten flashings of 1.2m length and shorter through the extended “S” locks. Fasten flashings over 1.2m length and shorter through the extended “S” locks and at the mid-length with a 150mm long,  $0.85 \pm 0.1$ mm thick galvanized steel clip.
- .6 Fasten flashings at maximum 600mm o.c.
- .7 Fit flashings together so that one end of each section is free to move in the joint. Do not use any caulking or other sealants at joints.
- .8 Lap, cap or counter flashings with base flashings, minimum 100mm.
- .9 Where possible, do not set base flashing screws lower than 200mm from top of the roof membrane.
- .10 Allow for thermal expansion and contraction in all exterior sheet metal work.
- .11 All exposed and pre-finished flashings to provide a smooth flat surface free of indentations, bumps, oil canning, or twists, all edges, bends hard, sharp and true to line.

### 3.3 GUM BOXES

- .1 Fill gum boxes with plastic cement in two equal lifts. Separate lifts with one ply of organic felt, precision cut to fit the box.
- .2 Apply two plies of organic felt stripping over flange and extend down face of curb. Reinforce stripping with a 2 ply of woven glass cloth.

### 3.4 VENT STACKS

- .1 Vent stack shall be at same elevation as top of curb.
- .2 Screw lead flashings down to the base flashing.
- .3 Lead flashings shall be sized to extend down the curb base flashing, minimum 150 mm.

### 3.5 EXPOSED FLASHINGS

- .1 All flashing visible from building exterior and as noted on drawings shall be pre-finished.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Air / Vapour Barriers: Section 07271.
- .2 Sheet Metal Flashings and Trim: Section 07620.
- .3 Sealants: Section 07900.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Section 01621 for requirements pertaining to product options and substitutions.

**1.3 REFERENCE STANDARDS**

- .1 CSSBI Pub. No. 38.6-79 - "Metric Standard for Sheet Steel Cladding."
- .2 CSSBI Pub. No. 40.6-79 - "Metric Zinc Coated (Galvanized) Sheet Steel for Structural Building Products."
- .3 CSSBI Pub. No. 40.7-70 - "Pre-finished and Post-Painted Galvanized Sheet Steel for Exterior Building Products."
- .4 CSSBI Pub. No. B11-89 - "Criteria for the Design and Installation of Double Skin Insulated Steel Roofs."

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings for approval prior to fabrication including plans and sections of each condition. Include metal thickness, finish, methods of installation, clips and fastener locations to accommodate thermal movement.

**1.5 SAMPLES**

- .1 Submit two 457 mm x 457 mm sample pieces of each product.
- .2 Samples to be representative of material, finish, colour and profile of specified work.

**1.6 QUALITY ASSURANCE**

- .1 Erection of the wall cladding system shall be performed by erection forces in the permanent employ of the manufacturer.
- .2 A minimum of five (5) years experience in installation of metal roofing system specified in this section.
- .3 Inspect substrate prior to wall cladding system installation to verify substrate complies with shop drawings layout and specified tolerances.
- .4 Inspect coil and/or product to ensure that the material is properly packaged and undamaged.
- .5 Final inspection to verify panel installation complies with shop drawings and specified tolerances.



**1.7 DESIGN CRITERIA**

- .1 Design metal wall panel to provide for thermal movement of component materials caused by ambient temperature range of 120°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .2 Design members to withstand dead load and wind loads calculated in accordance with National Building Code of Canada and applicable local regulations, to maximum allowable deflection of 1/180th of span.
- .3 Provide for positive drainage of condensation occurring within construction and water entering at joints, to exterior face of roof in accordance with NRC "Rain Screen Principles". Control movement of water behind facing of wall cladding to ensure that water is not retained and that elements will not be strained, restrained, or damaged by water and ice. Locate weepers, vents, and drain holes in such positions as not to contribute to staining, streaking, or marking of the roof cladding or other exterior finishes.
- .4 Metal wall panels shall be capable of being formed on the job site, or other approved location, in continuous lengths. Horizontal lap joints not permitted.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Exterior Metal Cladding: Prefinished, preformed sheet galvanized sheet steel, 0.76 mm (.030"), metal core thickness. Profile 38 mm deep x 300 mm wide x maximum length, colour as selected by Consultant from Stelco/Dofasco 8000 Series standard colour range. Basis of Design : VicWest 'AD300R', Equal products accepted.
- .2 Interior Metal Liner: Prefinished, preformed sheet galvanized sheet steel, 13 mm corrugated 29 gauge. Profile 13 mm deep x 813 mm wide x maximum length, colour as selected by Consultant from manufacturer standard colour range. Basis of Design : Westman ½" corrugated, Equal products accepted.
- .3 Flashings: Drip flashings, closures, and trim of same material thickness and finish as wall panels, break formed to shape.
- .4 Eavestroughing and downspouts: metal building standard. Colour from manufacturer's standard colour range.

**2.2 FABRICATION**

- .1 Cladding shall be formed in continuous one-piece lengths and manufactured to actual field dimensions and radii.
- .2 Flashings, gutters and downspouts to be shop fabricated in 3050 mm maximum lengths.

**3 EXECUTION**

**3.1 EXAMINATION**

- .1 Examine related work prepared by other trades and notify the Architect of any defects affecting the work of this section, before commencement of any work.
- .2 Inspect delivered materials upon receipt to ensure that no damage has occurred during shipment.

**3.2 INSTALLATION OF SHEET METAL PANEL**

- .1 Install all wall assemblies by erection crews approved by manufacturer in accordance with reviewed shop drawings.
- .2 Install panel hold-down clip assembly using fasteners as recommended by manufacturer.
- .3 Install panels plumb, straight, and true to adjacent work. Horizontal laps are not acceptable.
- .4 Install membrane air/vapour barrier in accordance with Section 07190.
- .5 When installing multiple panels over longer lengths, the product shall be installed securely but shall also allow and permit the movement resulting from expansion and contraction forces.

**3.3 FLASHINGS**

- .1 Install flashings and trim lapping end joints and caulk to provide weather tightness.
- .2 Exposed fasteners to be same colour as cladding sheet.

**3.4 TOUCH-UP AND CLEANING**

- .1 Touch-up minor paint abrasions with touch-up paint.
- .2 Clean wall by dry-wiping.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

.1	Cast-In-Place Concrete:	Section 03300.
.2	Precast Insulated Concrete Wall Panels:	Division 3
.3	Architectural Woodwork:	Section 06400.
.4	Air/Vapour Barriers:	Section 07271.
.5	Spray Applied Insulated Air Barrier:	Section 07273.
.6	Sheet Metal Flashings and Trim:	Section 07620.
.7	Sheet Metal Cladding:	Section 07645.
.8	Steel Doors and Frames:	Section 08110.
.9	Gypsum Wallboard:	Section 09260.
.10	Mechanical:	Division 15.

**1.2 SUBMITTALS**

- .1 Provide colour samples of the actual sealants for approval; painted or printed colour charts are not acceptable.
- .2 Submit duplicate copies of manufacturer's product literature for each type of sealant material specified and duplicate samples of each type of material and colour.
- .3 Before performing caulking work, do sample applications of each type of sealant for approval. Site locations for sample applications shall be designated by Consultant. Approved samples shall form standard for this project and no work of inferior quality will be allowed. Start no final work until approval of samples is given by the Consultant.

**1.3 ENVIRONMENTAL REQUIREMENTS**

- .1 Proceed with the work only when forecasted weather conditions are favourable for purpose care.
- .2 Maintain air temperature range of 4°C to 27°C in areas to receive sealants, 24 hours before, during application and until sealant has cured.
- .3 Should it become necessary to apply sealants at temperatures below or above this range advise the Owner and consult sealant manufacturer and follow the latter's recommendations.

**1.4 QUALITY ASSURANCE**

- .1 Installer Qualifications: only competent, qualified applicators, using adequate plant and equipment with previous experience on comparable projects that are approved by each sealant manufacturer shall execute the work of this section.
- .2 The employment of unqualified or insufficiently trained applicators, may result in the rejection of the work of this section at any time.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Joint Cleaner: non-corrosive and non-staining solvent type, recommended by sealant manufacturer for applicable substrate.
- .2 Primer: non-staining type as recommended by sealant manufacturer.
- .3 Joint Back-up
  - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam
    - .1 Extruded open cell foam backer rod.
    - .2 Size: oversize 30 – 50%
  - .2 Neoprene or Butyl Rubber
    - .1 Round solid rod, Shore A hardness 70.
  - .3 High Density Foam
    - .1 Extruded closed cell polyvinyl chloride (PVC) or neoprene foam backer, size as recommended by manufacturer.
  - .4 Bond Breaker Tape
    - .1 Polyethylene bond breaker tape which will not bond to sealant.
- .4 Sealants

<b>TYPE</b>	<b>CGSB SPEC</b>	<b>ASTM SPEC</b>	<b>PRODUCT DESCRIPTION</b>
S-1	CAN2-19.24-M80 Type 2 Class B Class 25 Grade NS	C-920-79 Type M	- Two component, non-sag, polyurethane or polysulphide sealant  - Shore A hardness of 20.40 - Joint movement range of ± 25%
S-2	CAN2-19.24-M80 Type 1 Class B Class 25	C-920-79 Type M  Grade P	- Two component, self-levelling, polyurethane or polysulphide sealant - Shore A hardness of 25.40 - Joint movement range of ± 25%
S-3	CAN2-19.13-M82 Type 1 & 2 Class B Class 25	C-920-79 Type S	- Low modulus, one component non-sag, polyurethane or polysulphide sealant - Shore A hardness of 15-25 - Joint movement range of ± 40% - Minimum elongation of 700%
S-4	CAN2-19.13-M82 Type 1 & 2 Class B	C-920-79 Type S Class 25	- One component, non-sag, polyurethane or polysulphide - Shore A hardness of 15-45

	Class B	Grade P	- Joint movement of $\pm 25\%$
S-5	19GP-19.13-M82 Type 2 Class B Grade NS	C-920-79 Type S Class 25	- Low modulus, one component, non-sag, neutral cure, silicone sealant - Shore A hardness of 15-20 - Joint movement range of $\pm 40\%$ - Joint size may be as little as two times joint movement
	<b>CGSB</b>	<b>ASTM</b>	<b>PRODUCT DESCRIPTION</b>
	<b>TYPE SPEC</b>	<b>SPEC</b>	
S-6	19GP-19.13-M82 Type 2 Class 25 Grade NS	C-920-79 Type S Class 25	- One component, neutral cure, non-sag, silicone sealant - Shore A hardness of 25-30 - Joint movement range of $\pm 25\%$
S-7	19GP-18M Type S Class 25 Grade NS	C-920-79	- One component, acetoxy cure, non-sag, silicone sealant - Shore A hardness of 25-30
S-8	19-GP-22M Type S Class 25 Grade NS	C-920-79	- One component, non-sag, mildew resistant silicone sealant - Shore A hardness of 25-30
S-9	19-GP-20M Type M/S Class 25 Grade P/NS	C-920-79	- One or two component, coal tar extended, fuel resistant polyurethane sealant - Shore A hardness of 15-35
C-1	19-GP-5-M	C-834-76	- One component acrylic latex caulking min.75% recovery per ASTM C-736-82 - Maximum joint movement $\pm 7.5\%$
C-2	19-GP-17-M	N/A	- One component, butyl rubber caulking - Maximum joint movement $\pm 5\%$
C-3	19-GP-21-M	N/A	- One component, acoustical caulking - Non-drying, non-hardening, synthetic rubber, normally not paintable

## 1.1 COLOURS

- .1 For bidding purposes provide the following colours for sealants:
  - .1 For joints around door and window openings and other non-moving objects, match colour of frame.
  - .2 For joints around aluminium frames, match colour of aluminium.
  - .3 For joints around mechanical and electrical penetrations, match colour of adjacent surfaces.
  - .4 Vitreous surfaces, clear, or if joint visible matching colour.
  - .5 Joints in masonry, match colour of brick or concrete block.
  - .6 Expansion and control joints, match colour of adjacent surfaces.

## 2. EXECUTION

### 2.1 INSPECTION

- .1 Ensure materials to be used are compatible with adjacent surfaces, other sealants and accessories and other membrane materials.
- .2 Examine substrate materials, joint voids and ensure they are acceptable to receive sealant materials.
- .3 Report unacceptable conditions to the Owner. Do not proceed with work until conditions have been corrected.

### 2.2 PREPARATIONS

- .1 Remove rust, paint, loose mortar and other foreign matter. Dry joint surfaces.
- .2 Remove rust, mill scale and other coatings from ferrous metals by wire brush or sandblasting.
- .3 Remove oil, grease and other coatings from non-ferrous metals with appropriate sealant.
- .4 Prepare cementitious and masonry surfaces to produce a clean, sound substrate capable of developing optimum bond with sealant.
- .5 Clean glazed, porcelain enamel and vitreous surfaces with appropriate chemical cleaner not harmful to substrate or will inhibit bond of substrate.
- .6 Where specific joint depth-to-width ratio is not available from manufacturer, install joint back-up material to achieve a joint depth-to width ratio of 1:2, with a minimum width of 6 mm and a maximum width of 25 mm.
- .7 Protect adjacent surfaces prior to beginning priming and during applications of sealant materials.
- .8 Prime sides of joints in accordance with manufacturer's directions.
- .9 Apply bond breaker tape in accordance with manufacturer's instructions.

**2.3 APPLICATION**

- .1 Sealant.
  - .1 Apply sealant in accordance with manufacturer's instructions.
  - .2 Apply sealant in continuous beads.
  - .3 Apply sealant using gun with proper size nozzle.
  - .4 Use sufficient pressure to fill voids and joints solid.
  - .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .6 Tool exposed surfaces to give slightly concave shape.
  - .7 Remove excess compound promptly as work progresses and upon completion.
  - .8 Seal perimeter of hollow metal door frames on both sides.
  - .9 Seal control joints in gypsum board and stucco, and junctions between interior partitions with exterior walls.
  - .10 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained, as indicated on drawings.
  - .11 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.
  - .12 Seal at all locations where dissimilar materials meet, where indicated on drawings.
- .2 Curing.
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.
- .3 Clean-up.
  - .1 Clean adjacent surfaces immediately and leave work neat and clean.
  - .2 Remove excess and droppings, using recommended cleaners as work progresses.
  - .3 Remove masking tape after initial set of sealant.

**2.4 SEALANT SCHEDULE**

<u>Conditions</u>	<u>Sealant Type</u>
.1 External Walls, Windows, Metal Roof	S-1,3,4 or 6
.2 Interior of External Walls	S-5 or S-6
.3 Interior Partition Joints	C-1
.4 Hollow Metal Door Frames to Walls	C-1
.5 Plumbing Fixtures	S-8
.6 Acoustic Sealant	C-3
.7 Millwork	C-1

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED OTHER SECTIONS**

.1	Spray Applied Insulated Air Barriers	Section 07273.
.2	Sealants	Section 07900.
.3	Door Schedule	See Drawings.
.4	Steel Doors and Frames	Section 08110.
.5	Sectional Overhead Doors	Section 08301.
.6	Hardware	Section 08710.
.7	Glazing	Section 08810.
.8	Steel Stud Framing	Section 05410.
.9	Gypsum Wallboard	Section 09260.
.10	Site Painting and Finishing	Section 09910.

**1.2 QUALITY ASSURANCE**

- .1 Manufacture fire door and frame components and assemblies to ULC/ULI/WARNOCK HERSEY/FACTORY MUTUAL requirements.
- .2 Hollow Metal Trades Association - Canadian Manufacturing Standards for Metal Doors and Frames.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Division 1.
- .2 Clearly indicate each type of frame, material, material thicknesses, mortises, reinforcements, anchors, finish, and special features.
- .3 Reference frames to door schedule. Indicate door numbers and construction where applicable.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Frames: 1.6mm for all interior locations and exterior doors; commercial quality steel cold rolled to ASTM A526-80; zinc coated to ASTM A525M-80, Z275 coating designation for exterior frames, ZF075 for interior frames. Frames shall be fully welded and re-finished so welding is not visible



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- .2 Accessories: Glazing stops, floor anchors, channel spreaders, 1.6mm tee anchors, 1.2mm wall stud anchors, zinc coated to ASTM A525M-80, coating designation ZF075. Corrugate tee anchors for masonry bond, Drill stud anchors for wire tie to studs, Lag bolts, shields and bushing for existing or concrete openings.
- .3 Guard Boxes: 0.50mm steel, ZF075 coating designation zinc finish to ASTM A525M-80.
- .4 Door Bumpers: Black neoprene; three silencers on strike jambs of single door frames; two silencers on heads of double-door frames; stick on bumpers are not acceptable.
- .5 Thermal Separators: extruded PVC, arctic grade.
- .6 Reinforcement for Hardware: carbon steel, welded in place, prime painted, to the following thicknesses:
  - .1 Hinge & Pivot reinforcements 30mm x 250mm x 3.5mm
  - .2 Strike reinforcements 1.6mm
  - .3 Flush Bolt reinforcements 1.6mm
  - .4 Closer reinforcements 2.5mm
  - .5 Surface hardware reinforcements 2.5mm
- .7 Door Jamb Reinforcement: 100mm x 40mm structural steel channel to CAN3-G40.21-M81.
- .8 Primer: to CGSB 1-GP-178M, for touch-up.

## **2.2 FABRICATION**

- .1 Fabricate frames in accordance with details and approved shop drawings. To Underwriters requirements and provide Underwriters labels.
- .2 Provide a minimum 13mm frame return where frame abut gypsum wallboard.
- .3 Mortise, reinforce, drill and tap frames and reinforcements to receive hardware using templates provided. Locate mortising to National Builders Hardware Association Standards.
- .4 Protect strike, hinge reinforcement completely by guard boxes welded to frame.
- .5 Weld in 50mm channel spreaders to frame; ensure proper frame alignment.
- .6 Where frames terminate at finished floor, provide floor plates for anchorage to structural slab.
- .7 Cut mitres accurately and weld on inside of frame profile.
- .8 Grind welded corners to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .9 Fill surface depressions and butted joints with metallic paste filler and sand to a uniform smooth finish.
- .10 Touch-up frames by priming areas where galvanizing is damaged.

- .11 Reinforce head of frames wider than 1200mm with 2.5mm formed steel channel welded in place, flush with top of frame.
- .12 Provide 3 jamb anchors per jamb for frames up to 2130mm high and 1 additional for each 600mm over 2130mm high.
- .13 Minimum depth of stop: 15mm. Glazing stops mitre joints, channel shape 15mm wide with counter screws.
- .14 Reinforce both jambs where door openings occur in screens. Install reinforcing continuous structure to structure.
- .15 Provide thermally broken frames to exterior locations.
- .16 Where fixed glazing occurs, sealed units must be installed on the outboard frame stop.

### **3. EXECUTION**

#### **3.1 INSTALLATION**

- .1 Set frames in plumb and square at correct elevation. Limit of acceptable frame distortion - 2mm out of plumb measured on face of frame, maximum twist corner to corner of 3mm.
- .2 Secure anchorages and connections to adjacent construction. Anchor doorjamb reinforcement securely to structure.
- .3 Brace frames solidly to maintain in position while being built-in.
- .4 Install a temporary horizontal wood spreader at mid-height of door opening to maintain frame width until building work completed.
- .5 For frames over 1200mm in width, provide vertical support at the centre of head.
- .6 Remove temporary spreaders only after completion of adjacent work.
- .7 Co-ordinate grouting of all frames solid to adjacent construction.
- .8 Provide formed metal drip section full width of frame opening for exterior doors.
- .9 Make allowance for deflection of structure to ensure structural loads are not transmitted to frames or screens.
- .10 All Exterior door frames that do not receive grout are to be install with closed-cell insulation sufficient enough to fill entire void, but not installed in a manner that shall affect the frame position or hardware movement. Excess or visually obtrusive insulation shall be neatly removed.
- .11 All frames to be caulked neatly with caulking suiting the application.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK IN SPECIFIED IN OTHER SECTIONS**

- |    |  |               |
|----|--|---------------|
| .1 | Insulated Precast Concrete Wall Panels | Division 3    |
| .2 | Sheet Metal Flashings and Trim         | Section 07620 |
| .3 | Commercial Door Operators              | Section 08734 |

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - .2 ASTM D523, Test Method for Specular Gloss.
  - .3 ASTM D822, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.105, Quick-Drying Primer.
  - .2 CAN/CGSB-1.213, Etch Primer (Pretreatment Coating) for Steel and Aluminum.
  - .3 CGSB 1.181, Coating, Zinc-Rich, Organic, Ready Mixed.
  
- .3 Canadian Standards Association (CSA International).
  - .1 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  
- .4 Environmental Choice Program (ECP).
  - .1 CCD-016, Thermal Insulation.
  - .2 CCD-047a, Paints, Surface Coatings.
  - .3 CCD-048, Recycled Water-Borne Surface Coatings

**1.3 SYSTEM DESCRIPTION**

- .1 Design exterior door assembly to withstand windload as defined in the National Building Code for the local area, with a maximum horizontal deflection of 1/360 of opening width.
- .2 Design door panel assemblies with thermal insulation factor 1.25 minimum RSI.
- .3 Design door assembly to withstand minimum 100,000 total life cycle.

**1.4 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.
  
- .2 Shop Drawings
  - .1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.
  - .2 Indicate sizes, service rating, types, materials, operating mechanisms, hardware and accessories, required clearances and electrical connections.
  
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
  
- .4 Manufacturers' Field Reports: submit copies of manufacturers field reports.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for overhead door hardware for incorporation into manual specified in Section 01790 - Closeout Submittals.

**1.6 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
  
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Division 1.
  
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  
- .3 Dispose of corrugated cardboard, polystyrene, plastic, packaging material in appropriate on-site bin for recycling in accordance with site waste management program.
  
- .4 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

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- .5 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

**1.8 MAINTENANCE**

- .1 Provide maintenance data for maintenance of sectional overhead doors, hardware and operation mechanism for incorporation into the maintenance manual as specified in section 01790.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Overhead Door Heavy Duty Thermacore Door #592 or equal. 51mm thick, R 17.5, ribbed texture, factory applied exterior color (standard palette), interior color:white. Exterior Color as indicated on drawings.
- .2 Aluminum Sash sections to be anodized black. Vision panels to be 16mm triple wall polycarbonate glazing, Light Transmission 50%, U Value .42. Configuration as indicated on the drawings.
- .3 Primer: polyvinylidene fluoride (PVF2) or to CAN/CGSB-1.181.
- .4 Insulation: polyurethane foam to meet design requirements. Insulation must be compatible with prolonged wet locations where applicable.
- .5 Product equals must possess or surpass designated R-Value, Air Infiltration values and come with a factory installed color and finish as the selected over-head door. Color shall be selected from the manufacturer's standard palate. UNO white exterior color will not be accepted.

**2.2 DOORS**

- .1 Fabricate 51 mm thick insulated ribbed flush panel doors of galvalume coated steel sections as indicated.
- .2 Fabricate panel frames by a continuous foamed-in-place polyurethane lamination process to form a homogenous sandwich panel of even textured polyurethane insulation of metal/foam/metal. Roll form sections to produce a thermal break.
- .3 Assemble components by means of spot or arc welding or coated rivet system or adhesive and self-tapping screws.
- .4 Provide sections with 1.6 mm base metal thickness steel end caps for bracket and hinge attachment.

### 2.3 HEAVY DUTY INDUSTRIAL HARDWARE

- .1 Finish: all hinges, brackets, tracks shaft brackets etc., to be commercially galvanized to Z275 designation.
- .2 Track: standard vertical lift hardware in combination with standard lift track. The door path is required to follow the building section as close as possible; with 79.4 mm size 2.8 mm core thickness track for torsion spring lifting and include ancillary hardware items.
- .3 Track Brackets: 3.2 mm base metal thickness galvanized steel, rib reinforced.
- .4 Track angles: continuous track angles to attach tracks to structure, fix welded or bolted adjustable type, running full height of opening, fabricated of galvanized steel, 2.4 mm base metal thickness.
- .5 Track hangers: 25 mm x 25 mm x 2.4 mm thick galvanized steel perforated angles.
- .6 Rollers: full floating hardened steel, with inner and outer ball races of hardened steel, 75 mm diameter complete with ten (10) 7.9 mm diameter ball bearings and 11.1 mm diameter roller axle.
- .7 Roller brackets: adjustable and minimum 3.2 mm galvanized steel.
- .8 Hinges: heavy duty, secure with rivets or self tapping screws, minimum 3.2 mm galvanized steel.
- .9 Counterbalance: torsion springs, grooved precision drums and flexible aircraft cables. Mount units on tubular or solid steel shaft, fully keyed full length and run on ball bearings. Shaft sizes as to be 31.8 mm diameter.
- .10 Accessories:
  - .1 5 mm thick formed sheet 1500 mm high track guards.
  - .2 Pusher springs.
  - .3 Pillow block bearing plates for high cycle door.
  - .4 Double contact type extruded neoprene weatherstrip for door sill section, full width.
  - .5 Extruded aluminum and arctic grade vinyl weatherstrip for jambs and head, to manufacturer's standard.
- .11 Finish ferrous hardware items with minimum zinc coating of 300 g/m<sup>2</sup> to CAN/CSA-G164.
- .12 Motion Eye entrapment protection to be included.
- .13 'Canimex 588'-stop bottom fixtures are required on each overhead door, one (1) for each cable.

**2.4 OPERATORS**

- .1 .Equip doors for operation by:
  - .1 Electrically Operated Doors: See Section 08734 Commercial Door Operators.  
Provide emergency Chain hoist with galvanized steel chain.

**2.5 ELECTRICAL OPERATOR**

- .1 See Section 08734, Commercial Door Operators

**3. EXECUTION**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

**3.1 INSTALLATION**

- .1 Install doors and hardware in accordance with manufacturer's instructions.
- .2 Rigidly support rail and operator and secure to supporting structure.
- .3 Touch-up steel doors with primer where galvanized finish damaged during fabrication.
- .4 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.
- .5 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.
- .6 Adjust weather-stripping to form a weather tight seal.
- .7 Adjust doors for smooth operation.

**3.2 FIELD QUALITY CONTROL**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.

- .2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Obtain reports within three days of review and submit.

**3.3 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**



**1. GENERAL**

**1.1 SUMMARY**

- .1 General: Provide access doors and panels in accordance with requirements of the Contract Documents

**1.2 LEED REQUIREMENTS**

- .1 Refer to Section 01 35 21 for LEED Requirements.

**1.3 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A568/A568M, Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
  - .2 ASTM A591/A591M Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications
  - .3 ASTM A653/653M, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, General Requirements
  - .4 ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
  - .5 ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .6 ASTM C36/C36M, Standard Specification for Gypsum Wallboard
- .2 National Fire Protection Agency (NFPA):
  - .1 NFPA 80, Standard for Fire Doors and Fire Windows.
- .3 Underwriters Laboratories of Canada (ULC):
  - .1 ULC S104, Fire Tests of Door Assemblies
- .4 Underwriters' Laboratories (UL), Standards for Safety acceptable to the Standards Council of Canada (SCC).

**1.4 ADMINISTRATION REQUIREMENTS**

- .1 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with as follows:
  - .1 Attendance will be required by the Contractor, major Mechanical and Electrical Subcontractors, and other subcontractors affected by work of this Section; purpose of meeting will be to discuss placement and type of access doors and panels and obtain Consultant's acceptance of locations before completing any permanent work of this Project.

- .2 Coordination: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in below, and as follows:
  - .1 Coordinate locations of all access panels in gypsum board ceilings with Consultant for size and location prior to installation, making every effort to locate outside of gypsum board ceilings.
  - .2 Coordinate acceptable locations and sizes with Architectural Reflected Ceiling Plans; no access panels are allowed in public corridors or feature ceilings.
  - .3 Coordinate closely with mechanical and electrical sections for size and locations of access panels in walls and ceilings; provide access doors and panels required for project.

**1.5 SUBMITTALS**

- .1 Product Data: Submit for Consultant's action. Furnish manufacturer's literature, specifications and installation instructions describing the general properties of each material and accessory to be used in the Work.
- .2 Shop Drawings: Submit for Consultant's action. Furnish shop drawings for the fabrication and installation of the Work. Prepare details at appropriate scale. Show typical details of the conditions for anchorage and support system.
- .3 Closeout Submittals: Submit for Owner's documentation. Warranty

**1.6 QUALITY ASSURANCE**

- .1 Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work
- .2 Regulatory Requirements: Provide fire rated access doors and frames in accordance with NFPA 80 or ULC S104, and labelled and listed by UL, ULC or ITS/Warnock Hersey, or another testing and inspecting agency acceptable to Authority Having Jurisdiction and Section 07 05 80.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.

**1.8 WARRANTY**

- .1 Special Warranty: Submit for Owner's documentation. Furnish 2 year written warranty in form stipulated by Consultant, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Owner. Other guarantees or warranties may not be substituted by the Contractor for the terms of this special warranty.

**2. PRODUCTS**

**2.1 NON-RATED ARCHITECTURAL ACCESS PANELS**

- .1 Flush doors and trimless frames, fabricated as follows:
  - .1 Aluminum Extrusions: ASTM B221/B221M, alloy 6063-T6.
  - .2 Door: Extruded aluminum frame with gypsum board inlay and structural nylon corner elements:
    - .1 Gypsum Board: to ASTM C36, 13 mm and 16 mm thickness to match adjacent construction.
    - .2 Size: Square sized to suit access requirements if not indicated on Drawings.
  - .3 Latch: Flush cam latch operated by tamper-resistant torx drive.
  - .4 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120 degrees and allowing door to be removed.
  - .5 Edge Bead: Recessed extruded aluminum frame edge bead providing surface that can be finished to adjacent gypsum board.
  - .6 Accessories: Fibreglass reinforced nylon, zinc plated screws, stainless steel springs and retaining wire to manufacturer's standard.
  - .7 Finish: Aluminum frames, gypsum board, nylon and aluminum cam latch to receive the same finish and paint as the surrounding surface.
  - .8 Acceptable materials:
    - .1 Access Panel Solutions, BaucoPlus Architectural Access Panel

**2.2 FIRE RATED ACCESS PANELS IN GYPSUM BOARD**

- .1 Flush, fire rated access doors and trimless frames, fabricated from zinc coated steel sheet, and as follows:

- .1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.
- .2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M
- .3 Z180 (G60) mill phosphatized zinc coating, at fabricator's option.
  - .1 Door: Flush panel, minimum thickness of 0.95 mm.
  - .2 Latch: Self-latching bolt operated by standard screwdriver with interior release.
  - .3 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.
  - .4 Automatic Closer: Spring type.
- .2 Edge Beads: Edge trim formed from 0.80 mm nominal thickness zinc coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.
- .3 Door Frame: Minimum 1.6 mm thick sheet metal with gypsum board bead.
  - .1 Acceptable materials: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - .1 Acudor Products, Inc., FB-5050-DW
    - .2 Nystrom Building Products Co., UW Series

**2.3 FIRE RATED ACCESS PANELS IN MASONRY OR CONCRETE**

- .1 Flush, fire rated access doors and trimless frames, fabricated from zinc coated steel sheet, and as follows:
  - .1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.
  - .2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M Z180 (G60) mill phosphatized zinc coating, at fabricator's option.
  - .3 Door: Flush panel, minimum thickness of 0.95 mm.
  - .4 Latch: Self-latching bolt operated by standard screwdriver with interior release.

- .5 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.
- .6 Automatic Closer: Spring type.
- .7 Edge Trim: All purpose exposed flange formed from 1.98 mm nominal thickness zinc coated steel sheet.
- .8 Door Frame: Minimum 1.6 mm thick sheet metal with gypsum board bead.
- .9 Acceptable materials: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - .1 Acudor Products, Inc., FB-5050
  - .2 Nystrom Building Products Co., UT Series
  - .3 Milcor Limited., UNIFRAD Universal Fire Rated Access Door

#### **2.4 ACCESS PANELS IN WALLS WITH TILE FINISH**

- .1 Flush, trimless frames, fabricated from zinc coated steel sheet, and as follows:
  - .1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.
  - .2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M Z180 (G60) mill phosphatized zinc coating, at fabricator's option.
    - .1 Mifab CAD-FR Series 16ga satin coated door with integral 16ga. satin coated steel frame. Where fire-ratings are required, the fire-rated access panels are required.
    - .2 Maintain required tile mortar grout thickness.

#### **2.5 FABRICATION**

- .1 Provide access door assemblies manufactured as integral units ready for installation.
- .2 Provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness for metal surfaces exposed to view in the completed Work.
- .3 Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

- .4 Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed based on size of door or panel opening.
- .5 Apply manufacturer's standard protective coating on aluminum that will come in contact with concrete after fabrication.

## 2.6 FINISHES

- .1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- .2 Finish metal fabrications after assembly.
- .3 Aluminum Finishes:
  - .1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - .2 As-Fabricated Finish: AA-M10 Mechanical Finish: as fabricated, unspecified (mill finish).
- .4 Steel Finishes:
  - .1 Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For zinc coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.
  - .2 Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pre-treating, as follows:
    - .1 Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
    - .2 Shop Primer for Zinc Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
    - .3 Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

**3. EXECUTION**

**3.2 PREPARATION**

- .1 Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

**3.3 INSTALLATION**

- .1 Provide access doors to locations indicated on drawings and for the following:
  - .1 Valves
  - .2 Volume and splitter dampers
  - .3 Fire dampers
  - .4 Cleanouts and traps
  - .5 Fan coil/force flow units
- .2 Install access doors in walls and ceilings in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .3 Co-ordinate exact location of access doors with other trades.
- .4 Ensure correct types of access doors and installed to accommodate applied wall and ceiling finishes.
- .5 Paint access panel to match adjoining wall color.

**3.4 ADJUSTING AND CLEANING**

- .1 Adjust doors and hardware after installation for proper operation.
- .2 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK IN OTHER SECTIONS:**

.1	Precast Insulated Concrete Wall Panels:	Division 3
.2	Metal Stud System:	Section 05410
.3	Air/Vapour Barriers:	Section 07271
.4	Sheet Metal Flashings and Trim:	Section 07620
.5	Sheet Metal Cladding:	Section 07645

**1.2 REFERENCES**

- .1 Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
- .2 Canadian General Standards Boards (CGSB)
  - .1 CAN/CGSB-1.40, Anticorrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-79.1, Insect Screens.
- .3 Canadian Standards Association (CSA) International
  - .1 CSA-A440, A440, Windows/ Special Publication A440.1, User Selection Guide to CSA Standard A440, Windows.
  - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-Z91, Safety Code for Window Cleaning Operations

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawing in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, and caulking. Indicate location of manufacturer's nameplates.
- .3 The supplier is responsible for approving glazing spans as they apply to the environmental conditions of the project location as required by the current Alberta Building Code. All suppliers must use engineer verified span tables. Engineer verified span tables must be included as part of the submittal.
- .4 If glass spans fall outside of normal span charts, or cannot proven to comply, it is the responsibility of the supplier to provide shop drawings sealed by a professional engineer.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01790 - Closeout Submittals.



**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 As indicated in Division 1

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Materials: to CSA-A440/A440.1 supplemented as follows:
  - .2 All aluminum windows by same manufacturer.
  - .3 Fasteners:
    - .1 In contact with aluminum: 300 series Type 316 stainless steel, conforming to ASTM A167 or 400 series cadmium plated steel, finish conforming to ASTM B766, Type NS, or aluminum, finish to match framing.
    - .2 In contact with steel: zinc plated steel, finish conforming to ASTM B633, Type LS.
    - .3 Exposed fasteners where permissible: aluminum, finish to match framing.
  - .4 Glass Settings and Gaskets: resilient type as recommended by the frame manufacturer, suitable for receiving glazing as specified in section 08810.
  - .5 Isolation Coating: alkali resistant bituminous paint
  - .6 Aluminum Flashing and Brake Shapes: 2.1 mm thick minimum prefinished aluminum flashing and brake shapes to match aluminum framing color.
  - .7 Sills: 2.1 mm thick minimum prefinished aluminum break shapes to shapes indicated.
  - .8 Glazing Gaskets: continuous semi-rigid neoprene and reinforced with nylon of the best quality; designed to neatly fit into and between the aluminum members and glazing. Provide point contact compression type gaskets; colour black.
  - .9 Glazing Tape: 'Polyshim II' tape as manufactured by Tremco or pre-approved product.
  - .10 Screws for securing aluminum members to structure: stainless steel, or a size and shape to withstand all stress and superimposed loads.
  - .11 Steel reinforcements and anchor plates: to CAN/CSA G40.21, Grade 300 W, galvanized after fabrication.

- .12 Foamed-In-Place Insulation: as specified in Section 07273.
- .13 Glazing: as specified in Section 08810.
- .14 Caulking: As specified in Section 07900.

## **2.2 WINDOW SYSTEM**

- .1 Basis of Design (Interior Glazing):
  - .1 Desa 175 Flushline Series Window, anodized aluminum Contractor to confirm glass spans are sufficient for extrusion system selected. Include all hinges, handles, weep covers, insect screens and accessories required for having a fully functional product.
  - .2 Desa 350 Series wide-style interior doors. Include rim cylinder and thumb turn keyed to owner keyways. Include 300mm offset handle (25mm) and 25mm 'd' push bar. Include 4040 door closer, door stop and Elephant foot.
- .2 Basis of Design (Exterior Glazing):
  - .1 Desa 45 Series Window c/w operating windows as shown. Back mullion as shown on drawings is the minimum depth. Aluminum Contractor to confirm back mullion is sufficient for wind loading.
  - .2 100mm Back Mullion, or as recommended by final supplier.
  - .3 Include all hinges, handles, weep covers, insect screens and accessories required for having a fully functional product.
- .3 Equal products accepted from U.S. Aluminum, Kawneer or other proven North American Supplier.

## **2.3 FABRICATION**

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of  $\pm 1.5$  mm for units with a diagonal measurement of 1800mm or less and  $\pm 3$ mm for units with a diagonal measurement over 1800mm.
- .3 Brace frames to maintain squareness and rigidity during shipment and installation.
- .4 Finish steel clips and reinforcement with 380 g/m<sup>2</sup> zinc coating to CAN/CSA-G164.

**2.4 ALUMINUM FINISHES**

- .1 Provide all exposed aluminum sections, exterior brake shapes, flashings and the like:
  - .1 Black Anodized finish to Aluminum Association AA-M12C 22A31 specification, free from defects and blemishes (Exterior).
  - .2 Clear Anodized finish to Aluminum Association AA-M12C 22A31 specification, free from defects and blemishes (Interior).
  - .3 Brake form all panels and flashing prior to application of finish.

**2.5 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of isolation coating:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood

**2.6 GLAZING**

- .1 Glaze windows in accordance with Section 08810 and CSA-A440/A440.1.

**3. EXECUTION**

**3.1 WINDOW INSTALLATION**

- .1 Install in accordance with CSA-A440/A440.1, then manufacturer's instructions and the reviewed shop drawings.
- .2 Arrange components to prevent abrupt variation in colour.

**3.2 CAULKING**

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .2 Apply sealant in accordance with Section 07900 – Joint Sealing. Conceal sealant within window units except where exposed use is permitted by Engineer.

**END OF SECTION**

**1. GENERAL**

**1.1 SUMMARY**

- .1 Provide Door Hardware in accordance with requirements of the Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA):
  - .1 ANSI/BHMA A156 Series of Standards
  - .2 ANSI/BHMA A156.18 Materials and Finishes
- .2 Builders Hardware Manufacturer Association (BHMA):
  - .1 Directory of Certified Products
- .3 Door and Hardware Institute (DHI):
  - .1 Sequence and Format for the Hardware Schedule
  - .2 ANSI/DHI A115.IG Installation Guide for Doors and Hardware
- .4 International Code Council (ICC)
  - .1 ICC A117.1, Standard for Accessible and Usable Buildings and Facilities

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Submission of Substitutions: The hardware listed in the Door Hardware Schedule establishes the quality standards, finishes, manufacturers and functions; Materials other than the named products for the Project may be acceptable to the Consultant.
- .2 Pre-installation Conference: Arrange a pre-construction meeting a discuss the following:
  - .1 Keying Conference: Conduct keying conference at Project site and incorporate decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
    - .1 Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion
    - .2 Requirements for key system schematic diagram
    - .3 Requirements for key control system
    - .4 Address for delivery of keys
- .3 Coordination: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware and coordinate with shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware in accordance with indicated requirements.

## 1.4 SUBMITTALS

- .1 Product Data: Submit for Consultant's action. Furnish in conjunction with hardware schedule. Label samples to indicate product, characteristics, and locations in the Work. Samples will be reviewed for colour and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Furnish samples of the following.
  - .1 Finish Samples: Furnish samples of each type of finish required for hardware. Make samples not less than 100 x 150mm plate size. Distribute the acceptable samples to the item manufacturers for purpose of matching.
  - .2 Hardware Samples: Submit for Consultant's action. Furnish a list of manufacturers and hardware items. Submit typed hardware schedule in a vertical format. Schedule hardware items for each door separately. List hardware and describe each piece with manufacturer's numbers. The schedule shall list each opening in individual headings and by item number sequence. Each opening shall be listed with location, door and frame size, door and frame materials, hand of door, degree of opening, fire label identification and other special details of the opening. The Consultant's original scheduled hardware set numbers shall be included in the item heading details. Keying information shall be listed in a separate column of the vertical format.
  - .3 Samples: Submit for Consultant's action. Furnish in conjunction with hardware schedule. Label samples to indicate product, characteristics, and locations in the Work. Samples will be reviewed for colour and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Furnish samples of the following.
    - .1 Finish Samples: Furnish samples of each type of finish required for hardware. Make samples not less than 100 x 150mm plate size. Distribute the acceptable samples to the item manufacturers for purpose of matching.
    - .2 Hardware Samples: Furnish 1 sample of each typical item of hardware to be exposed in the Work. Deliver the acceptable samples to the job site for comparison with the hardware delivered for installation.
- .4 Closeout Submittals: Submit for Owner's documentation.
  - .1 Warranty.
  - .2 Maintenance Data.

**1.5 QUALITY ASSURANCE**

- .1 Supplier Qualification: Recognized architectural finish hardware supplier, with warehousing facilities, who has been providing hardware for period of not less than 10 years in the Province of Alberta. The supplier shall be, or employ, a certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) currently registered in the continuing education program as administered by the Door and Hardware Institute (DHI). The hardware schedule shall be prepared, stamped, and signed by a certified AHC/EHC. Submissions without this stamp and signature will be rejected.
- .2 Installer Qualifications: Firm with 3 years' experience in installation of similar hardware to that required for this project, including specific requirements indicated. Must be certified to install integrated access control locks by the specified manufacturer.
- .3 Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work.
- .4 Fire-Rated Assemblies: Comply with the requirements of NFPA 80. For fire-rated doors and frames, provide only hardware which is labeled by ULC for the required fire-resistance ratings and complies with the label requirements of the doors and frames.
- .5 Manufacturing Compliance: Use only products listed in the BHMA Directory of Certified Products for the hardware of this Project.
- .6 Templates: Manufacture finish hardware to templates, and furnish hardware with fasteners of proper type to suit door and frame details. Furnish templates and schedules to door and frame manufacturers and other trades requiring same, so that doors and frames can be cut, reinforced and otherwise prepared in the shop to receive hardware.
- .7 Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of National, Provincial and Municipal authorities having jurisdiction. Obtain necessary approval from all such authorities.
- .8 Performance Requirements: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated, and generally comply with the following provisions:
  - .1 Accessibility requirements in accordance with ANSI 117.1.
  - .2 Handles, Pulls, Latches, Locks, and other Operating Devices:
    - .1 Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
  - .3 Door Closers: Maximum opening force requirements as follows:
    - .1 Interior Hinged Doors: Nominal 20 N applied perpendicular to door.
    - .2 Sliding or Folding Doors: Nominal 20 N applied parallel to door at latch.

- .3 Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- .4 Thresholds: Maximum 13mm high; bevel raised thresholds with a slope of maximum 1:2.
- .5 Latches, Locks, and Exit Devices: Nominal 65 N to release the latch, and shall not require the use of a key, tool, or special knowledge for operation.
- .6 Delayed-Egress Locks: Lock releases within 15 seconds after applying a force nominal 90 N.
- .7 Door Closers: Nominal 130 N to set door in motion and nominal 65 N to open door to minimum required width.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 General: Package and label each item of hardware separately. Tag each item in accordance with the final hardware schedule. Each package shall contain appropriate fastenings, instructions and installation templates. Protect all items from loss or damage in shipment. Store hardware items at the site in a locked space to prevent loss. Apply to doors as recommended by the hardware manufacturer and as required. Fit hardware in the respective doors and remove before painting. Reinstall after painting of doors is completed. Upon completion, adjust and lubricate hardware for proper operation.

## **1.7 WARRANTY**

- .1 Special Warranty: Submit for Owner's documentation. Furnish 5 year written warranty in form stipulated by Consultant, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Owner. Other guarantees or warranties may not be substituted by the Contractor for the terms of this special warranty.

## **1.8 MAINTENANCE**

- .1 Maintenance and Operating Manuals: Submit for Owner's documentation. Furnish complete manuals describing the materials, devices and procedures to be followed in operating, cleaning and maintaining the Work. Include manufacturers' brochures and parts lists describing the actual materials used in the Work. Assemble manuals for component parts into single binders identified for each system.
- .2 Maintenance Service: Approximately 6 months after the acceptance of hardware in each area, the Installer and the representative of the lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware items which have deteriorated or failed due to faulty materials or installation of hardware units. Furnish a written report of current and predictable significant problems in the performance of the hardware.

**2. PRODUCTS**

**2.1 SCHEDULED DOOR HARDWARE**

- .1 Provide door hardware for each door in accordance with requirements in this Section, door hardware sets indicated in door, frame and hardware schedule and the Hardware Schedule below.

**2.2 AUTOMATIC SWING DOOR OPERATORS**

- .1 Coordinate the work of all trades, including glass and glazing, masonry, and electrical requirements covered in manufacturer's details and appropriate sections of the specifications.
- .2 The electrical contractor shall provide 117 volt, 60 cycle, single phase 15 ampere service for 1-2 operators, 30 ampere service for 3-4 operators, and as follows:
  - .1 Coordinate with electrical contractor for provision of service to each operator from junction box for multiple operators.
  - .2 Coordinate with electrical contractor shall provide electrical conduit and wiring from specified controls to operators as outlined on manufacturer's drawings.
- .3 Finish hardware supplier shall provide and install concealed electro-mechanical swing door operator, consisting of electro-mechanical swinging door operator and electronic control, aluminum header, connecting hardware, and power on/off switch and safety sensor, and as follows:
  - .1 Automatic entrance equipment: comply with ANSI A156.10 for A156.19.
  - .2 Aluminum header extrusions: minimum nominal 4 mm wall thickness with finish to match adjacent aluminum materials.
  - .3 Equipment must operate between -35°C and +55°C in all climate conditions.
  - .4 Operator: Electro-mechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit.
  - .5 Bearings: Fully lubricated and sealed to minimize wear and friction.
- .4 Operator shall open the door with a 1/8 HP motor through reduction gears, door arm, and linkage assembly, and as follows:
  - .1 Low energy operator, door opening time: not be less than 4 seconds.
  - .2 The drive train shall have a positive, constant engagement. The operator shall stop the door in the open position by electrically reducing the motor voltage and stalling against a 90° stop.
  - .3 Close the door by spring energy; controlled by employing the motor as a dynamic brake.
  - .4 Door closing time shall not be less than 4.5 seconds.



- .5 Pre-load closing spring for positive closing action at a low material stress level for long spring life.
  - .6 The operator shall function as a manual door closer in the direction of swing with or without electrical power.
- 
- .5 The door forces and speeds generated during power opening, and manual opening in both direction of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI A156.10 or A156.19.
  - .6 Verify that no defects or errors are present in completed phases of the work that would result in poor application or installation, or cause latent defects of the automatic door equipment.
  - .7 Installation and warranty adjustments shall be performed by authorized distributors' factory trained technician.

**2.3 STAINLESS STEEL THRESHOLD AT FIRE RATED DOORS**

- .1 Provide brushed finish stainless steel threshold at all fire rated doors as indicated on drawings, and as follows:
  - .1 Basis-of-Design Material: Pro-Finish Hardware Associates Ltd., Series PGH 12.

**2.4 FASTENERS**

- .1 Supply all necessary
- .2 y screws, bolts and other fasteners of suitable size and type to adequately and permanently secure hardware in place.
- .3 Fasteners shall be of same material and finish as hardware.
- .4 Use fasteners that are compatible with materials through which they pass.

**2.5 HARDWARE FINISHES**

- .1 Conform to ANSI/BHMA A156.18-2000, Recommended Practices for materials and Finishes.

**2.6 KEYING**

- .1 Nomenclature shall conform to the American Society of Architectural Hardware Consultant handbook entitled "Keying"
- .2 Form keys form nickel silver.
- .3 Furnish two change keys for each lock except where noted otherwise.

- .4 Keying System:
  - .1 Provide construction keying and master keying.
  - .2 Consult with school board representative regarding keying system.

### **3. EXECUTION**

#### **3.1 EXAMINATION**

- .1 Examine doors and frames, with installer present, for compliance with requirements for installation tolerances, labelled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- .2 Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- .1 Steel Doors and Frames: Comply with DHI A115 series.
- .2 Wood Doors: Comply with DHI A115-W series.

#### **3.3 INSTALLATION**

- .1 Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required in accordance with governing regulations:
  - .1 Standard Steel Doors and Frames: DHI's Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
  - .2 Wood Doors: DHI WDHS.3, Recommended Locations for Architectural Hardware for Wood Flush Doors.
- .2 Install each door hardware item in accordance with manufacturer's written instructions.
- .3 Coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way.
- .4 Do not install surface mounted items until finishes have been completed on substrates involved, and as follows:
  - .1 Set units level, plumb, and true to line and location.
  - .2 Adjust and reinforce attachment substrates as necessary for proper installation and operation.

- .3 Drill and countersink units that are not factory prepared for anchorage fasteners.
- .4 Space fasteners and anchors according to industry standards.
- .5 Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.
- .6 Protect doors and frames from damage due to installation of hardware.
- .7 Installation of Hinges
  - .1 Install three hinges per door for doors up to 2280mm high and one additional hinge for every additional 760mm.
  - .2 Install each hinge flush with surface of door and frame so as to prevent binding.
  - .3 Attach hinges to metal work using paint clearing template machine screws.
- .8 Installation of Lock/Latch sets
  - .1 Provide and install manufacturer's standard wrought box strike for each lock or latch bolt, with curved lip extended to protect frame. Finish to match hardware set.
  - .2 Secure lock and latch sets to metal doors using machine screws.
- .9 Installation of Closers
  - .1 Unless otherwise indicated, install closers on room side of door.
  - .2 Secure to metal doors using template machine screws and sex bolts.
  - .3 Install all necessary mounting plates, extra length arms and other special accessories.

### **3.4 ADJUSTING**

- .1 Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and in accordance with referenced accessibility requirements:
  - .1 Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - .2 Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - .3 Door Closers: Adjust sweep period so that, from an open position of 70°, the door will take at least 3 seconds to move to a point 75mm from the latch, measured to the leading edge of the door.
- .2 Six Month Adjustment: Approximately six months after date of Substantial Performance, perform the following:
  - .1 Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
  - .2 Consult with and instruct Owner's personnel on recommended maintenance procedures.

- .3 Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

**3.5 CLEANING AND PROTECTION**

- .1 Clean adjacent surfaces soiled by door hardware installation.
- .2 Clean operating items as necessary to restore proper function and finish
- .3 Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

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**1. GENERAL**

**1.1 SECTION INCLUDES**

- .1 Overhead Sectional Door Openers.

**1.2 RELATED SECTIONS**

- .1 Precast Insulated Concrete Wall Panels Division 3
- .2 Sectional Overhead Doors: Section 08301
- .3 Door Hardware: Product Requirements for cylinder core and keys. Section 08710
- .4 Wire and Cable Section 16121
- .5 Conduit Section 16131
- .6 Boxes and Fittings: Section 16135

**1.3 REFERENCES**

- .1 NEMA 250, Enclosures for electrical equipment (1000 Volts Maximum).
- .2 NEMA 1CS 6, Enclosures for Industrial Controls and Systems.
- .3 NEMA MG 1, Motors and Generators.

**1.4 DESIGN / PERFORMANCE REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.
- .2 Electric Motors shall be alternating-current squirrel-cage motors conforming with NEMA MG 1.
- .3 Wiring Connections: Requirements for electrical characteristics.
  - .1 208 volts, 60 HZ single phase.

**1.5 SUBMITTALS**

- .1 Submit under provisions of Section 01330.
- .2 Product Data: Manufacturer's data sheets on each product to be used, including:
  - .1 Preparation instructions and recommendations.
  - .2 Storage and handling requirements and recommendations.
  - .3 Details of construction and fabrication.
  - .4 Installation methods.
- .3 Shop drawings: Include detailed plans, elevations, details of framing members, required clearances and accessories. Include relationship with adjacent construction.
- .4 Manufacturer's Certificates: Certify products meet or exceed specified requirements.

- .5 Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

## **1.6 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: Company specializing in manufacturing products specified with minimum of five years documented experience.
- .2 Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.
- .3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - .1 Install in areas designated by Architect.
  - .2 Do not proceed with remaining work until workmanship and installation is approved by Architect.
  - .3 Refinish mock-up area as required to produce acceptable work.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Store products in manufacturer's unopened packaging until ready for installation.
- .2 Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- .3 Store materials in a dry, warm, ventilated weathertight location.

## **1.8 PROJECT CONDITIONS**

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **1.9 WARRANTY**

- .1 Provide operators with a 2 year or 20,000 cycle limited warranty on motor and parts.

## **2. PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Acceptable Manufacturer: Overhead Door Corp.

- .2 Products equal in performance, size and power draw accepted.
- .3 Requests for substitutions will be considered in accordance with provisions of section 01600.

## 2.2 OVERHEAD SECTIONAL DOOR OPERATORS

- .1 Commercial Sectional Door Operator: Model RSX Commercial Door Operator:
  - .1 Application:
    - .1 Standard Lift Sectional Door.
    - .2 Full Vertical Sectional Door.
  - .2 Electric Motor: UL listed.
    - .1 Rating:
      - .1  $\frac{3}{4}$  horse power (hp) single phase.
    - .2 Motor frame comply with:
      - .1 NEMA 56 for  $\frac{3}{4}$  and 1 hp all phases.
    - .3 Construction:
      - .1 Open drip-proof construction.
      - .2 Wash-down – NEMA 4/12 construction.
    - .4 Reduction: Primary reduction is SuperBelt, an auto tension poly-V flex belt that does not require adjustment. Secondary reduction is by chain and sprocket.
    - .5 Duty cycle: Accommodate standard usage, up to 60 cycles per hour during peak usage periods.
      - .1 Brake: DC Disc type with selectable Progressive Braking for smooth stopping.
      - .2 Clutch: Adjustable friction disc type.
      - .3 Limit System: LimitLock limit system, magnetic type providing absolute positioning with push to set and remote setting capabilities. Limit System shall remain synchronized with the door during manual operation and supply power interruptions.
  - .3 Control System: Microprocessor based with relay motor controls on a single board. System incorporates a 16 character Liquid Crystal Display (LCD) to display the system status. System shall include the following:
    - .1 Capable of monitoring and reporting on a variety of operating conditions, including: Current operating status, Current command status, Motor movement status, Current error status (if applicable), Hoist Interlock status (if applicable), External Interlock status, and 24VDC status.
    - .2 A delay-on-reverse operating protocol.
    - .3 Maximum run timers in both directions of travel that limit motor run time in the event a clutch slips or some other problem occurs.
    - .4 Provisions for the connection of a 2-wire monitored photo-eye or a 2-wire monitored edge sensor, as well as non-monitored 2-wire sensing edges, photo-eyes or other entrapment protection devices.

- .5 Control action will be constant contact close until a monitored entrapment device is installed, allowing for selection of momentary contact.
  - .6 Provisions for connection of 3-button control stations
  - .7 Provisions for connection of an external 3-wire radio controls and related control devices.
  - .8 On board open, close and stop control keys for local operation.
  - .9 CodeDodger radio receiver that is dual frequency cycling at 315 Mhz and 390 Mhz capable of storing 250 single button and/or 250 Open-Close-Stop transmitters with the ability to add and/or delete transmitters individually, identify and store activating transmitter IDs.
- .4 Mounting:
- .1 Sectional Steel Doors:
    - .1 Jackshaft/Hoist that is side mounted with:
      - .1 Direct shaft-to-shaft coupling to door.
- .5 Release:
- .1 Release shall be a pull and hold type mechanism with single cable operation and an integrated interlock switch on hoist units.
- .6 Hoist: Chain hoist consists of chain pocket wheel, chain guard and smooth hand chain on hoist units.
- .7 Entrapment Protection:
- .1 Control system shall have provisions to connect monitored entrapment protection devices such as monitored electric sensing edge, or monitored photo-eye and to provide constant contact close control operation in lieu of such devices.
- .8 Control accessories:
- .1 Operator Controls:
    - .1 Push-button operated control stations with open, close, and stop buttons.
    - .2 Controls for interior location.
    - .3 Controls surface mounted.
    - .4 Remotes for Apparatus
  - .2 Special Operation:
    - .1 Commercial monitored photo-eyes.
    - .2 Door operation and full open auxiliary contacts for door traffic lights.



**3. EXECUTION**

**3.1 EXAMINATION**

- .1 Verify door sizes, configuration, tolerances and conditions are acceptable.
- .2 Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- .3 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.2 PREPARATION**

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.3 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Use anchorage devices to securely fasten assembly without distortion or stress.
- .3 Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- .4 Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

**3.4 ADJUSTING**

- .1 Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- .2 Adjust hardware and operating assemblies for smooth and noiseless operation.

**3.5 CLEANING**

- .1 Clean components using non-abrasive materials and methods recommended by manufacturer.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.

**3.6 PROTECTION**

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

**1. GENERAL**

**1.1 SUMMARY**

- .1 General: Provide Low energy power operated door operators, in accordance with requirements of the Contract Documents.

**1.2 LEED REQUIREMENTS**

- .1 Refer to Section 01 35 21 for LEED Requirements.

**1.3 REFERENCE DOCUMENTS**

- .1 Meet or exceed requirements of ANSI/BHMA A156.19, American National Standard for Power Assist and Low Energy Power Operated Doors and Alberta Building Code.

**1.4 DEFINITIONS**

- .1 Low Energy Power Operated Doors: doors with a power mechanism that opens and closes the door upon receipt of an actuating signal and does not generate more kinetic energy than specified in ANSI/BHMA A156.19. Closing of doors is linked to and integral with power operator mechanism.

**1.5 PERFORMANCE REQUIREMENTS**

- .1 Meet or exceed performance requirements of ANSI/BHMA A156.19.
- .2 Doors shall operate smoothly, quietly, safely and consistently.
- .3 Force required to manually open doors shall not be more than force required in event of operator failure.
- .4 Exterior doors shall operate as specified under wind pressure prescribed in the Alberta Building Code, applied against opening and closing cycles, and in a temperature range of minus 40 to plus 40 degrees Celsius.
- .5 Hold-open Time:
  - .1 Push Plate/Button Activation: field-adjustable from 5 to 30 seconds.
  - .2 Door Movement Switch Activation: less than 1 second.
- .6 Locking electric strikes shall disable door operator activation devices. Momentary Release of electric strikes during off-hours shall enable door operator activation devices for a period of time, field-adjustable from 1-30 seconds.
- .7 Operators shall open doors 90 degrees from closed position.

**1.6 SUBMITTALS**

- .1 Shop drawings: Submit for Consultant's action Shop Drawings and show the following:
  - .1 Components, materials, and finishes.
  - .2 Dimensions and relationship to surrounding construction, using plan view, elevation views, and section details.
  - .3 Plan view showing door swing in relation to surrounding construction.
  - .4 Installation wiring diagrams.
- .2 Samples: Submit for Consultant's action, duplicate samples of finishes of exposed system components.

**1.7 OPERATION AND MAINTENANCE DATA**

- .1 Submit operation and maintenance data including the following:
  - .1 Parts lists referenced to isometric exploded view of door operator.
  - .2 Schematic wiring diagrams including all components, switching devices and current characteristics.
  - .3 Manufacturer's recommendations for servicing frequencies, adjustment and operation applicable to each component.
  - .4 Description of remedial action required to correct possible operational deficiencies.

**1.8 REGULATORY REQUIREMENTS**

- .1 Comply with Alberta Building Code requirements for door release hardware at required exits and accessibility signs.

**1.9 COORDINATION**

- .1 Coordinate with electric door locking system specified in Section 08 71 00.

**2. PRODUCTS**

**2.1 OPERATORS**

- .1 Refer to Section 08 71 00.
- .2 Type: electro-mechanical, surface-mounted to door frame header, connected to door with pivoting linkage arm.

- .3 Motor: electric, permanent magnet, minimum 1/12 HP 60W DC motor, equipped with circuit protection, connections for power and control wiring, and suited to building's electrical service at point of installation.
- .4 Provide semi-concealed, readily accessible, "on-off" switch.
- .5 Gears shall be in an air-tight, gasketed gear box concealed within operator enclosures.
- .6 Operators shall be equipped with a clutch mechanism as required to meet performance and regulatory requirements.

## 2.2 ELECTRONIC CONTROLS

- .1 Electronic controls shall be solid state, low voltage compatible with card access system.
- .2 Swing doors controls shall include provision for time delay from 1-30 seconds before closing, and individually adjustable closing and opening speeds.
- .3 Provide readily accessible, semi-concealed "on-off" switch.

## 2.3 ACTIVATING DEVICES

- .1 Provide hard-wired push plates as indicated on Door Schedule and drawings
- .2 Push Plates: 100 mm diameter round or square, stainless steel.

## 2.4 OPERATOR ENCLOSURES

- .1 Provide manufacturer's standard, surface mounted enclosure, designed to prevent entry of dust.
- .2 Enclosure shall allow ready access for adjustments, servicing and maintenance of operator and controls.
- .3 Enclosures Finish: Stainless steel: brushed finish.

## 2.5 POSTS

- .1 Posts shall be designed for concealed mounting of activating devices.
- .2 Posts: stainless steel, cross-section dimensions 150 x 150 mm.
- .3 Materials shall be as follows:
  - .1 Galvanized Steel: to CAN/CSA-G40.21-M92, Grade 300W, hot dip galvanized with minimum Z275 coating designation to ASTM A653M.
  - .2 Stainless Steel: to ASTM A167-96, Type 304.

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- .4 Steel Clips, Supports and Reinforcement: to CAN/CSA-G40.21-92, minimum 6.0 mm thick, hot-dip galvanized to CAN/CSA-G164-M92.

## 2.6 ACCESSORIES

- .1 Provide recessed international symbol of accessibility (ISA) and the following clearly legible wording under ISA's: "PUSH TO OPEN", on push plates.
- .2 Push plates and identification plates shall be stainless sheet steel, satin finish. Letters on plates shall be recessed, in colour matching symbol of accessibility, in upper case, and helvetica medium font.
- .3 Identification plates shall be minimum 100 mm x 100 mm.
- .4 Fasteners:
  - .1 Materials for Fastening Metals to Metals: aluminum, nonmagnetic stainless steel.
  - .2 Materials for Fastening Metals to Concrete and Masonry: stainless steel or carbon steel, hot dip galvanized to CAN/CSA-G164-M92.
  - .3 Provide tamper-resistant exposed fasteners for mounting devices.
- .5 Provide surface-type overhead door holder at each door to receive operator, finish to match existing hinges.

## 2.7 FINISHES

- .1 Factory finish components.
- .2 Hardware: match door hardware.
- .3 Stainless Steel: type 304, satin finish.

## 3. EXECUTION

### 3.1 INSTALLATION

- .1 Install components to manufacturer's recommendations.
- .2 Install door holders to limit doors to opening swing specified.
- .3 Install operators on interior side of exterior entrances.
- .4 Install rubber dampening devices to sound isolate operators from door frames.
- .5 Isolate aluminum surfaces from contact with cementitious materials, using thick coating of bituminous paint. Let paint dry before installation of aluminum component.

**3.2 ADJUSTING**

- .1 After completing installation, adjust for optimum, smooth operation.
- .2 Adjust door hold open time to 8 seconds.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- |    |                         |                |
|----|-------------------------|----------------|
| .1 | Door Schedule:          | See Drawings   |
| .2 | Steel Doors and Frames: | Section 08110. |
| .3 | Aluminum Windows:       | Section 08511. |
| .4 | Washroom Accessories:   | Section 10282. |

**1.2 DELIVERY, STORAGE AND HANDLING**

- .1 Suitably protect glass products to prevent damage from weather, breakage and work of other trades. Individually wrap accessory materials to protect them from damage.
- .2 Store glass vertically, off the ground, on 'A' frames, braced or blocked to prevent racking, twisting, or sagging.
- .3 Protect glass products from exposure to moisture or condensation prior to installation.

**2. PRODUCTS**

**2.1 GLASS MATERIALS**

- .1 Type 1: Wired Glass: not used.
- .2 Type 2: Safety Glass: to CAN/CGSB-12.1, transparent, 6mm clear float tempered.
- .3 Type 3: Mirrors to CAN 2-12.5, silvered, 5 mm thickness, unframed.
- .4 Type 4: Basis of Design: 'Solarban 60' or better. Sealed unit system: 6mm annealed w/low e coating/ 13mm AS argon/ 6mm annealed.
- .5 Type 5: Float glass: to CAN/CGSB-12.3, glazing quality, 6 mm thick.

**2.2 GLASS SPANS**

- .1 It is the responsibility of the glazing contractor to confirm designated glass thickness and strengths conform to each circumstance (span) as defined by the Alberta Building Code 2014.
- .2 The designated glass thicknesses and strengths will be governed by Section 2.1 of this specification or the Alberta Building Code 2014, whichever is the more stringent requirement.

**2.3 GLAZING COMPOUNDS**

- .1 Sealing Compound: to CGSB-19-GP-5M, one component, acrylic base, gun grade, colour to match.
- .2 Glazing Tape Standard of Performance: 440 tremtape.

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- .3 Setting Blocks: neoprene, 80 durometer hardness, 100mm long x 10mm thick x 6mm high.
- .4 Spacer Shims: neoprene, 50 durometer hardness, 75mm long x 2mm thick x 10mm high.
- .5 Glazing Splines: neoprene, manufacturer's standard dry glazing splines to suit aluminum extrusions.

### **3. EXECUTION**

#### **3.1 INSTALLATION**

- .1 Methods as listed below:
  - .1 Clean contact surfaces with solvent and wipe dry.
  - .2 Cut glazing tape to proper length and set against permanent stops. Install horizontal strips first, extend over entire width of opening before applying vertical strips. Weld corners together by butting tape and dabbing with sealant.
  - .3 Place setting blocks at 1/4 points.
  - .4 Remove paper backing from tape.
  - .5 Install glass, rest on setting blocks, push against tape with sufficient pressure to ensure full contact and adhesion at perimeter.
  - .6 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

#### **3.2 GLAZING SCHEDULE**

- .1 Type 1: All fire rated doors and frames
- .2 Type 2: All interior doors and sidelights.
- .3 Type 3: Unframed mirrors, as indicated on drawings.
- .4 Type 4: All insulated metal doors and exterior pressed steel door frames.
- .5 Type 5: All other locations.
- .6 PVC window glazing by PVC window manufacturer.

#### **3.3 CLEANING**

- .1 After installation, mark light with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.
- .2 Remove glazing materials from finish surfaces.
- .3 Remove labels after work is complete.
- .4 Clean glass and mirrors.

**END OF SECTION**



**1 GENERAL**

**1.1 SUMMARY**

- .1 Provide Gypsum Board Assemblies in accordance with the requirements of the Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
  - .3 ASTM A5110/A510M, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire
  - .4 ASTM A641/A641Ma, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
  - .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .6 ASTM B221M, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]
  - .7 ASTM C11, Standard Terminology Relating to Gypsum and Related Building Materials and Systems
  - .8 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - .9 ASTM C475/C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
  - .10 ASTM C645, Standard Specification for Non-structural Steel Framing Members
  - .11 ASTM C754, Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products
  - .12 ASTM C834, Standard Specification for Latex Sealants
  - .13 ASTM C840, Standard Specification for Application and Finishing of Gypsum Board
  - .14 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications
  - .15 ASTM C954, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.75 mm) to 0.112 in. (2.84 mm) in Thickness
  - .16 ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - .17 ASTM C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

- .18 ASTM C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
- .19 ASTM C1280, Standard Specification for Application of Gypsum Sheathing
- .20 ASTM C1396M, Standard Specification for Gypsum Board
- .21 ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- .22 ASTM D5420 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
- .23 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
- .24 ASTM E136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-19.21, Sealing and Bedding Compound for Acoustical
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA S136 North American Specification for the Design of Cold Formed Steel Structural Members
- .4 Northwest Wall and Ceiling Bureau (NWCB):
  - .1 Specifications Standards Manual
- .5 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials
  - .2 CAN/ULC S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - .3 CAN/ULC S114, Standard Method of Test for Determination of Non-Combustibility in Building Materials
  - .4 CAN/ULC S702, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1
  - .5 Underwriters' Laboratories of Canada (ULC), List of Equipment and Materials

### **1.3 SYSTEM DESCRIPTION**

- .1 Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ULC.
- .2 STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

- .3 Load and Deflection Criteria: Interior gypsum board walls are designed to withstand a lateral loading of 240 Pa positive and negative pressure, and maximum deflection not to exceed 1/240 of the wall height. If more stringent requirements are required notify Consultant for direction.

#### **1.4 DEFINITIONS**

- .1 Levels of Finish: Standard levels of finish defined by NWCB Manual apply to products of this Section as follows:
  - .1 Level 0: No tape or joint compound in joints.
  - .2 Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, unless a higher level of finish is required for fire resistance related assemblies and sound rated assemblies.
  - .3 Level 2: Embed tape and apply separate first and finish coats of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile.
  - .4 Level 3: Embed tape and apply separate first and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will receive [heavy gauge wall coverings specified in Section 09 72 00 – Wall Coverings as final decoration.]
  - .5 Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view.
  - .6 Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat over entire surface for corridors, long hallways, walls and ceilings longer than 7500 mm or walls higher than 3600 mm, and for all curved or angled wall surfaces.
- .2 Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

#### **1.5 SUBMITTALS**

- .1 Action Submittals: Provide following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data for each type of product indicated.
  - .2 Shop Drawings: Submit for Consultant's action. Furnish shop drawings to show the proposed locations of items that are required, but not shown on the Drawings, including access doors, control joints, and details for isolation of framing from structure. Prepare details at not less than 1:5 minimum scale
  - .3 Samples: Submit samples for trim accessories, full-size sample 300 mm long for each trim accessory indicated.

- .4 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:
  - .1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Appendix D of Alberta Building Code for review by the Consultant.
  - .2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed
  - .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

## **1.6 QUALITY ASSURANCE**

- .1 Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work.
- .2 Field Samples: Prior to the Pre-Construction Conference, provide a field sample for each type of gypsum board construction and special conditions in the building at areas to be designated by the Consultant. Utilize the same materials and installation methods in the sample as required for the final Work. Schedule the installation so that the sample may be examined, and any necessary adjustments made, at least 1 week prior to date scheduled for commencing installation of the Work. When accepted, sample areas shall serve as the standard for materials, workmanship, and appearance for such Work throughout the project and shall remain a part of the final Work.
- .3 Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of National, Provincial and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time of installation.

**1.8 PROJECT/SITE CONDITIONS**

- .1 Environmental Requirements: Do not start installation of gypsum board unless building is enclosed and interior spaces are continuously maintained at a uniform temperature not less than 13°C from 1 week before start of gypsum board joint treatment until after the completed treatment is cured dry. Temperature requirements may be waived only on recommendation by gypsum board materials manufacturer. Provide ventilation to remove excess moisture from the air during joint treatment.

**2 PRODUCT**

**2.1 MANUFACTURERS**

- .1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 CertainTeed
  - .2 CGC Inc.
  - .3 Georgia-Pacific Canada, Inc.
- .2 Additional Manufacturers: Additional manufacturers are listed for accessory items and are incorporated into the Work subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials.

**2.2 PERFORMANCE REQUIREMENTS**

- .1 Fire Test Response Characteristics: Refer to Section 07 05 80; use materials identical to those listed for ULC assemblies submitted to Consultant.
- .2 Sound Transmission Characteristics: Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency for STC ratings of specific assemblies indicated on Drawings.

**2.3 MATERIALS**

- .1 Interior Gypsum Panels: Provide in maximum lengths and widths available that minimize joints in each area and correspond with support systems as indicated on drawings, in thicknesses as indicated and as follows:
  - .1 Regular Type Gypsum Board: Meeting requirements of ASTM C1396M with long edges tapered, and as follows:
    - .1 Location: Vertical surfaces, unless otherwise indicated.

- .2 Acceptable Materials:
  - .1 CertainTeed, Easi-Lite
  - .2 CGC Inc., Sheetrock
  - .3 Georgia-Pacific Canada, Inc., Toughrock Gypsum Wallboard
- .2 Fire Resistant Type (Type X) Gypsum Board: Meeting requirements of ASTM C1396M with long edges tapered, and as follows:
  - .1 Location: Where required for fire resistance rated assembly.
  - .2 Acceptable Materials:
    - .1 CGC Inc., Sheetrock Firecode.
    - .2 Georgia-Pacific Canada, Inc., Toughrock Fireguard
    - .3 CertainTeed Inc., Type X Gypsum Board
- .3 Sag Resistant Gypsum Board: Meeting requirements of ASTM C1396M, ceiling board manufactured to have more sag resistance than regular gypsum board with long edges tapered, and as follows:
  - .1 Location: Ceiling surfaces.
  - .2 Acceptable Materials:
    - .1 CGC Sheetrock Interior Ceiling Board
    - .2 Georgia-Pacific Tough Rock CD Ceiling Board
    - .3 CertainTeed Interior Ceiling Gypsum Board
- .4 Water Resistant Gypsum Board: To ASTM C1396; maximum permissible length and width; ends square cut; water repellent face paper; fire rated as indicated:
  - .1 Thickness: As indicated, minimum 16 mm thickness for wall
  - .2 Long Edges: Tapered.
  - .3 Location: Walls in washroom and housekeeping areas
  - .4 Acceptable Materials:
    - .1 CertainTeed M2Tech Moisture and Mold Resistant Gypsum Board
    - .2 CGC Sheetrock Mold Tough
    - .3 Georgia-Pacific Tough Rock Moisture-Guard
- .5 Impact Resistant Gypsum/Cellulose Fibre Board: Manufactured to produce superior resistance to surface indentation and through penetration than standard gypsum panels; gypsum panels with cellulose fibre reinforced facers and glass fibre reinforced core, tapered edges, minimum 13.7 kg/m<sup>2</sup>, 13 mm thickness, Type X ULC fire rating, conforming to ASTM C1629, and tested to the following performance ratings:
  - .1 Location; as indicated on Drawings.
  - .2 Tested in accordance with ASTM C1629 with the following performance or greater:
    - .1 Surface Abrasion: Level 3
    - .2 Surface Indentation: Level 1
    - .3 Soft Body Impact: Level 3
    - .4 Hard Body Impact: Level 3

- .3 Acceptable Materials
  - .1 CertainTeed Air Renew Extreme Impact, Type X, where required.
  - .2 CGC Sheetrock Brand Mold Tough VHI, Firecode X, where required.
- .2 Exterior Sheathing: Provide gypsum sheathing panels in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated, and as follows:
  - .1 Exterior Gypsum Soffit Board: ASTM C1396 proprietary brand gypsum based wall sheathing material formulated specifically for exterior use in water managed building envelope systems, type X where indicated to for required fire ratings and as follows:
    - .1 Location: soffits
    - .2 Acceptable Materials:
      - .1 CertainTeed Exterior Soffit Board (Type X)
      - .2 CGC Sheetrock Exterior Ceiling Board (Type X)
      - .3 Georgia-Pacific Toughrock Soffit Board
  - .2 Gypsum Based Wall Sheathing Board: ASTM C1177 proprietary brand gypsum based wall sheathing material formulated specifically for exterior use in water managed building envelope systems and as follows:
    - .1 Location: Exterior walls, coordinate with Drawings.
    - .2 Acceptable Materials:
      - .1 CertainTeed GlasRoc Exterior Sheathing (For rated applications = Securock Firecode Type X Glass- Mat Sheathing)
      - .2 Georgia-Pacific DensGlass Exterior Sheathing (For rated applications = DensGlass Fireguard Type X Exterior Sheathing)
  - .3 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475 and as follows:
    - .1 Joint Tape:
      - .1 Interior Gypsum Board: Paper.
      - .2 Exterior Gypsum Soffit Board: Fibreglass mesh tape.
    - .2 Joint Compound for Interior Gypsum Board: Vinyl based, non- asbestos, low dusting type compatible with other compounds applied on previous or for successive coats, and as follows;
      - .1 Pre-filling: Setting type taping compound.
      - .2 Embedding the Fire Coat: Drying type compound.
      - .3 Fill Coat: Drying type compound.
      - .4 Finish Coat: Drying type, sandable topping compound.
      - .5 Skim Coat: Drying type, sandable topping compound.
  - .4 Steel Suspended Ceiling Framing: Provide components and materials in accordance with ASTM C754 for interior conditions as indicated on Drawings, and as follows:

- .1 Tie Wire: ASTM A641 Class 1 zinc coating, soft temper, No. 18 guage wire.
- .2 Hangers:
  - .1 Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, No. 8 guage.
- .3 Carrying Channels: Cold rolled, commercial steel sheet with a base metal thickness of 1.2 mm x 13 mm minimum wide flange, with ASTM A653, Z180, hot dip galvanized zinc coating; 38 mm minimum depth.
- .4 Furring Channels: Commercial steel sheet with ASTM A653, Z180, hot dip galvanized zinc coating and as follows:
  - .1 Hat Shaped, Rigid Furring Channels; ASTM C645, 0.46 mm thickness x 22 mm deep.
- .5 Steel Partition Framing: Provide components and materials in accordance with ASTM C754 for conditions indicated on Drawings.
- .6 Steel Sheet Components, Steel Studs and Runners: In accordance with ASTM C645 requirements for metal and with ASTM A653, Z180, hot dip galvanized zinc coating and as follows:
  - .1 Steel Studs: Nominal 0.46 mm base metal thickness, except use 0.75 mm heavy weight framing to support fire rated door frames; depth as indicated on drawings.
  - .2 Runners: Width, thickness and galvanizing to match steel studs, and as follows:
    - .1 Slotted Deflection Track for Fire Separations:

Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm o/c along length of runner; tested and certified for use in fire rated wall construction:

      - .1 Acceptable Materials:
        - .1 Brady Construction Innovations, SliptrackSystems
        - .2 Dietrick Metal Framing, SLP-TRK
      - .2 Double Runner Deflection Track: Outside runner using 50 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.
      - .3 Base Runner: Bottom track with 33 mm upstanding legs.
  - .3 Flat Strap and Backing Plate, Strapping: Steel sheet for blocking and bracing in length and width indicated; 1.2 mm nominal base metal thickness x 406 mm wide.
  - .4 Horizontal Cross Bracing: 1.2 mm nominal base metal thickness; 13 mm minimum width flange x 38 mm minimum depth.
  - .5 Clip Angles: 38 mm x 38 mm x 1.8 mm nominal base metal thickness
  - .6 Furring Channels: Commercial Steel sheet with ASTM A653, Z180, hot dip galvanized zinc coating, as follows:



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- .1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.75 mm thickness x 22 mm deep.
  - .2 Resilient Furring Channels: 0.46 mm thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).
  - .7 Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
  - .7 Heavy Gauge Interior Partition Framing: Steel Stud framing for walls exceeding 5000 mm in height, and as follows:
    - .1 Cold Formed Sheet Steels: Commercial steel sheet interior members not forming a part of the exterior building envelope shall have a minimum ASTM A653, Z180, hot dip galvanized zinc coating, thickness of framing members exclusive of galvanized coating.
    - .2 Studs: to CAN/CSA-S136 and shall be identified as to specification, type grade and mechanical properties; minimum 65 mm deep x 38 mm wide x metal core thickness 0.75 mm spaced at 305 mm on centre, hot dipped galvanized steel; roll formed with knurled flanges, services and bracing cut outs.
    - .3 Sill tracks: To CAN/CSA-S136, top track shall be a single track system with minimum metal core thickness 0.75 mm hot dipped galvanized steel. Top track flanges of depth to suit vertical deflection; do not fix top of studs to track, minimum depth 38 mm and width to suit studs. Floor track to suit stud width, and 33 mm flanges.
    - .4 Channel stiffener: 19 mm cold rolled channel of 1.2 mm, electro-galvanized steel.
    - .5 Fasteners:
      - .1 Stud to stud; Steel, self-drilling, self-threading, and case hardened.
        - .1 Material: stainless steel or steel with minimum 0.008mm cadmium or zinc coating.
        - .2 Head Profile: hex, pan, and low profile type.
        - .3 Length: adequate to penetrate not less than 3 fully exposed threads beyond joined materials.
      - .2 Track to concrete: Hilti drilled insert, sizes as specified. Do not use Powder Actuated Fasteners.
      - .3 Track to steel: Secure track to structural over 8 mm thickness with Hilti "DX fastening system" with "X-EDNI" nails as specified. Provide additional steel back up above interstitial steel deck for wall support.
      - .4 Drilled Inserts: Steel, cadmium plated or hot dip galvanized, sizes as indicated on drawings.
    - .6 Bolts and Nuts: Meeting requirements of ASTM A307, with large flat type steel washers, sized to suit fasteners, hot dip galvanized, 413.68 MPa Tensile Strength

- .7 Welding Electrodes: Minimum tensile strength series of 480 MPa, suitable for material being welded.
- .8 Touch up Paint for galvanized surfaces: MPI #18, inorganic or SSPC-Paint 20, Type 1 Inorganic; zinc-rich primer.

## **2.4 ACCESSORIES**

- .1 Joint Tapes: ASTM C475, in dry powder form, or pre-mixed ready for application, as especially recommended by gypsum board manufacturer for conditions of the application.
- .2 Joint Compounds: ASTM C475, in dry powder form, or pre-mixed ready for application, as especially recommended by gypsum board manufacturer for conditions of the application.
- .3 Exterior Gypsum Soffit Board Compounds: Use setting-type taping compound and setting-type, sandable topping compound.
- .4 Adhesive: As recommended by the gypsum board manufacturer for adhering of gypsum board to backing material.
- .5 Acoustical Sealant: ASTM C834. Non-sag emulsion sealant. Specifically recommended by manufacturer as an acoustical sealant.
  - .1 Pecora Corporation “AC-20 FTR”
  - .2 Tremco Mfg. Co. “Acoustical Sealant”
  - .3 Specified Technologies, Inc. “Smoke and Sound”
  - .4 Serious Energy, Inc. “Quiet Seal ProAC-20 + Silicone”
- .6 Vinyl Foam Isolation Tape: Compressible, self-adhesive, non-exuding, closed cell, vinyl foam glazing tape of approximately 30 Shore 00 hardness. Nominal 6 mm thickness.
  - .1 Saint Gobain “Norseal V- 980” (adhesive two sides)
  - .2 Saint Gobain “Norseal V-780” (adhesive one side)
- .7 Trim Accessories:
  - .1 Interior Trim: Galvanized coated steel sheet or rolled zinc meeting the requirements of ASTM C1047, in the following shapes:
    - .1 CB Corner Bead: Standard 0.40 mm thickness, corrosion resistant outside corner reinforcements, angle to suit installation.
    - .2 Reinforced Corner Bead: Heavy duty 0.46 mm thickness, corrosion resistant outside corner reinforcements for use at high exposure corners, angle to suit installation.
    - .3 LC Edge Bead: U-shaped trim 0.40 thickness to provide a clean finished edge; exposed long flange receives joint compound; use at exposed panel edges, and returns to adjacent materials.
    - .4 Expansion Joints: Back-to-back edge beads at joints spanning building expansion and movement joints.

- .5 Control Joints: V-shaped trim having strippable joint protection specifically manufactured to provide thermal stress relief to large ceiling and wall areas; confirm locations with Consultant before installation.
- .6 Strippable Edge Trim: Extruded PVC with pre-masked L-shaped tape on trim with tear away protective serrated strip for removal after compound and paint is applied, for use at areas where gypsum butts aluminum frames and where gypsum butts concrete or concrete block.
- .7 Bullnose Bead: Architecturally finished corners and transitions, used only where detailed.
- .8 Acceptable Materials.
  - .1 Dietrich Industries, Metal Trims and Finishing Products
  - .2 Other materials may be acceptable provided information is sent to and accepted by the Consultant before installing products required by this Section.
- .2 Aluminum Trim: Extruded accessories of profiles and dimensions indicated:
  - .1 Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 alloy 6063-T5.
  - .2 Finish: Clear anodized compatible with joint compound and finish materials.
- .8 Acoustic Materials: Coordinate placement of acoustic materials with wall assembly types. Use only fire rated materials in fire and smoke rated assemblies. Acoustic sealants shall be applied prior application of fire and smoke seals specified in Section 07 84 00 and as follows:
  - .1 Acoustic Sealant for Exposed Joints: Non-sag, paintable, non-staining, latex sealant in accordance with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction:
    - .1 Basis-of-Design Materials: Pecora Corp., AC-20 FTR Acoustic and Insulation Sealant.
    - .2 Acoustic Sealant for Concealed Joints: Non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission:
      - .1 Acceptable Materials:
        - .1 Pecora Corp., BA-98.
        - .2 Tremco, Acoustical Sealant

- .3 Acoustic Insulation for Fire and Smoke Rated Assemblies: Meeting the requirements of ULC S702 mineral fibre acoustic sound batts, Type 1 for all properties except thermal performance, width to friction fit steel studs; un-faced, thickness minimum 89 mm to fill a minimum of 90% of the cavity thickness, nominal density 40 kg/m<sup>3</sup> minimum; STC ratings as indicated on drawings; having maximum flame spread and smoke developed of 20/20 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114:
  - .1 Acceptable Materials:
    - .1 Owens-Corning Canada Inc., Sound Attenuation Fire Batts
    - .2 Roxul Inc., Roxul AFB Acoustical Fire Batt
  
- .4 Acoustic Insulation for Fire and Smoke Rated Assemblies: Meeting the requirements of ASTM C423, ASTM E90 and ASTM E413, and ULC S702 mineral fibre acoustic sound batts, Type 1 for all properties other than thermal, width to friction fit steel studs; un-faced, thickness to fill a minimum of 90% of the cavity thickness, nominal density 12.2 kg/m<sup>3</sup> minimum; STC ratings as indicated on drawings:
  - .1 Acceptable Materials:
    - .1 Owens-Corning Canada Inc., Quietzone Acoustical Batts
    - .2 Johns-Manville Sound Shield Glass Fibre Batts
  
- .9 Auxiliary Materials: Provide auxiliary materials in accordance with referenced installation standards and manufacturer's written recommendations, and as follows:
  - .1 Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - .2 Steel Drill Screws: ASTM C1002, unless otherwise indicated, except use screws in accordance with ASTM C954 for fastening panels to steel members form 0.75 mm to 2.67 mm thickness, and as follows:
    - .1 Type S: Shallow pitch screw; used for single layer gypsum board application
  - .3 Isolation Strip at Exterior Walls: Adhesive backed, closed cell vinyl foam strips that allow fastener penetration without foam displacement, 3 mm thick, in width to suit steel stud size.
  - .4 Access Panels: Refer to Section 08 31 00, rated to suit wall or ceiling fire rating.

**3 EXECUTION**

**3.1 EXAMINATION**

- .1 Examine areas and substrates with Installer present, and including welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- .1 Suspended Ceilings:
  - .1 Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength
  - .2 Furnish inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction where concrete inserts are required.
- .2 Foam Deck Inserts:
  - .1 Coordinate with fire resistive foam deck inserts, firestopping and smoke seal materials specified in Section 07 84 00.
  - .2 Install specified materials in accordance with material manufacturer's written instructions.
- .3 Access Panels and Doors:
  - .1 Coordinate access panels and wall types with materials specified in Section 08 31 00.
  - .2 Coordinate with Mechanical and Electrical for locations and size requirements of access panels.
  - .3 Coordinate and confirm location of access panels before installation with Consultant.
  - .4 Install specified materials in accordance with material manufacturer's written instructions.
- .4 Fire Rated Construction:
  - .1 Install material forming a part of fire rated construction in accordance with manufacturer's instructions and as required to meet specific ULC listed construction requirements submitted by Subcontractor.
  - .2 Install fire rated gypsum wall panels vertically; horizontal installation does not meet testing standard unless horizontal blocking is installed behind horizontal joints.

- .5 Membrane Air and Vapour Retarders:
  - .1 Coordinate with self-adhered air and vapour retarder membrane to ensure compatibility with membrane and primers with selected exterior gypsum based sheathing.
  - .2 Install specified materials in accordance with material manufacturer's written instructions.
  
- .6 Cold Weather Application of Gypsum Board:
  - .1 Install gypsum board and joint compound in accordance with NWCB requirements and manufacturer's instructions.
  - .2 Provide temporary heat and moisture control for a period sufficiently in advance of gypsum board and joint compound application to allow building and substrates to acclimate to installation temperature and moisture range required by manufacturer.
  - .3 Maintain temporary heat until permanent building heating system is started and continuously running.
  - .4 Provide suitable ventilation to allow materials to dry properly; prevent excessive air movement that could dry materials too quickly and that could cause shrinkage cracking.

### 3.3 INSTALLING STEEL FRAMING

- .1 Installation Standards: ASTM C754, and ASTM C840 requirements that apply to framing installation.
  
- .2 Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. In accordance with details indicated and with gypsum board manufacturer's written recommendations or, if non available, with NWCB, Specifications Standards Manual.
  
- .3 Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement, and as follows:
  - .1 Isolate ceiling assemblies where they abut or are penetrated by building structure.
  - .2 Isolate partition framing and wall furring where it abuts structure, except at floor.
  - .3 Install double runner deflection track at head of assemblies that avoid axial loading of assembly and laterally support assembly.
  
- .4 Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

- .5 Installing Steel Suspended Ceiling and Soffit Framing: Suspend ceiling hangers from building structure as follows:
  - .1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  - .2 Install supplemental suspension members and hangers in form of trapezes or equivalent devices where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members.
  - .3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
  - .4 Secure wire hangers by looping and wire tying, either directly to structures 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 them to deteriorate or otherwise fail.
  - .5 Secure rod, flat or angle hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail:
    - .1 Do not attach hangers to steel deck tabs.
    - .2 Do not attach hangers to steel roof deck. Attach hangers to structural members. Provide additional carrier channels between structural elements where structure does not align with hangers.
    - .3 Do not connect or suspend steel framing from ducts, pipes, or conduit.
  - .6 Install steel framing components for suspended ceilings so members or panel attachment are level to within 3 mm in 3600 mm measured lengthwise on each member and transversely between parallel members.
  - .7 For exterior soffits, install bracing and framing to resist wind uplift.
  - .8 Wire-tie furring channels to supports, as required in accordance with requirements for assemblies indicated. Clips will not be acceptable.
  - .9 Install suspended steel framing components in sizes and spacing indicated, but not less than that required by the referenced steel framing and installation standards:
    - .1 Hangers: 1220 mm o/c.
    - .2 Carrying Channels (Main Runners): 1220 mm o/c
    - .3 Furring Channels (Furring Members): 406 mm o/c
    - .4
- .6 Installing Steel Partition Framing: Install tracks (runners at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction:
  - .1 Install foam gasket isolation strip between studs where studs are installed directly against exterior walls.

- .2 Install each steel framing and furring member so fastening surfaces vary not more than 3 mm from the plane formed by the faces of adjacent framing.
- .3 Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board:
  - .1 Cut studs 13 mm short of full height to provide perimeter relief.
  - .2 For fire resistance rated and STC rated partitions that extend to the underside of floor slabs and roof decks or other continuous solid structure surfaces: Install framing around structural and other members extending below floor slabs and roof decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
  - .3 Terminate partition framing at suspended ceilings where indicated.
- .4 Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- .5 Install horizontal cross bracing to steel studs at 1220 mm o/c vertically for the entire length of wall for unbraced walls exceeding 3660 mm in length.
- .6 Frame door openings using 0.75 mm steel studs and in accordance with gypsum board manufacturer's applicable written recommendations:
  - .1 Screw vertical studs at jambs to jamb anchor clips on door frame; install runner track section (for cripple studs) at head and secure to jamb studs.
  - .2 Install two studs at each jamb, connected for entire length.
  - .3 Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- .7 Frame openings other than door openings the same as required for door openings. Install framing below sills of openings to match framing required above door heads.

### **3.4 ACCESS PANELS**

- .1 Install access panels in wall assemblies to maintain fire rating of assembly.
- .2 Confirm location of access panels with the Consultant before installation.
- .3 Minor adjustments to location within wall system may be required where panel interferes with architectural appearance.

### **3.5 APPLYING AND FINISHING PANELS**

- .1 Gypsum Board Application and Finishing Standards: ASTM C840.



- .2 Panel Application Methods:
  - .1 Single Layer Application:
    - .1 On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing.
    - .2 On partitions, apply gypsum panels vertically (parallel to framing), unless horizontal application is indicated or otherwise required by fire resistance rated assembly, and to minimize end joints.
    - .3 Stagger abutting end joints not less than one framing member in alternate courses of board.
    - .4 At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire resistance rated assembly.
    - .5 Apply gypsum panels to supports using Type S screws fastened 10 mm from edges of board.
    - .6 Apply gypsum board to assemblies having resilient channels using Type S screws fastened 38 mm from edges of boards.
  - .2 Double Layer Application:
    - .1 Apply fire layer with enough screws to hold panel in place.
    - .2 Stagger and offset joints of second layer from first layer.
    - .3 Apply second layer over first layer and secure as specified for single layer application using screws long enough to penetrate both layers and penetrate 10 mm into metal framing.
  - .3 Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
  - .4 Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling; stagger abutting end joints of adjacent panels not less than one framing member spacing.
  - .5 Install gypsum panels with face side out; butt panels together for a light contact at edges and ends with not more than 1.5 mm of open space between panels; do not force into place.
  - .6 Locate edge and end joints over supports:
    - .1 Do not place tapered edges against cut edges or ends.
    - .2 Stagger vertical joints on opposite sides of partitions.
    - .3 Do not make joints other than control joints at corners of framed openings.
    - .4 Stop gypsum board away from underside of floor above and roof deck to allow for deflection of structure.
    - .5 Attach gypsum board to vertical studs, not to ceiling track, to allow for deflection.
  - .7 Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
  - .8 Attach gypsum panels to framing provided at openings and cut outs.

- .9 Form control joints to account for thermal movements, to account for movement where direction of framing changes direction, and movements arising differing substrate materials using V-Shaped trims by framing back-to-back framing members and a break in gypsum panel at a maximum of 7.5 meters o/c, as follows:

- .1 Install control joints in wall and ceiling construction in accordance with ASTM C840 so that gross area enclosed by joints does not exceed 80 m<sup>2</sup> between joint using limiting distance as follows:

Partition Type	Maximum Single Dimension
Interior Partitions	9 metres
Interior Ceilings with Perimeter Relief	15 metres
Interior Ceilings without Perimeter Relief	9 metres
Exterior Ceilings	9 metres
Exterior Walls	9 metres

- .2 Lay out control joints to coincide as far as possible with door, window or screen frames, but not necessarily to occur at every individual frame; install control joints vertically and horizontally from corners of openings.
- .3 Provide continuous dust barrier behind joints.
- .4 Install joints straight and true.
- .5 Form control joints to meet sound rated construction and fire ratings required for remainder of wall or ceiling construction.
- .6 Obtain Consultant's acceptance of control joint layout before starting installation of materials specified in this Section.
- .10 Form expansion joints to account for building movements using back-to-back framing members and edge trims, and a break in gypsum panel over structural movement joints and floor slab control joints as follows:
- .1 Install expansion joints incorporating continuous air and vapour membranes and with sufficient gap to allow for projected building movements.
- .2 Seal back-to-back edge bead control joints with clear silicone sealant as specified in Section 07 92 00.
- .3 Provide continuous dust barrier behind joints.
- .4 Install joints straight and true.
- .5 Form expansion joints to meet sound rated construction and fire ratings required for remainder of wall or ceiling construction.
- .11 Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally:

- .1 Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 0.7 m<sup>2</sup> in area.
- .2 Fit gypsum panels around ducts, pipes, and conduits.
- .3 Cut gypsum panels to fit profile formed by coffers, joists, and other structural members where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks; allow 6 mm to 10 mm wide joints to install sealant.
- .12 Isolate perimeter of non-load bearing gypsum board partitions at structural abutments, except floors. Provide 6 mm to 13 mm wide spaces at these locations, and trim edges with J-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustic sealant.
- .13 Space fastener in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations, and as follows:
  - .1 Space screws a maximum of 300 mm o/c for vertical applications.
  - .2 Space fasteners in panels that are tile substrates a maximum of 200 mm o/c.
- .14 Install fire rated and labelled gypsum board at all locations indicated on Drawings; continue fire and smoke rated wall construction behind and around fire hose cabinet recesses and other recessed items larger than a double gang switch box to maintain wall fire rating.
- .15 Install sheet metal backing where required for mounting of items. Spot glue sheet in place before applying surface layer of gypsum board.
- .16 Exterior Soffits and Ceilings: Apply exterior soffit board perpendicular to supports, with end joints staggered and located over supports:
  - .1 Install with 6 mm open space where panels abut other construction or structural penetrations.
  - .2 Fasten with corrosion resistant screws.
- .17 Tile Backing Panels:
  - .1 Install standard gypsum board panels in areas not subject to wetting to produce a flat surface.
  - .2 Install water resistant gypsum board in all washrooms and housekeeping rooms.
  - .3 Shim surfaces to produce a uniform plane across panel surfaces where tile backing panels abut other types of panels in the same plane.
- .18 Finishing Gypsum Board Assemblies:
  - .1 Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

- .2 Pre-fill open joints, rounded or bevelled edges, and damaged surface areas.
- .3 Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- .4 Provide the finish level, specified in ASTM C840, for the following surfaces:
  - .1 Level 1: plenum areas above ceilings and other concealed areas.
  - .2 Level 2: surfaces that are to receive ceramic tile.
  - .3 Level 3: surfaces that are to receive heavy spray or trowel applied finishes.
  - .4 Level 4: surfaces to receive wallcoverings, flat paints or light textures.
  - .5 Level 5: surfaces to receiving eggshell sheen paints to semi-gloss sheen paints.
- .5 Water Resistant Gypsum Board: Do not tape or fill joints in water resistant gypsum board used as a substrate for ceramic tile.
- .6 Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed vertically applied wall sheathing.

### 3.6 ACOUSTIC INSTALLATION

- .1 STC Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustic sealant. Install acoustic sealant at both faces of partitions at perimeters and through penetrations. In accordance with ASTM C919 and manufacturer's written recommendations for locating edge trim and closing off sound flanking paths around or through gypsum board assemblies, including sealing partitions above acoustic ceilings.
- .2 Acoustic Sealants:
  - .1 Seal sound rated partitions in strict in accordance with gypsum board manufacturer's instructions for the specific sound rating requirements. Provide two (2) beads of sealant where no sealant are indicated; one under each inner and outer layer of gypsum board.
  - .2 Locate sealant to ensure it is covered at completion of partition when finishes applied; use appropriate sealant for exposed locations.
  - .3 Seal around mechanical and electrical work and other work in walls to ensure proper sound ratings.
  - .4 Provide gaskets where partitions abut a finished surface or material and where partitions meet exterior wall furring.
  - .5 Build in all door and borrowed light frames and equipment to provide a neat, cleanly finished system.

- .6 In fire rated partitions use firestopping sealant instead of acoustic sealant to maintain required sound ratings. Zero rated smoke separations shall be constructed the same as for fire rated partitions.
  
- .3 Acoustic Sound Batts:
  - .1 Install acoustic sound batts within metal stud space and above suspended gypsum board ceiling as indicated for sound or fire rating.
  - .2 Acoustic sound batts to extend full height of partitions.
  - .3 Fill behind electrical outlet boxes, fire hose cabinets, washroom accessories and other openings with at least 150 mm lap around perimeter of opening; do not compress acoustic sound batts as this could cause the gypsum board finish to bulge or push outward.
  - .4 Coordinate with Electrical and Mechanical Subcontractors and verify that no back-to-back openings are formed, whether or not so indicated on drawings.
  - .5 Installation in accordance with manufacturer's current written recommendations.

### **3.7 FIRE RATING SEALANT INSTALLATION**

- .1 Seal fire rated partitions strictly in accordance with fire sealant manufacturer's instructions for specific fire rating requirements listed; coordinate with Section 07251.
- .2 Locate sealant to ensure it is covered at completion of partition when finishes applied.
- .3 Seal around mechanical and electrical work and other work in wall to ensure proper fire rating.

### **3.8 INSTALLING TRIM ACCESSORIES**

- .1 For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- .2 Control Joints: Install control joints at locations indicated on Drawings, confirm locations of joints with Consultant before construction, and in accordance with ASTM C840 and in specific locations approved by Consultant for visual effect where joints are not otherwise indicated.
- .3 Reveals: Cut vertical trims and casing beads at horizontal reveal locations, and install horizontal reveals continuous around corners and edges.

**3.9 SITE QUALITY CONTROL**

- .1 Above Ceiling Observation: Before installing gypsum board ceilings, Consultant will conduct an above ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected:
  - .1 Notify Consultant seven (7) working days in advance of date and time when Project, or part of Project, will be ready for above ceiling observation.
  - .2 Before notifying Consultant, complete the following in areas to receive gypsum board ceilings:
    - .1 Installation of 80% of lighting fixtures, powered for operation.
    - .2 Installation, insulation, and leak and pressure testing of water piping systems.
    - .3 Installation of air duct systems.
    - .4 Installation of air devices.
    - .5 Installation of mechanical system control air tubing.
    - .6 Installation of acoustic isolation system.
    - .7 Installation of ceiling support framing.

**END OF SECTION**

1415-057-00

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**1 GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Steel Stud Framing: Section 05410.
- .2 Gypsum Wallboard: Section 09260.
- .3 Room Finish Schedule: See Drawings.
- .4 Mechanical: Division 15.
- .5 Electrical: Division 16.

**1.2 SAMPLES**

- .1 Submit duplicate samples of each component of acoustical systems for approval. Include accessories and mitred interior and exterior corners of wall mouldings.
- .2 Install sample panel and components including suspension system at a location designated by the Owner.

**1.3 MAINTENANCE MATERIALS**

- .1 Provide one (1) sealed carton of each type of ceiling board for future replacements and store where directed.

**2 PRODUCTS**

**2.1 MATERIAL**

- .1 It is the intention to match the existing Acoustic units. Units vary situationally. The below unit is assumed to be the preferred, contractor to confirm the extents of usage:
  - .1 Acoustic Units LAT Type I: Standard of Performance: Armstrong Dune Second Look Tegular Lay-In Tile #1811. 24" x 48" x 3/4" with Pattern #2, or equal.
    - .1 Flame Spread Class A
    - .2 NRC- Noise Reduction Coefficient Range: 0.50.
    - .3 LRC- Light Reflectance ASTM E 1477: 83%.
    - .4 CAC- Ceiling Attenuation Class: ASTM C 1414: 35.
  - .2 Suspension System: Non fire rated exposed tee bar grid including wall moulding, to ASTM-C-636 for flush and tegular systems, Prelude exposed T grid. Match colour to grid to Type I.

NOTE: Add cross T's as per manufacturers guidelines where Type I ceiling are indicated on room finish schedule.

- .3 Suspension System Components: Commercial quality cold rolled steel zinc coated die cut interlocking components main and cross tee of double web with rectangular bulb depth governed by span. All components 15/16" exposed face.
- .4 Hangers: 2.6mm steel wire galvanized.
- .5 Suspension Accessories: Splices, clips, retainers, etc. to complement suspension system components.

### **3 EXECUTION**

#### **3.1 JOB ENVIRONMENT**

- .1 Commence installation after building enclosed and dust generating activities completed.
- .2 Permit wet work to dry prior to commencement of installation.
- .3 Maintain uniform minimum temperature of 15°C and humidity of 20-40% prior to, during and after installation.

#### **3.2 INSTALLATION**

- .1 Ensure suspended system is coordinated with location or related components.
- .2 Install ceilings in the indicated locations, level to within a tolerance of 3mm in 3600mm.
- .3 Install acoustic units parallel to building lines with edge unit not less than 50% of unit width. Refer to reflected ceiling plan.
- .4 Scribe acoustic units to fit adjacent work. Butt joints tightly, terminate edges with moulding.
- .5 Support suspension system main runners at 1.2m o.c. maximum, with hanger wire from building structural system. Completed assembly to support all super-imposed loads. Maximum permissible deflection is 1/360 of span.
- .6 Interlock cross member to main runner to provide rigid assembly
- .7 Install suspension assembly to manufacturers written instructions.
- .8 Install flush edge moulding at junction of acoustic unit ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.
- .9 Install framed access panels supplied under Divisions 15 and 16.
- .10 Seal vertical air plenum closure and acoustical ceiling where ventilating ceiling occurs. Use vinyl tape and 100 micrometre polyethylene to make positive, continuous seal.
- .11 Electrical fixtures shall be supported by the main runners and cross runners, but in addition to this the acoustical Subcontractor shall supply and install to each and every fixture a 2.6mm galvanized soft annealed mild steel wire hangers within 150mm of each corner. Fixtures exceeding 610mm x 1220mm shall be supported by other Sub-Contractors responsible to the General Contractor.
- .12 Runners supporting ceiling fixtures shall remain horizontal across their width within 2 degrees after the fixture loads are imposed.



- .13 Do not install acoustic units until work above suspension system is complete and has been inspected by Owner.
- .14 Allow for future servicing and removal of mechanical equipment, as detailed.
- .15 Use a sheet metal filler where any face dimension of a piece of acoustic board, measured from centre of Tee to face of wall is less than 75mm.
- .16 Refer to Mechanical Drawings for radiant panel supports.

**3.3 CLEANING**

- .1 Keep acoustic installation and all components clean. Remove blemishes immediately.
- .2 Remove and replace units which are damaged or improperly installed.

**3.4 SCHEDULE**

- .1 TYPE I: Typical to all LAT ceilings as shown on reflected ceiling plans except as noted otherwise.

**END OF SECTION**

**1 GENERAL****1.1 SUMMARY**

- .1 Provide Resilient Flooring and Accessories in accordance with requirements of Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM D2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
  - .2 ASTM F141, Standard Terminology Relating to Resilient Floor Coverings
  - .3 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .4 ASTM F970, Standard Test Method for Static Load Limit
  - .5 ASTM F1066, Vinyl Composition Floor Tile
  - .6 ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing
  - .7 ASTM F1516, Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended)
  - .8 ASTM F1861, Standard Specification for Resilient Wall Base
  - .9 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .10 ASTM F2034, Standard Specification for Sheet Linoleum Floor Covering
- .2 National Fire Protection Association (NFPA):
  - .1 NFPA (Fire) 255, Standard Method of Test of Surface Burning Characteristics of Building Materials
- .3 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC S102.3 Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Coordinate floor flatness and levelling requirements of this section with requirements of Section 03350; work of this Section includes floor levelling and patching required to meet resilient flooring manufacturer's installation requirements; notify Consultant where differences occur between specified tolerances and actual conditions

- .2 Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer.
- .3 Install flooring and accessories after other finishing operations, including painting and ceiling construction, have been completed.

#### **1.4 SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit one copy of product data for each type of product specified.
  - .2 Samples for Verification:
    - .1 Resilient Flooring: Submit samples of each different specified product for verification of colour and pattern in manufacturer's standard size, but not less than 150mm x 200mm in size for tile or sheet material, or 150mm long for resilient accessories.
- .2 Informational Submittals: Provide the following submittals during the course of the work:
  - .1 Site Quality Control Test Results: Submit results or moisture emission testing of concrete subfloors prior to installation of flooring. Results shall include comparison of manufacturer's recommended moisture content to actual moisture vapour emission rate.

#### **1.5 PROJECT CLOSEOUT SUBMISSIONS**

- .1 Operation and Maintenance Data: Submit manufacturer's written instructions for maintenance and cleaning procedures, include list of manufacturer recommended cleaning and maintenance products, and name of original installer and contact information.
- .2 Extra Materials: Provide ten (10) m<sup>2</sup> of each colour and type of flooring to be provided for future maintenance; packaged with protective covering for storage, and identified with labels describing contents.

#### **1.6 QUALIFICATIONS**

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Resilient Flooring Installer: Use an installer who is competent and have a minimum of three (3) years documented experience in the installation of resilient sheet flooring and seams in accordance with manufacturer's training or certification program:

- .2 Source Limitations: Obtain each type, colour, and pattern of flooring of accessories specified from one source with resource to provide products of consistent quality in appearance and physical properties without delaying the Work.

### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver flooring and installation accessories to site in manufacturer's original, unopened cartons and containers, bearing names of product and manufacturer, project identification, and shipping and handling instructions.
- .2 Storage and Handling Requirements: Store products in dry spaces protected from the weather, with ambient conditions maintained between manufacturer's recommended temperature range, and as follows:
  - .1 Do not stack tile goods over four cartons high, and distribute cartons evenly over floor area to prevent overloading of structure.
  - .2 Keep water based adhesives from freezing
  - .3 Store rolls upright in accordance with manufacturer's instructions.

### **1.8 PROJECT CONDITIONS**

- .1 Ambient Conditions: Maintain air and substrate temperature of between 21°C and 30°C in spaces receiving resilient flooring for a minimum of 72 hours before installation, during installation, and 48 hours after installation, or longer as recommended by manufacturer's written instructions, and as follows:
  - .1 Move flooring and installation accessories into spaces where they will be installed a minimum of 72 hours before installation.
  - .2 Maintain a minimum temperature of 15°C after installation to prevent damage to flooring materials
  - .3 Do not install flooring materials on substrates colder than ambient air temperature
  - .4 Do not install flooring materials and accessories until they are at the same temperature as the space where they are installed.

### **1.9 WARRANTY**

- .1 Notwithstanding the 12 months warranty period prescribing in the General Conditions of Contract, the flooring installation warranty shall include floor sealer manufacturer's warranty for products stating that sealer will perform to specified level for time period indicated, with repair or replacement at no cost to Owner, including removal of applied floor covering and any relocation of furnishings required, as follows:
  - .1 Level 1 Performance Criteria: seven (7) years
  - .2 Levels 2 and 3 Performance Criteria: ten (10) years

**2 PRODUCT****2.1 TILE FLOORING**

- .1 Not required in this project.
- .2 Static Dissipative Flooring:
  - .1 Not required in this project.

**2.2 SHEET FLOORING**

- .1 Safety Flooring: slip-resistant, resilient safety flooring as follows:
  - .1 Thickness: 2.0mm
  - .2 Thickness Wear Layer: Top Shield Surface finish
  - .3 Roll Width: Manufacturers Standard roll length
  - .4 Length: Manufacturers Standard roll length
  - .5 Colour: Standard Architectural Palate.
  - .6 Basis of Design: Forbo Marmoleum

**2.3 RESILIENT ACCESSORIES**

- .1 Resilient Wall Base: Smooth, buffed exposed face and ribbed or grooved bonding surface supplied in maximum practical length, conforming to ASTM F1861 and as follows:
  - .1 Type: TP – Thermoplastic Rubber
  - .2 Group: 1 – Homogeneous
  - .3 Style: Straight
  - .4 Height: 100mm
  - .5 Thickness: 3.2mm
  - .6 Colour: Standard Architectural Palate
  - .7 Length: Manufacturers standard maximum length
- .2 Resilient Transition and Edge Strips: Extruded vinyl shapes meeting or exceeding ADA Recommendations for change of level transitions for transition between floors finishes having different levels, i.e.: between resilient flooring on underlayment to carpet with no cushion or undergarment; acceptable materials as follows:
  - .1 The following list is included to indicate the most commonly used transition and edge strip accessories; additional materials may be required where transition heights differ from the products listed and shall be included as a part of the Contract.
  - .2 Transition Strip: Ceramic Tile to Resilient Flooring Transition: Johnsonite CTA-XX-K Transitional Moulding between flooring materials having dissimilar thicknesses, colour: selected from manufacturer's standard range.

- .3 Transition Strip: Resilient Flooring to Concrete Slab Transition: Johnsonite SSR-XX-B Transitional Moulding between materials having a thickness to materials having no thickness; colour: selected from manufacturer's standard range.
- .4 Transition Strip: Resilient Flooring to Resilient Flooring Transition; Johnsonite CTA-XX-N Transitional Moulding between materials having the same thickness; colour: selected from manufacturer's standard range.
- .5 Coordinate with Section 09650 for additional transition strips that may affect work of this section.
- .3 Transition Leveller: Johnsonite LS-40 Leveller system – cut to length to suit height of lift required between dissimilar heights of floor finishes.
- .4 Resilient Stair Accessories: Complying with FS RR-T-650 and the following:
  - .1 Composition: A – Rubber
  - .2 Colour: Selected from manufacturers standard range.
  - .3 Component:
    - .1 Stair Nosing: round nose profile, 3mm thickness, 38 mm vertical face, 70mm horizontal surface, double lock for butting to resilient flooring, ribbed, slip resistant profile; colour selected from manufacturers standard range.
    - .2 Stair Tread: round nose profile, 4mm overall thickness, 100 mm vertical face, width and depth to suit tread, diamond profile; colour selected from manufacturers standard range, complete with integral riser.

## 2.4 INSTALLATION ACCESSORIES

- .1 Trowellable Levelling and Patching Compounds: Latex modified, portland cement based formulation provided or approved by resilient product manufacturer for applications indicated; Gypsum based materials will not be accepted for use on this project.
- .2 Adhesives: Solvent free, water resistant primer and adhesive as recommended by flooring or resilient accessory manufacturer to suit resilient products specified and substrate materials and conditions, and as follows:
  - .1 Flooring adhesive: Light bodied adhesive recommended by flooring manufacturer
  - .2 Coved Flooring Base Adhesive: Heavy bodied adhesive recommended by flooring manufacturer.
  - .3 Rubber Base Adhesive: Contact adhesive recommended by base manufacturer.
  - .4 Vinyl Composite Tile Adhesive: Roberts 3057 Floor Tile Adhesive.
- .3 Stair Tread Nose Filler: Two part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours
- .4 Heat Welding Bead: Solid strand product recommended by flooring manufacturer for heat welding seams, and as follows:
  - .1 Colour and Pattern: Match colour and pattern of resilient flooring, unless otherwise noted on Drawings.

- .5 Flash Cove Base Accessories:
  - .1 Cove Strip: Pre-formed radius support for integral flash cove base provided or approved by flooring manufacturer
    - .1 Custom PVC Cove Filler Strip profile, Johnsonite # CFS-00-S1, radius of 10mm at front face, such that at door frame, finished integral cove base will abut and be completely contained by 13mm projection of door frame beyond wall surface, with no open gaps resulting from too large diameter cove filler. Notched back. Both sides tapered, extending to 25mm overall length, to cover gaps between floor substrate and gypsum board wall substrate.
    - .2 Cove Base Cap Strip: Square metal cap for integral flash cove base as recommended by flooring manufacturer.
  - .6 Sealer and Wax: Coordinated with Owners preferred long term maintenance program, sealer or wax as appropriate to flooring materials specified.
  - .7 Polyethylene: 150  $\mu\text{m}$  thickness conforming to CAN/CGSB-51.34.
  - .8 Tape: Self adhesive 65mm wide cloth tape.
  - .9 Provide brushed finish stainless steel threshold at all fire rated doors as indicated on drawings, refer to Section 08710.

### 3 EXECUTION

#### 3.1 EXAMINATION

- .1 Testing and Inspections: Test Moisture emission rate of concrete subfloor or wood subfloor prior to installing flooring, using the calcium chloride test method or electronic moisture test equipment in accordance with ASTM F1869, and as follows:
  - .1 Provide 72 hours notice to the Consultant of commencement of the Work
  - .2 Include cost of testing as a part of the price for work of this section.
  - .3 Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test, and as follows:
    - .1 Resilient flooring manufacturers generally set the maximum safe moisture emission level of concrete slabs at 0.170  $\mu\text{g/s.m}^2$ , confirm manufacturer's recommended emission rate before starting testing.
    - .2 Moisture tests must be conducted on all concrete slabs and is especially critical where low VOC or water based adhesives are specified
    - .3 Carefully monitor test conditions to ensure that tampering or disturbance of the test packs does not affect the results.
    - .4 Maintain a minimum temperature of 13°C for substrates during testing operations.

- .2 Examine substrates, areas, and conditions affecting work are in accordance with manufacturer's requirements, and as follows:
  - .1 Verify that floor surfaces are smooth and flat to plus or minus 3mm over 3000 mm; notify Consultant in writing where floor tolerances are not within acceptable values.
  - .2 Verify that concrete slabs comply with ASTM F-710 and the following:
    - .1 Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
    - .2 Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
    - .3 Verify that concrete slabs exhibit normal alkalinity of between 5 and 9 and that they are free of carbonization or dusting deleterious to flooring installation or adhesive bond.
    - .4 Subfloor finishes comply with requirements specified in Section 03350 for slab receiving resilient flooring.
    - .5 Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits that could interfere with flooring installation.
  - .3 Verify that wood subfloors comply with the following:
    - .1 ASTM F1482 for wood underlayment materials.
    - .2 Requirements specified in Section 06 10 00.
    - .3 Underlayment surface is free of irregularities and substances that may interfere with adhesive bond, show through surface, or stain flooring.

### 3.2 PREPARATION

- .1 Comply with resilient flooring manufacturer's written installation instructions for preparing substrates indicated to receive flooring.
- .2 Fill cracks, holes, and depressions in substrates using trowellable levelling and patching compounds in accordance with manufacturers written instructions and as follows:
  - .1 Levelling and patching shall be restricted to correcting minor deviations or imperfections to bring floor surface finish to within flooring manufacturer's tolerances for flatness.
  - .2 Coordinate finished floor tolerances with Section 03 35 00; this section is not responsible for providing levelling materials to achieve specified floor flatness as measured in accordance with Section 03 35 00.
- .3 Broom and vacuum clean substrates immediately before installing flooring.
- .4 After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

### 3.3 INSTALLATION

- .1 If required: Install vapour emission control floor sealer in accordance with manufacturer's instructions
- .2 Comply with resilient flooring manufacturer's written installation instructions.



- .3 Unroll flooring and allow stabilizing before cutting and fitting in accordance with manufacturer's installation instructions.
- .4 Layout tile flooring as follows:
  - .1 Lay tile with joints parallel to building lines or as indicated on drawings to produce a symmetrical tile pattern
  - .2 Install tile flooring so that perimeter tile width is minimum 1/2 full size.
  - .3 Install to pattern and direction indicated on Drawings.
- .5 Layout sheet flooring as follows:
  - .1 Maintain uniformity of resilient flooring direction
  - .2 Do not bridge building expansion joints with sheet flooring.
  - .3 Arrange for a minimum number of seams, where seams are necessary place them in inconspicuous and low traffic areas, and not less than 150mm away from parallel joints in flooring substrates.
  - .4 Match edges of flooring for colour shading and pattern at seams in accordance with manufacturer's written recommendations.
  - .5 Obtain Consultant's acceptance in writing before installing materials having cross seams; make adjustments to seaming plan as directed by Consultant to minimize or eliminate cross seams.
  - .6 Weld seams with welding rod where optional with manufacturer in accordance with written instructions for treatment of flooring adjacent to seams:
    - .1 Route joints of sheet flooring, leaving recommended joint profile for welding rod and permanently weld seams in accordance with ASTM F1516
    - .7 Install flooring flush with adjoining floor covering surfaces.
    - .8 Cove sheet flooring to walls, columns, cabinets, floor outlets and other appurtenances. Coordinate installation with Section 09652 for locations as indicated on Drawings
    - .9 Top of covered sheet flooring shall be straight and level to variation of plus or minus 3mm over 3000mm straight edge
    - .10 Roll sheet flooring in both directions in accordance with manufacturer's instructions:
      - .1 Use flat bladed tool adjacent to walls and door casings, and where access by roller is not practicable.
  - .6 Layout resilient base as follows:
    - .1 Fit joints tight and vertical
    - .2 Joints along one plane shall be a minimum 7000mm spacing, at inconspicuous locations.
    - .3 Mitre internal corners, groove and shape back side of base to fit around external corners and exposed ends.
    - .4 Install base on solid backing. Adhere tightly to wall and floor surfaces.
    - .5 Scribe and fit to door frames and other obstructions
    - .6 Install outside corners prior to installation of straight sections.
    - .7 Install straight and level to variation of  $\pm 3$ mm over 3000mm straight edge.

- .8 Do not stretch base during installation.
  - .9 Shave back of base where necessary to produce snug fit to substrate.
  - .10 Fill voids along top edge of resilient base with manufacturers recommended adhesives filler material where base is installed on masonry walls.
- .7 Layout resilient accessories as follows:
- .1 Install stair nosing and stair treads one piece for full width of tread. Adhere over entire surface and fit accurately.
  - .2 Install edge strips at unprotected and exposed edges where flooring terminates.
- .8 Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including build-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- .9 Extend flooring and base materials into toe spaces, door reveals, closets, and similar openings.
- .10 Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor using chalk or other non-permanent, non-staining marking device.
- .11 Set thresholds for fire rated doors in full bed of epoxy adhesive as specified in Section 08 71 00.

### 3.4 CLEANING AND PROTECTING

- .1 Perform the following operations immediately after installing flooring:
- .1 Remove adhesive and other surface blemishes using cleaner recommended by flooring manufacturer
  - .2 Sweep or vacuum floor thoroughly
  - .3 Do not wash flooring until after time period recommended by flooring manufacturer
  - .4 Damp mop floor to remove marks and soil
- .2 Protect flooring against mars, marks, indentations, and other damage arising from construction operations and placement of equipment and fixtures during the remainder of construction period using protection methods recommended in writing by flooring manufacturer, and as follows:
- .1 Apply protective floor finish or sealer, as appropriate to the specified materials; coordinate selection of floor polish or sealer with Owner's long term maintenance service.
  - .2 Use only commercially available product acceptable to flooring manufacturer, and provide list of products used as a part of maintenance instructions specified for this Section.
  - .3 Confirm with manufacturer that Owners preferred floor polish or sealer is compatible with manufacturers recommended commercial flooring installation maintenance procedures; notify Consultant where Owner's preferred products are not compatible with manufacturers recommendations.

- .3 Cover flooring with un-dyed, untreated building paper until inspection for Substantial Performance.
- .4 Do not move heavy and sharp objects directly over flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- .5 Provide final cleaning not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Performance, and as follows:
  - .1 Clean flooring in accordance with manufacturers written recommendations.
  - .2 Clean and strip protective floor finish applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
  - .3 Reapply polish to floor surfaces to restore protective floor finish in accordance with flooring manufacturer's written recommendations.
  - .4 Coordinate with Owner's maintenance program and provide listing of materials required to maintain resilient flooring.

**END OF SECTION**

**1 GENERAL**

**1.1 SAMPLES**

- .1 Submit samples in accordance with Section 01330 – Submittal Procedures.
- .2 Submit duplicate 300mm long samples of rubber base for each colour.

**1.2 ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48h before, during and for 48h after installation.

**1.3 EXTRA MATERIALS**

- .1 Provide 3m length of each colour rubber base required for this project for maintenance use.
- .2 Extra materials to be from same production run as installed materials.
- .3 Deliver to Owner, upon completion of the work of this section.

**2 PRODUCTS**

**2.1 MATERIALS**

- .1 Primers and adhesives: waterproof, recommended by base manufacturer for specific material on applicable substrate.
- .2 Rubber bases: 3mm thick by 100mm tall, ASTM F 1861, Type TS (thermoset vulcanized rubber), Group 1 homogeneous). Colour to be as selected by the Engineer from the manufacturer's standard colours.

**3 EXECUTION**

**3.1 BASE**

- .1 Match edges at seams or double cut adjoining lengths. Install with hairline, flush butt joints.
- .2 Do not use preformed corner pieces.

- .3 Form inside corners on job from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of wall base as the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate
- .4 Form outside corners on job from straight pieces of maximum lengths possible by shaving back of base at point where bending will occur. Remove a strip perpendicular to length of base and only deep enough to produce a snug fit without bends whitening or removal of more than half the thickness of base.
- .5 Scribe base accurately to abutting materials.

**END OF SECTION**

**1 GENERAL**

**1.1 SUMMARY**

- .1 Provide Tile Carpeting in accordance with requirements of Contract Documents.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Install carpeting before installing items indicated for installation of top of carpet and after other finishing operations, including painting and ceiling construction, has been completed.

**1.3 SYSTEM DESCRIPTION**

- .1 Fire Hazard Classification: Provide carpeting materials tested in accordance with ASTM E648 and certified to have critical radiant flux not less than 0.45 W/cm<sup>2</sup>.
- .2 VOC Emission Limits: Provide carpeting materials certified to meet the requirements for chemical emission levels in accordance with the CRI “Green Label Plus” indoor air quality testing program for carpet and adhesive products, and the CRI “Green Label” program for carpet cushion.

**1.4 SUBMITTALS**

- .1 Product Data: Submit for Consultant’s action. Furnish manufacturer’s literature, specifications and installation instructions describing the general properties of each material and accessory to be used in the Work.
- .2 Shop Drawing: Submit for Consultant’s action. Furnish shop drawings for the fabrication and installation of the Work. Show the proposed cross-joints, seam locations and lengths, and pile direction, details of seaming and installation of carpeting and accessories, and provisions for Work of other trades.
- .3 Samples: Submit for Consultant’s action. Label samples to indicate product, characteristics, and locations in the Work. Samples will be reviewed for colour and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Furnish samples of each type and colour of carpet, showing the seaming, binding, and edging required in the Work.
  - .1 Furnish full-size samples of carpet tile.
- .4 Certifications: Submit for Architect’s information.
  - .1 Fire Hazard Classification: Furnish certified test reports verifying that the carpeting materials meet the specified fire hazard rating.

- .2 VOC Emission Limits: Furnish certified test reports verifying that the carpeting materials meet the specified VOC Emission Limits.

## 1.5 QUALITY ASSURANCE

- .1 Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work.
- .2 Field Samples: Prior to the Pre-Construction Conference, provide a field sample for each type carpet in the building at areas to be designated by the Consultant. Utilize the same materials and installation methods in the sample as required for the final Work. Schedule the installation so that the sample may be examined, and any necessary adjustments made, at least 1 week prior to date scheduled for commencing installation of the Work. When accepted, sample areas shall serve as the standard for materials, workmanship, and appearance for such Work throughout the project and shall remain a part of the final Work.
  - .1 Adhesive Test Sample: Remove adhesive-installed carpet from sample area, while Owner's personnel are present, to demonstrate removal procedures that will minimize damage to carpet and floor.
- .3 Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of National, Provincial and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

## 1.6 DELIVERY AND STORAGE

- .1 Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Furnish carpet with registered number tags attached intact. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.

## 1.7 WARRANTY

- .1 Submit for Owner's documentation. Furnish 2 year written warranty in form stipulated by Consultant, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defects in materials or workmanship. Failure shall include excessive wear, fading, tearing, cracking, separation, deterioration or loosening from substrate, seam failure, ripples, scallops, piling or puckering. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Owner. Other guarantees or warranties may not be substituted by the Contractor for the terms of this special warranty.

**1.8 MAINTENANCE**

- .1 Maintenance Manuals: Submit for Owner's documentation. Furnish complete manuals describing the materials, devices and procedures to be followed in cleaning and maintaining the Work. Include manufacturer's brochures describing the actual materials used in the Work, including information needed for the removal of common stains.
- .2 Extra Carpet Tile: Furnish 2 boxes of extra carpet tile for each size, pattern and colour installed in the Work. Deliver to the Owner in manufacturer's original packaging and store at the project site where directed.

**1.9 SITE CONDITIONS**

- .1 Ambient Conditions: Maintain temperature and ventilation in work area using permanent heating system, and portable supply and exhaust fans in accordance with manufacturer's requirements; provide 72 hours notification to the Owner before starting installation in occupied spaces.

**2 PRODUCT**

**2.1 PERFORMANCE REQUIREMENT**

- .1 Modular tile carpeting performance requirements are based on acceptable minimums published by the Carpet and Rug Institute as follows, and as otherwise modified by actual materials specified:
  - .1 Dimensional Stability:  $\pm 0.15\%$  Maximum
  - .2 Tuft Bind: 3.6 kg for Loop Pile, minimum average value based on ASTM D1335
  - .3 Colourfastness: Test all specified colours; provide proof of performance before installation of specified materials:
    - .1 Crocking AATCC 165: Class 4 Minimum, wet and dry
    - .2 Lightfastness AATCC 16: Grade 4 Minimum
    - .4 Electrostatic Propensity AATCC 134: Permanent static control using static conducting fibres or durable static control for lifetime of carpet where static conducting fibres do not form a part of the manufacturer's standard construction providing  $\leq 3.5$  kV dissipation.
  - .5 Flammability: Tested in accordance with ASTM D2859 and ASTM E662, and as follows:
    - .1 Radiant Panel Test: Class 1, 0.45 W/cm<sup>2</sup>
    - .2 Smoke Density:  $\leq 450$  Corrected Optical Density



## 2.2 MATERIALS

- .1 Tile Carpeting (CPT-1):
  - .1 Yarn: Dynex SD Nylon
  - .2 Static Control: Permanent “built-in” anti-static filament for life of carpet. AATCC 134 test with static discharge that does not exceed 3.5 kV after minimum 5 HWE. (AATCC 171 Hot Water Extraction test) under standard conditions of 21°C and 20% relative humidity. Electrostatic Propensity (Static delayed Signal) to AATCC 134.
  - .3 Construction: Stratatec Patterned Loop
  - .4 Pile Height Average: Nominal 4.7 mm
  - .5 Dye Method: 100% Solution Dyed
  - .6 Gauge/Stitches: 50.4/42.5/10 cm
  - .7 Backing: Non-Woven Synthetic Fibre
  - .8 Tuft Bind: Lifetime of carpet.
  - .9 Edge Ravel: Lifetime of carpet.
  - .10 Delamination: Lifetime of carpet.
  - .11 Stain resistance: Manufacturers stain protection coating against soil, alkyd and acid burned stains.
  - .12 Electrostatic Propensity 3.5kV or less.
  - .13 Colour: Indicated as CTP-1 on Interior Materials Finish Legend on Drawing A1402.
  - .14 Tile Size: 610mm x 610mm
  - .15 Installation Pattern: Stacked as indicated on Drawings.
  - .16 Basis of Design: TBD
    - .1 Contractor to carry a material allowance of \$35 per square meter. The material allowance shall be for material only. Shipping, overhead and profit shall not be included in this value.

## 2.3 ACCESSORIES

- .1 Trowellable Levelling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the Tile Carpeting manufacturer.
- .2 Resilient Accessories: specified on Finish Schedule, of types indicated on drawings and as required to protect exposed edge of carpet; maximum lengths to minimize running joints.

**3 EXECUTION**

**3.1 EXAMINATION**

- .1 Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
- .2 Verification of Conditions (Concrete Substrates): Verify that concrete substrates and conditions are satisfactory for carpet installation and comply with the following specified requirements:
  - .1 Concrete subfloor complies with ASTM F710 and moisture emissions are within manufacturer's recommendations in accordance with ASTM F1869.
  - .2 Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
  - .3 Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
  - .4 Slab finishes comply with requirements specified in Section 03 35 00 for slabs receiving carpet.
  - .5 Slabs are free of cracks, ridges, depressions, scale, and foreign deposits that could affect the quality of the carpet installation.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- .1 Subfloor Treatment: Remove dust, dirt, sealer and wax from existing surfaces; remove ridges and bumps; seal porous and powdery surfaces with concrete floor sealer and apply sub-floor filler to low spots and cracks to achieve level floor to a tolerance of 1:500 in accordance with manufacturer's written requirements.
- .2 Test Layout: Dry lay 10 m<sup>2</sup> area of tile carpeting with required seam and nap direction and obtain acceptance from Consultant before commencing with installation.

**3.3 INSTALLATION**

- .1 Install in accordance with manufacturer's printed instructions using material from same dye lot: mix materials to obtain consistent colour, pattern and texture match within any one visual area.
- .2 Layout tile carpeting as with joints parallel to building lines or as indicated on drawing to produce a symmetrical tile pattern so that perimeter tile width is minimum half of full size and as follows:
  - .1 Stacked turn installation unless otherwise indicated.

- .3 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fittings, around perimeter of rooms into recesses and around projections:
  - .1 Cut tile carpeting to fit accurately around perimeter of rooms into all recesses and around fixtures.
  - .2 Make cut out for floor mounted service boxes, receptacles, switches, hardware where they occur on tile carpeting.
  - .3 Cut holes as close as possible to allow services to pass through and that trim will completely hide holes when installed.
  - .4 Cooperate and coordinate with electrical trade to ensure correct location of outlets is obtained.
- .4 Install tile carpeting to under floor duct system and to access covers.
- .5 Install tile carpeting in pan type floor access covers.
- .6 Install edging strips at all openings or doorways and where tile carpeting abuts other floor covering.

**3.4 CLOSEOUT ACTIVITIES**

- .1 Clean-up: Remove tile carpeting waste and debris from premises and leave installation clean after completion of carpeting operations in an area; protect finished areas from work following installation in accordance with manufacturer's written instructions.
- .2 Repairs: Replace damaged or defective tile carpeting at no cost to Owner.

**END OF SECTION**

**1 GENERAL**

**1.1 SUMMARY**

- .1 General: Provide painting in accordance with requirements of the Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM D16, Standard Terminology for Paint, Related Coatings, Materials, and Applications
  - .2 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
  - .3 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .2 Canadian Standards Association (CSA):
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
- .3 Canadian General Standards Board (CGSB):
  - .1 CGSB 1 Series of Standards contained in the MPI Manual Description of Products, for products forming a part of the specified systems.
  - .2 CAN/CGSB 85.10, Protective Coatings for Metals
  - .3 CAN/CGSB 85.100, Painting
- .4 Environmental Choice Program (ECP);
  - .1 Paints and Surface Coatings, Low VOC Product Listings
- .5 The Master Painters Institute (MPI):
  - .1 New Surfaces: Architectural Painting Specification Manual.
- .6 The Society for Protective Coatings (SSPC):
  - .1 Coating Materials Guidelines
  - .2 Surface Preparation Guidelines
  - .3 Application, Inspection and Quality Control Guidelines

**1.3 DEFINITIONS**

- .1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows to designate required gloss levels for indicated areas:
  - .1 G1 – Matte or Flat: Lustreless or matte finish with a gloss range below 10 when measured at 85° to meter and 0 to 5 when measured at 60°.
  - .2 G2 – Velvet: Matte to low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 0 to 10 when measured at 60°.

- .3 G3 - Eggshell: Low sheen finish with a gloss range to 10 to 35 when measured at 85° to meter and 10 to 25 when measured at 60°.
- .4 G4 – Satin: Low to medium sheen with a gloss range of minimum 35 when measured at 85° to meter and 20 to 35 when measured at 60°.
- .5 G5 – Semi-Gloss: Medium sheen finish with a gloss range of 35 to 70 when measured at 60° to meter.
- .6 G6- Gloss High sheen finish with a gloss range of 70 to 85 when measured at 60° to meter
- .7 G7- High Gloss: Reflective sheen having a gloss range in excess of 85 when measured at 60° to meter.

#### 1.4 SUMITTALS

- .1 Submit consent of surety with Bid Submission as proof of ability to supply a 100% two (2) year Maintenance Bond, where local MPI Accredited Quality Assurance Association's guaranty option is not used.
- .2 Drawdown Samples:
  - .1 Prior to ordering paint materials, provide to consultant the following for verification purposes: three drawdown sample charts (cards) for each type, texture and colour of finish specified.
    - .1 Apply paint sample in layers to Opacity Charts by The Leneta Company, or similar, until the paint colour the black and white areas is identical, or the specified level of opacity has been achieved.
    - .2 Apply paint to Opacity Charts (cards) in an even coat as soon as possible after mixing. Apply enough layers to make the painted area completely opaque, or to the required level of opacity for translucent products.
  - .2 Order paint only for approved Drawdown cards.
  - .3 Final colour selection is by Consultant.
  - .4 Resubmit until approved by Consultant.
  - .5 Consultant will furnish colour chips if alternate colours are to be selected for rejected cards.
- .3 Submit two sets of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site as required.
- .4 Provide an itemized list complete with manufacturer, paint type and colour coding for all colours used for Owner's later use in maintenance.

#### 1.5 QUALITY ASSURANCE

- .1 Conform to the standards contained in the MPI Manual.
- .2 Applicator Qualifications: A firm or individual experience in applying paints and coatings, similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:

- .1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.
- .2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.
- .3 Only qualified journeymen who have a Tradesman Qualification Certificate of Proficiency shall be engaged in painting and decorating work.
- .4 Apprentices may be employed provided they work under the direct supervision of a qualified journeymen in accordance with trade regulations.
- .3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:
  - .1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

## **1.6 ENVIRONMENTAL REQUIRMENTS**

- .1 Conform to MPI Manual and manufacturer's requirements.
- .2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.
- .3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.
- .5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous product. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
- .6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
- .7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

## **1.7 MAINTENANCE MATERIALS**

- .1 Leave on the premises not less than 4 liters each of all colours selected.
- .2 Ensure all containers are tightly sealed and clearly labeled.
- .3 Store as directed by the consultant.

## **1.8 GUARANTY**

- .1 Provide and pay for either:
  - .1 MPI Accredited Quality Assurance Association's 2 Year Guaranty, or
  - .2 100% 2 Year Maintenance Bond in accordance with MPI Manual requirements for painting, commencing at date of Substantial Performance.

## **2 PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Subject to compliance with requirements, manufacturers that have attained the pre-requisites for ecologically sustainable labelling mark on their products and may be incorporated into the work include; but are not limited to, the following:
  - .1 Benjamin Moore and Co. Limited
  - .2 Dulux.
  - .3 Par Paints
  - .4 PPG Canada Inc. – Architectural Finishes
  - .5 SICO Inc.
  - .6 Sherwin-Williams LLC

### **2.2 MATERIALS**

- .1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

### **2.3 COLOUR SCHEDULE**

- .1 Refer to Painting Schedule at the end of this specification section for numbers and types of paint coatings.
- .2 Refer to Drawing A0.3 for Colours

**3 EXECUTION**

**3.1 PREPARATION OF SURFACES:**

- .1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

**3.2 APPLCIATION**

- .1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.
- .2 Paint or stain surfaces requiring paint or stain finish to Custom MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.
- .3 Continue paint finishes through behind wall mounted items.
- .4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

**3.3 EXTERIOR SURFACES**

- .1 Paint exterior surfaces in accordance with the MPI Manual painting systems listed in this section.
- .2 Structural Steel and Metal Fabrications:
  - .1 EXT 5.1B – Inorganic zinc/water based light industrial coating G5 finish.
- .3 Steel – High Heat (heat exchangers, breeching, pipes, flues, stacks, etc., temperature range as noted):
  - .1 EXT 5.2A – Heat resistant enamel finish, maximum 205°C (400°F).
  - .2 EXT 5.2B – Heat resistant aluminum paint finish, maximum 427°C (800°F).
  - .3 EXT 5.2C – Heat resistant inorganic zinc finish, maximum 400°C (750°F).
  - .4 EXT 5.2D – High heat resistant aluminum paint finish, maximum 593°C (1100°F).
- .4 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, gutters, flashing, etc.):
  - .1 EXT 5.3D – Wash primer/2 component aliphatic polyurethane G5 finish (high contact areas).
  - .2 EXT 5.3E – Bituminous finish (for unexposed galvanized metal next to concrete, masonry, etc.).
  - .3 EXT 5.3F – Aluminum paint finish (for low contact/traffic areas only).



### 3.4 INTERIOR SURFACES

- .1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this section.
- .2 Concrete Horizontal Surfaces (floors):
  - .1 INT 3.2G – Concrete floor sealer on all areas noted as ‘conc sealer’ to be non-slip water based penetrating densifier type, ‘Sika 3s’ or Equal. Post cure, concrete sealed floors require 2 passes minimum with a high-speed Hog-hair burnisher.
- .3 Concrete Vertical Surfaces (Interior), Masonry or Cast. MPI recommended Latex primer. Provide 2 additional coats:
  - .1 High performance architectural latex G3 finish, G1 for ceilings:  
Where shown on drawings, Color: tbd.
- .4 Structural Steel and Metal Fabrications:
  - .1 INT 5.1A – Quick dry G3 finish. Includes OWSJ Framing.
- .5 Columns (above the slab, of alternate steel structure is elected):
  - .1 INT 5.1B – Water Based Light Industrial Coating, G5 finish.
- .6 Steel – High Heat (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc.; temperature range as noted):
  - .1 INT 5.2A – Heat resistant enamel finish, maximum 205°C (400°F).
  - .2 INT 5.2B – Heat resistant aluminum paint finish, maximum 427°C (800°F).
  - .3 INT 5.2C – Heat resistant inorganic zinc finish, maximum 400°C (750°F).
  - .4 INT 5.2D – High heat resistant aluminum paint finish, maximum 593°C (1100°F).
- .7 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts etc.):
  - .1 INT 5.3B – Water based light industrial coating G5 finish.
  - .2 INT 5.3H – Waterborne Dry Fall (for low contact/ traffic areas)
  - .3 INT 5.3m – High performance Architectural Latex G5 Finish for door and frames.
- .8 Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):
  - .1 INT 9.2A – Latex (Over Latex Primer Sealer)
  - .2 INT 9.2B – High performance architectural latex G3 finish, G1 for ceilings: 2 coats over suitably prepared surfaces min. Coating over previously dark color substrates may take more.  
Color: tbd. Contractor to allow for 30% of the area to be deeply colored.
  - .3 INT 9.2F – Epoxy-Modified Latex (Over Latex Primer / Sealer) Washrooms and kitchens

### 3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 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 In exposed-to-view exterior and interior areas.
  - .2 In interior high humidity interior areas.
  - .3 In boiler rooms, mechanical and electrical rooms.
- .2 Leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.
- .3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line and primer and one coat of matte black (non-reflecting) paint.
- .4 Paint the inside of light valances gloss white.
- .5 Refer to Mechanical and Electrical specifications for painting, banding, stenciling of other surfaces/equipment, and generally as follows:
  - .1 Paint gas piping gas standard yellow where visible in service spaces.
  - .2 Paint both sides and all edges of plywood backboards for equipment before installation.
  - .3 Leave equipment in original finish except for touch-ups as required, and paint conduits, mounting accessories and other unfinished items.
  - .4 Do not paint over nameplates.

### 3.6 FIELD QUALITY CONTROL

- .1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 1220mm (48”) from the painted surface:
  - .1 Runs, sags, hiding or shadowing by inefficient application methods.
  - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, cevices, pockets, corners and re-entrant angles.
- .2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.
  - .1 Damage due to touching before paint is sufficiently dry or any other contributory cause.
  - .2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  - .3 Damage or contamination of paint due to wind blown contaminants (dust, sand blast materials, salt spray, etc).

- .3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the owner or Consultant.
  - .1 Small affected areas may be touched up
  - .2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.
  - .3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

### **3.7 PROTECTION**

- .1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.
- .2 Curing periods shall exceed the manufacturer's recommended minimum time requirements.
- .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

### **3.8 RESTORATION**

- .1 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.
- .2 Clean, prime and re-paint all bolts, nuts and fasteners after torquing or re-tightening following specified paint finish.
- .3 Remove protective coverings and warning signs as soon as possible after operations cease.
- .4 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.
- .6 Fill, Prime and Paint all exposed damaged surfaces caused by human activity-from previous usage or through construction activities. This includes previous voids that were painted without filling.

### **3.9 CLEAN-UP**

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etc.), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

**END OF SECTION**

**1. GENERAL**

**1.1 SUMMARY**

- .1 General: Provide Roller Window Shades in accordance with the requirements of the Contract Documents.

**1.2 REFERENCE STANDARDS**

- .1 American Architectural Manufacturer's Association (AAMA):
  - .1 AAMA 611, Voluntary Specification for Architectural Anodized Aluminum
- .2 American National Standards Institute (ANSI)/Window Covering Manufacturers Association (WCMA):
  - .1 ANSI/ WCMA A100.1, Safety of Corded Window Covering Products
- .3 American Society for Testing and Materials (ASTM):
  - .1 ASTM B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- .4 Underwriters Laboratories Canada (ULC):
  - .1 CAN/ULC S109, Flame Tests of Flame Resistant Fabrics and Films

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling: Schedule installation of roller shades only after wet and dirty finish work in spaces; including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

**1.4 SUBMITTALS**

- .1 Product Data: Submit for Consultant's action, information for each type of product indicated including, but not limited to, the following:
  - .1 Styles, material descriptions, construction details, dimensions of individual components and profiles, features, and finishes.
  - .2 Operating instructions.
- .2 Shop Drawings: Submit for Consultant's action, shop drawings indicating location and extent of roller shades including, but not limited to, the following:
  - .1 Elevations, sections, details, and dimensions not shown in submitted product data.
  - .2 Installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

- .3 Samples: Submit for Consultant's action the following:
  - .1 Verification Samples: Submit samples for verification of selected products as follows:
    - .1 Complete, full-size operating unit not less than 400 mm wide for each type of roller shade indicated.
- .4 Schedule: Submit for Consultant's action, window treatment schedule using same room designations as indicated on Drawings.

**1.5 PROJECT CLOSEOUT SUBMISSIONS**

- .1 Provide operations and maintenance information including the following:
  - .1 Methods for maintaining roller shades and finishes.
  - .2 Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
  - .3 Operating hardware.
- .2 Submit manufacturers standard maintenance contract for review by Owner.

**1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Flame Spread Rating: Provide roller shade panel materials with flame spread and smoke developed characteristics required by Authority Having Jurisdiction, as determined by testing identical products in accordance with CAN/ULC S109.
- .2 Qualifications:
  - .1 Installer: Use installer experienced and who has completed installations of roller shades similar in material, design, and extent to that indicated in this Section; submit proof of capabilities when requested by Consultant.
  - .2 Supplier: Obtain roller shades through one source from a single manufacturer, from a manufacturer approved supplier.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver shades in factory packages, marked with manufacturer and product name, fire test response characteristics, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

## 1.8 SITE CONDITIONS

- .1 Site Measurements: Verify dimensions of adjacent construction by site measurements before fabrication and indicate measurements on shop drawings where roller shades are indicated to fit to other construction:
  - .1 Allow clearances for operable glazed units' operation hardware throughout the entire operating range.
  - .2 Notify Consultant of discrepancies.
  - .3 Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## 1.9 WARRANTY

- .1 Manufacturer Warranty: Provide manufacturer's warranty from commencing from date of CCC in accordance with GC 4.44.1.

## 2. PRODUCTS

### 2.1 MANUFACTURERS

- .1 Acceptable Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 MechoShade Systems, Inc.
  - .2 Nysan Shading Systems Ltd.
  - .3 Silent Gliss Inc.
  - .4 Solarfective

### 2.2 ROLLER SHADE COMPONENTS

- .1 Roller Tube: One piece extruded 6061-T6 or 6063-T6 aluminum roller tube meeting the requirements of ASTM B429, having anodized finish as follows:
  - .1 Protective Finish: AA-M12 Mechanical Finish; C22 Non-Specular; A21 Chemical Finish, etched, medium matte anodic coating; clear coating 0.025 mm or thicker in accordance using AMA 611; roller tube assemblies having mill finish will not be acceptable.
  - .2 Tube Diameter and Thickness: Manufacturers recommended engineered diameter, wall thickness and aluminum grade as required for maximum allowable deflection of  $L/700$

- .3 Tube Configuration: Extrude tube with provision made for mechanical engagement with the operator and drive assembly; and having channels to accept fabric attachment spline.
- .2 Fabric Spline: Extruded vinyl profile, welded to fabric band or panel, allowing removal and re-installation of fabric bands or panels without removing the roller tube and hardware and having the following characteristics:
  - .1 Fabric bands or panels must be replaceable on site.
  - .2 Attachment of the fabric to the tube with double-sided adhesive tapes, adhesives, staples or rivets will not be acceptable.
- .3 Hem Bars and Hem Bar Pockets:
  - .1 Round shaped aluminum profile; nominal 15 mm diameter with wall thickness engineered to suit weight requirements; slide hem bar into welded fabric hem bar pocket with open ends; finished ends of hem bar with coloured PVC round end caps colour to match fabric.
- .4 Fasteners: Non-corrosive fasteners as recommended by manufacturer.
- .5 Valance: As indicated by manufacturer's designation for style and colour.
- .6 Mounting: Inside as indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

### **2.3 SHADE MATERIAL**

- .1 Shading Material (SC1): Non-PVC-coated fibreglass, and as follows:
  - .1 Bottom Hem: Straight.
  - .2 Material Openness Factor: 3%
  - .3 Material Colour: 3014 Pewter
- .2 Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade panel material without sagging; designed to be easily removable from support brackets; with hook-and-loop strip or manufacturer's standard method for attaching shade material.
- .3 Direction of Roll: Regular, from back of roller.
- .4 Mounting Brackets: Galvanized or zinc-plated steel.
- .5 Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.



- .6 Top/Back Cover: L shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
- .7 Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed-to-view, external-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- .8 Shade Operation: Manual; with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.
  - .1 Position of Clutch Operator: As indicated in a window treatment schedule.
  - .2 Position of Clutch Operator: Left side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated in a window treatment schedule.
  - .3 Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
  - .4 Loop Length: Length required to make operation convenient from floor level.
  - .5 Bead Chain: Nickel-plated metal.
  - .6 Cord Tensioner Mounting: Sill.

## **2.4 OPERATOR**

- .1 Manual Chain Operator:
  - .1 Mounting Brackets: Angle shaped brackets size and thickness to manufacturer's standard; unitized pre-moulded assembly; allowing for continuous front or back roll fascia across multiple shades without exposed fasteners.
  - .2 Chain Drive System: Continuous loop of #10 stainless steel bead chain having a rated strength of 40 kg to prevent chain breakage under normal operating conditions; and as limited by ANSI/WCMA A100.1 safety requirements, and as follows:
    - .1 Single chain operator with inertia brake mechanism capable of locking the shade panel at any point of travel
    - .2 Set travel length of chain operator assembly on-site without disassembly of hardware to suit travel length of shade panel
    - .3 Chain drive operator shall positively engage drive mechanism through internal profile configuration; friction fitted engagement of the roller tube to drive mechanism will not be acceptable.
    - .4 Chain operator shall prohibit operation by pulling on hem bar.
    - .5 Shade roller tube shall be removable from brackets without hardware removal; non-metal components shall be self-lubricating.

.6 Handing: Left Hand to suit operating requirements indicated on Drawings.

## 2.5 ROLLER SHADE FABRICATION

- .1 Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- .2 Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
  - .1 Lifting Mechanism: With permanently lubricated moving parts.
- .3 Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 23 °C:
  - .1 Shade Units Installed between Jambs: Edge of shade not more than 6 mm from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
- .4 Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- .5 Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- .6 Colour-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- .7 Colours of Metal and Plastic Components Exposed to View: As indicated by manufacturer's designations, unless otherwise indicated.
- .8 Hembars and Hembar Pockets:
  - .1 Round shaped profile, 15 mm diameter, wall thickness engineered to weight requirements, in welded hembar pocket with open ends. Finished with coloured PVC round end caps.
- .9 Fasteners:
  - .1 Non-corrosive as recommended by manufacturer.

## 2.6 ALUMINUM FINISHES:

- .1 All exposed aluminum shall be clear anodized oxide finish according to AA-M12C22A31; unless noted otherwise on Drawings.

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- .2 Fascia: Quaker Bronze
- .3 Unexposed aluminum unless otherwise specified: mill finish.

**3. EXECUTION**

**3.1 EXAMINATION**

- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 ROLLER SHADE INSTALLATION**

- .1 Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade panel is not closer than 50 mm to interior face of glass. Allow clearances for window operation hardware.

**3.3 ADJUSTING**

- .1 Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

**3.4 CLEANING AND PROTECTION**

- .1 Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- .2 Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- .3 Replace damaged roller shades that cannot be repaired, in a manner approved by Consultant, before time of Substantial Completion.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Gypsum Wall Board: Section 09260.
- .2 Rubber Base: Section 09652.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Stainless Steel corner guard: 16-gauge, 52.4 x 52.4 x 1220 mm size, with 6 MM radius corners, surface, adhesive mounted.
- .2 “Boston Corner” or equivalent product.

**2.2 ACCESSORIES**

- .1 Adhesive: water resistant type recommended by manufacturer for substrate.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install units on solid backing and erect with materials and components straight, tight, and in alignment.
- .2 Adhere wall guards to corner locations with top surface 1500 mm above finish floor line, straight and level to variation plus or minus 3 mm over 3000 mm straight edge, non-cumulative.

**END OF SECTION**

**1. GENERAL**

**1.1 SUMMARY**

- .1 General: Provide Toilet Accessories in accordance with the requirements of the Contract Documents.

**1.2 LEED REQUIREMENTS**

- .1 Refer to Section 01 35 21 for LEED Requirements.

**1.3 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .2 ASTM A167, Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - .3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .4 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-12.5, Mirrors, Silvered
- .3 Canadian Standards Association (CSA):
  - .1 CSA B651, Accessible Design for the Built Environment

**1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate accessory locations with other affected work to prevent interference with clearances required for access by disabled persons, proper installation within substrate, blocking requirements, adjustment, operation, cleaning, and servicing of accessories including, but not limited to, the following:
  - .1 Installation of grab bars to metal toilet partitions, provide templates and detail to partition manufacturer for shop fabrication of steel reinforcing plates. Instruct whether shop or field, drill and tap technique will be used.
  - .2 Reinforcement locations indicated on Drawings. Coordinate with Section 09260.

**1.5 SUBMITTALS**

- .1 Product Data: Submit for Consultants action, product data including construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

**1.6 PROJECT CLOSEOUT SUBMITTALS**

- .1 Operations and Maintenance Data: Submit for Consultant's action maintenance data for accessories; include lists of sources for disposable supplies, replacement parts and service recommendations.

**1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Install toilet accessories in accordance with CSA B651 at accessible washroom locations.

**1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Handling Requirements: Deliver washroom accessories in manufacturer's original, undamaged packaging, clearly marked for contents and location within building.

**1.9 WARRANTY**

- .1 Manufacturer's Mirror Warranty in accordance with GC 4.44.1.

**2. PRODUCTS**

**2.1 MANUFACTURERS**

- .1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 ASI Specialties Inc.
  - .2 Bobrick Washroom Equipment of Canada Ltd.
  - .3 Bradley Corporation

**2.2 MATERIALS**

- .1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule at 3.4 below subject to compliance with specified requirements.

- .2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.
- .3 Sheet Steel: Steel: In accordance with ASTM A366/A366M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.
- .4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.
- .5 Mirror Glass: In accordance with CGSB 12.5; 3A tempered mirror, 6 mm nominal thickness, with silvering, electroplated copper coating, and protective organic coating.
- .6 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.
- .7 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

## **2.3 FABRICATION**

- .1 Labels:
  - .1 Exposed Faces: Provide maximum 38 mm Ø, unobtrusive stamped manufacturer logo
  - .2 Interior or Non-Exposed Faces: Provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- .2 Washroom and Custodial Accessories:
  - .1 Surface Mounted:
    - .1 Fabricate units with tight seams and joints, and exposed edges rolled.
    - .2 Hang doors and access panels with continuous stainless steel hinge.
    - .3 Provide concealed anchorage where possible.
  - .2 Recessed Mounted:
    - .1 Fabricate units of all welded construction, without mitred corners.
    - .2 Hang doors and access panels with full length, stainless steel hinge.
    - .3 Provide anchorage that is fully concealed when unit is closed.

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- .3 Disposable supplies: Provide a list of disposable supplies to the Owner required by fixtures, including but not limited to toilet paper, paper towels, feminine hygiene products, soap and other items required for first fill.
- .4 Framed Glass Mirror Units:
  - .1 Fabricate frames for glass mirror units to accommodate glass edge protection material.
  - .2 Provide mirror backing and support system that permits rigid, tamper resistant glass installation and prevents moisture accumulation.
  - .3 Provide galvanized steel backing sheet, not less than 0.759 mm and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.
- .5 Mirror Unit Hangers: Provide rigid, tamper and theft resistant mirror unit mounting system, as follows:
  - .1 One piece, galvanized steel, wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
- .6 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

**3. EXECUTION**

**3.1 EXAMINATION**

- .1 Examine site conditions where Work will be applied and ensure acceptability for complete and satisfactory installation; beginning of installation will denote acceptance of site conditions.

**3.2 PREPARATION**

- .1 Verify wall thickness and construction that will accept recessed accessories.
- .2 Verify that solid blocking for support and anchoring of washroom accessories is installed where required.
- .3 Verify that frames and anchors provided, whether by this Section or others, are correctly and securely installed ready to accept the accessory scheduled for the specific location.
- .4 Verify that painting is complete and dry in area of installation before accessories are installed.



**3.3           INSTALLATION**

- .1     Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- .2     Mounting Heights: Conform to mounting heights indicated on Fixture Mounting Schedule as indicated on Drawings.
- .3     Secure mirrors to walls using concealed, tamper resistant hangers, toggle bolts, or screws:
  - .1     Set mirrors level, plumb, and square at locations indicated, centred over lavatory.
- .4     Install grab bars to withstand a downward load of at least 11.12 kN.
- .5     Install recessed fixtures in fire rated partitions to maintain required fire rating of assembly by installing 16 mm Type X gypsum board completely around unit, coordinate with Section 09 21 16.
- .6     Install and secure all fixtures rigidly in place using tamper proof headed fasteners and as follows:
  - .1     Stud walls: Install steel back plate to stud prior to plaster or drywall finish. Plate to have threaded studs or plugs provided.
- .7     Locate accessories to approximate areas as indicated on Drawings; exact locations will be determined by the Consultant.

**3.4           ADJUSTING AND CLEANING**

- .1     Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- .2     Remove temporary labels and protective coatings.
- .3     Clean and polish exposed surfaces in accordance with manufacturer's written recommendations.
- .4     Provide a list of paper towel, toilet paper and other disposable supplies required to make accessories usable.
- .5     Instruct Owner in proper adjustment, operation and refilling procedures.

### 3.5 WASHROOM AND CUSTODIAL ACCESSORY SCHEDULE

No. Description/Model

Hand Dryer: Surface mounted, 115 Volt AC, 12.5 Amp, 900 Watts, 60 Hz, automatic sensor cycle warm air hand dryer, GREENSPEC approved, colour white:

XLERATOR XL-W  
Dyson Airblade  
Sloan EHD-501-W

Grab Bar: Horizontal 1.214 mm thickness; 610 mm long x 38 mm Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws:

ASI 3801-24P  
Bobrick B-6806.99x24  
Bradley 812-001-24-2  
Frost 1001DPx24

Grab Bar: Horizontal 1.214 mm thickness; 1200 mm long x 38 mm Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws:

ASI 3801-48P  
Bobrick B-6806.99x48  
Bradley 812-001-48-2  
Frost 1001DPx48

Frameless mirror: Refer to Section 08 81 00.

Mirror: Framed, 915 mm high x 610 mm wide, fixed tilt installation for disabled persons, mounted 1000 mm to bottom of frame:

ASI 0535-1836  
Bobrick B-293x1836  
Bradley 740  
Paper Towel Dispenser:  
Wood Wyant; Colour: Black

Soap Dispenser:  
Wood Wyant; Colour: Black

Toilet Tissue Dispenser: Double roll, surface mounted, tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles:

ASI 7305-2B/R009  
Bobrick B-686-60  
Bradley 5234-52

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Mop Strip: Stainless steel mop and broom holder with non-slip handle restraints, designed to hold three (3) handles 19 mm to 30 mm Ø:

ASI 8215-4

Bobrick B-223x36

Bradley 9953

Frost 1113

Coordinate required blocking with Section 09 21 16 - Gypsum Board Assemblies

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 15010.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Sprinkler Equipment: Section 13905

**1.3 REFERENCE DOCUMENTS**

- .1 National Fire Protection Association (NFPA):
  - .1 NFPA (Fire) 10 Portable Fire Extinguishers, 2010 Edition
- .2 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC-S508-02 Standard for the Rating and Fire Testing of Fire Extinguishers, Including Amendments 1 and 2

**1.4 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 01 for requirements pertaining to product options and substitutions.

**1.5 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01330 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings, clearly indicating fabrication details, plans, elevations, edge details, hardware, and installation details.
  - .2 Submit large scale details of all anchorages, clearly indicating components, materials, and finishes, and related work.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data:
  - .1 Provide data describing maintenance of product for incorporation into Maintenance and Operation Manual.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Division 01.

**2. PRODUCTS**

**2.1 RATING OF PORTABLE FIRE EXTINGUISHERS**

- .1 Provide hand portable extinguishers rated in accordance with CAN/ULC S508 and bearing ULC label.

**2.2 FIRE EXTINGUISHER CABINET**

- .1 Fire Extinguisher Cabinet: cabinet tub formed of 1.6 mm steel. Door and adjustable frame are fabricated of 2.5 mm steel corrosion resistant treated, chrome plate.
- .2 Semi-recessed with canopy door

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install fire extinguisher cabinet with top of cabinet 1.5 m above floor.
- .2 Provide extinguishers of the type listed for the following areas.
  - .1 Electrical and telephone rooms: carbon dioxide
  - .2 Mechanical rooms: multi-purpose dry chemical
  - .3 Garbage room: multi-purpose dry chemical
  - .4 Maintenance workshop: multi-purpose dry chemical
  - .5 Kitchen: carbon dioxide
  - .6 Computer Rooms: carbon dioxide
  - .7 Office Areas: multi-purpose dry chemical
- .3 Install extinguishers in one of the following:
  - .1 Fire extinguisher cabinets, or

- .4 Provide extinguishers where indicated on drawings.
- .5 Where exact location is not indicated, mount in location as directed by the Minister.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical Spare Parts and Maintenance Materials: Section 15030.

**1.2 GENERAL REQUIREMENTS**

- .1 Provide complete sprinkler system as required by local Codes and as indicated on drawings.
- .2 Provide sprinklers for areas as indicated and required, including specialized rooms. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.

**1.3 SUBMITTALS**

- .1 Submit preliminary layout showing only head locations for review by the Consultant. Furnish additional heads which may be required for coordinated ceiling pattern without added cost, even though number of heads may exceed minimum code requirements.
- .2 Submit detailed pipe layout, component and hydraulic design calculations, approved by local Fire Commissioner. Include all costs associated with such approval in this work.
- .3 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 15010 – Mechanical General Requirements.
    - .1 Submit shop drawings stamped and signed by a professional engineer registered or licensed in the Province of Alberta.
- .4 Closeout Submittals:
- .1 Submit maintenance and engineering data for incorporation into manuals specified in Section 15021 – Mechanical Operation and Maintenance Manual.
  - .2 Submit “As-Built” record drawings that include all site revisions to the shop drawing submittals. Submit these documents on AutoCAD format to the Consultant.

**1.4 QUALITY ASSURANCE**

- .1 Sprinkler equipment and installation shall be reviewed and approved by the Code Authority having jurisdiction.
- .2 Sprinkler equipment shall be installed by qualified Contractors licensed and regularly engaged in installation of automatic fire sprinkler equipment.

- .3 Equipment, valves and material used in sprinkler systems shall be UL labelled.
- .4 Equipment and installation shall meet the requirements of NFPA 13 - Installation of Sprinkler Systems

**1.5 CONTRACTOR DESIGNED SPRINKLER SYSTEM**

- .1 A Professional Engineer licensed to practice in Alberta is required to design, review construction, witness, and certify the system testing, and consistent with Alberta Building Code (latest edition).
- .2 The area underneath the existing loading dock, as well as the concealed ceiling spaces in the existing building (non-combustible) are to be protected as required.

**1.6 HYDRAULICALLY DESIGNED SYSTEMS**

- .1 Consultant will accept a Contractor designed, hydraulically calculated sprinkler system provided the following requirements are met:
  - .1 System design to NFPA 13 for required hazard occupancy.
  - .2 System design to incorporate Owner's Insurer's requirements.
  - .3 Base design on current water supply data from the appropriate municipality.
  - .4 Make allowance for pressure losses through the backflow preventer assembly installed on the water supply to the sprinkler system.
  - .5 Sprinkler heads exceeding the minimum code requirements but necessary to coordinate ceiling patterns are provided.
  - .6 Other requirements specified in this section are met.

**1.7 ALLOWANCE FOR EXTRA HEADS**

- .1 Allow for installation of extra heads in addition to those shown on drawings for blind spots, offsets, ductwork, equipment, under stairs and other obstructions to provide adequate coverage and compliance with NFPA 13, and the Owner's Insurers.

**2. PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS**

- .1 Grinnell, Vipond, Viking, Gisbourne, Upper Valley Fire Protection



**2.2 PIPING AND FITTINGS**

- .1 Pipe or tube material and fittings to NFPA 13, Chapter 6 and to withstand a working pressure up to 2070 kPa.
- .2 Roll Grooved Piping Systems: Welded or seamless steel pipe joined by welding or couplings shall have the following wall thickness:
  - .1 Up to 125 mm diameter            Schedule 10
  - .2 150 mm diameter                    3.40 mm
  - .3 200 mm diameter                    3.78 mm
  - .4 250 mm diameter                    4.78 mm
- .3 Threaded or Cut Grooved Pipe Systems: Steel pipe joined by threaded fittings or couplings using cut grooves shall have the following wall thickness:
  - .1 Up to 200 mm diameter use schedule 40
  - .2 200 mm diameter and larger use schedule 30
- .4 Chlorinated polyvinyl chloride (CPVC) pipe and fittings may be used for wet pipe systems within the limits defined in the Alberta Building Codes, and subject to the requirements of NFPA.

**2.3 SPRINKLER HEADS**

- .1 Temperature rating on fusible links shall suit specific hazard area with minimum margin of safety 10°C.
- .2 For suspended ceilings, provide recessed pendant type with chrome plated finish and escutcheon.
- .3 For exposed areas, provide standard upright type with chrome plated finish. For sidewall application, provide sidewall type with chrome plated finish and escutcheon.

**2.4 SPRINKLER VALVE**

- .1 Provide approved automatic sprinkler valve with two pole flow detectors, pressure switch, outside water motor gong, outside electric gongs, inside electric gong and circuit breaker, excess pressure pump.
- .2 Auxiliary Contacts: Contacts for connection to alarm monitoring devices and control fire alarm panel.

**2.5 EXCESS PRESSURE PUMP**

- .1 Provide pump capable of pumping sprinkler system to 280 kPa in excess of normal pressure with supports, safety valves, gauge, starter and connection to sprinkler system.

**2.6 VALVES**

- .1 Isolation Valves: Indicating type valves, ULC labelled, with electric position monitor.
- .2 Drain Valves: Soft seated globe or angle globe valves, ULC labelled.
- .3 Check Valves: Soft seated single flapper type, ULC labelled.
- .4 Zone Valves. Indicating type valves with a flow indicating device, ULC labelled.

**2.7 ANTIFREEZE LOOPS**

- .1 Assembly: Antifreeze loop assembly, including approved backflow preventer, to NFPA 13.
- .2 Anti-freeze Solution: Premixed propylene glycol with water, 50% concentration by volume.

**2.8 AIR COMPRESSOR**

- .1 Provide electric drive, horizontal tank mounted, single stage compressor, capable of restoring normal system air pressure within 30 minutes, two pole air pressure operated electric pressure switch with 2-way release or breather valve, safety valve, check valve, tank drain, belt guard and controls.

**2.9 SIAMESE FIRE DEPARTMENT CONNECTION**

- .1 Provide two-way standard Siamese fire department connection with chrome plated finish, local fire department thread, dust caps and chains, marked "Sprinkler - Fire Department Connection."
- .2 Siamese fire department connection for sprinkler system shall match connection for standpipe and hose system.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Protect sprinkler heads against mechanical injury with standard guards where necessary.
- .2 Locate outside alarms on wall of building adjacent to Siamese fire department connection.

- .3 Provide 25 mm diameter nipple and 25 x 15 mm reducing fitting for each upright head.
- .4 Provide on sprinkler system take-off from water supply approved double check valve assembly with gate valves on either side.
- .5 Review the routing of all exposed piping with the Architect and Engineer prior to installation. Piping which has not been reviewed in advance of installation will be subject to removal and re-installation at the Contractor's cost.
- .6 Provide automatic sprinkler protection for the building in its entirety.
- .7 Do not commence installation of piping or components until proposed installation layout has been coordinated with work of other sections. Center heads one-way in ceiling tiles.
- .8 Install piping concealed above ceilings and in joist spaces to minimize obstructions. Expose heads only.
- .9 Chlorinated polyvinyl chloride (CPVC) pipe and fittings may be used if the following conditions are met:
  - .1 Light hazard occupancies.
  - .2 Sprinkler heads are not rated higher than 77°C.
  - .3 Primers, sealants or solvents installation procedures follow those recommended by the pipe manufacturer.
  - .4 Subject to the NFPA 13, 13R and 13D Guidelines.
- .10 Electric monitor all shut-off valves, main sprinkler valve, flow switches, and zone valves on sprinkler system at building fire alarm panel.
- .11 Zone shut-off valves to be visible from floor.
- .12 For each fire zone, provide a drain valve at lowest pipe elevation. Route drainage piping to nearest drain.
- .13 Provide pressure gauges at each floor level, accessible and readable from floor.
- .14 Install straightway check valve and automatic drip in low point between siamese connection and sprinkler system.
- .15 Install inspectors test connections near all zone valves and at the main valve. Test pipe shall discharge to drain.
- .16 Install shut-off valve at base of each vertical pipe riser.
- .17 Provide permanently marked identification signs on main control valve indicating the system it controls. Sign shall be secured with non-corrosive chain to the valve.

- .18 Install sprinkler heads under ductwork where width is 1200 mm or larger, whether shown on drawings or not.
- .19 If the ceiling height is 2290 or less A.F.F, fully recessed, concealed sprinkler heads are to be used.
- .20 Install test header approved by the Code Authority having jurisdiction located outside building, or where water can be easily dispersed, to allow fire pump testing to NFPA Standard 20. In-line metering is not acceptable.

**END OF SECTION**

**1. INTENT**

- .1 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances.
- .2 Contract documents of this Division and Drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are **not** detailed installation instructions.
- .3 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.
- .4 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Owner at no extra cost.
- .5 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test.

**2. RELATED REQUIREMENTS**

- |    |                                 |             |
|----|---------------------------------|-------------|
| .1 | Submittals:                     | Division 1. |
| .2 | Temporary Facilities:           | Division 1. |
| .3 | Contract Acceptance Procedures: | Division 1. |

**3. RELATED WORK SPECIFIED IN OTHER SECTIONS**

- |    |                                       |              |
|----|---------------------------------------|--------------|
| .1 | Electric motor power characteristics: | Division 16. |
|----|---------------------------------------|--------------|

**4. MATERIALS**

- .1 Materials and equipment installed shall be new, full weight and of quality specified. Use same brand or manufacturer for each specific application.
- .2 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.

**5. METRIC CONVERSION**

- .1 All units in this division are expressed in SI units.
- .2 Submit all shop drawings and maintenance manuals in SI units.

- .3 On all submittals (shop drawings etc.) use the **same** SI units as stated in the specification.

**6. SHOP DRAWINGS**

- .1 Comply with requirements of Division 1.
- .2 Provide shop drawings as indicated.
- .3 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Owner's office. Maintenance and operating manuals are not suitable submittal material.
- .4 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals materials or painting.
- .5 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes.
- .6 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by Owner.
- .7 Shop drawings not requested will not be reviewed and processed by the Owner.
- .8 Do not order equipment or material until Owner has reviewed and returned shop drawing.

**7. PRODUCTS OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 1 for requirements pertaining to product options and substitutions.

**8. PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT**

- .1 Installed mechanical equipment whose performance is questioned by Owner, may be subject to performance verification as specified herein.
- .2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.
- .3 Owner will determine by whom testing shall be carried out. When requested, arrange for services of an independent testing agency.
- .4 Testing procedures shall be approved by Owner.

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- .5 Maintain building comfort conditions when equipment is removed from service for testing purposes.
- .6 Promptly provide Owner with all test reports.
- .7 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay all costs resulting from performance verification procedure.
- .8 Should test results reveal that equipment does **not** meet specified performance requirements, equipment will be rejected and the following shall apply:
  - .1 Remove rejected equipment. Replace with equipment which meets requirements of Contract Documents including specified performance requirements.
  - .2 Replacement equipment will be subject to performance verification as well, using same testing procedures on originally installed equipment.
  - .3 Contractor shall pay all costs resulting from performance verification procedure.

**9. PROJECT RECORD DRAWINGS**

- .1 Submit record drawings identifying location of Equipment, Piping and Ductwork with actual room names or numbers.
- .2 Identify changes in sizes and routing where they differ from Permit drawings.
- .3 Record changes resulting from site instruction RFI and change directives.

**10. EQUIPMENT PROTECTION AND CLEAN-UP**

- .1 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
- .4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .5 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

**11. TEMPORARY OR TRIAL USAGE**

- .1 Temporary or trial usage by the Owner of mechanical equipment supplied under contract shall not represent acceptance.
- .2 Repair or replace permanent equipment used temporarily.
- .3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

**12. ELECTRICAL MOTORS**

- .1 Supply mechanical equipment complete with electrical motors.
- .2 Provide motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing, and operate at 1200 or 1800 r/min unless otherwise specified.
- .3 Motors shall have ball or roller type bearings.
- .4 Provide grease lubrication fittings on motors with frame sizes 254T and larger.
- .5 Refer to electrical specification for voltage, phase and cycle.

**END OF SECTION**



**1. INTENT**

- .1 Contractor shall obtain all specified operation and maintenance data. Using this data, Contractor shall prepare and submit operation and maintenance manuals as specified.

**2. RELATED REQUIREMENTS**

- .1 Comply with requirements of Operation and Maintenance Data and Manual requirements specified in Division 1.

**3. MANUAL DIVISIONS**

- .1 Organize manual into following divisions:
  - .1 Operations Division
  - .2 Maintenance Division
  - .3 Contract Documentation Division
  - .4 Standards Division
- .2 Provide master divider tab and index for each division.

**4. OPERATIONS DIVISION - MECHANICAL SYSTEMS**

- .1 Organize all data into sections according to system category, with divider tabs, as follows:
  - .1 AIR - Air Systems
  - .2 CTL - Control Systems
  - .3 CLG - Cooling Systems
  - .4 FPN - Fire Protection Systems
  - .5 HTG - Heating Systems
  - .6 MIS - Miscellaneous Systems
  - .7 PLG - Plumbing Systems
- .2 Organize data for each system category (section) into individual systems (subsections). Provide an index for each system category and a divider tab for each individual system.
- .3 For each individual system, except Controls System, include following data.
  - .1 System Description: provide details of system type, composition, areas served, location in building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description. Design criteria shall, at minimum, include following:
    - .1 Outdoor ambient conditions.
    - .2 Future load allowances.
    - .3 Standby capabilities.

- .4 Calculated load and design capacity of domestic water supply mains.
- .5 Calculated load and design capacity of drainage mains.
  
- .2 System Schematic: provide a system schematic showing all components comprising central system. Identify each component using its EMCS mnemonic and generic name designation. Use this mnemonic in all references to equipment throughout manual.
  
- .3 Operating Instructions: provide, in "operator" layman language, specific instructions for start-up, shutdown and seasonal change over of each system component. Include following:
  - .1 Exact type and specific location of each switch and device to be used in system operation.
  - .2 Identify safety devices and interlocks that must be satisfied in order for equipment to start.
  - .3 List conditions to be fulfilled before attempting equipment start up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.

**5. MAINTENANCE DIVISION**

- .1 Summarize data for this section from Supplier and Sub-trade maintenance submissions, supplemented by appropriate additional data.
  
- .2 Organize data into sections, with divider tabs as follows:
  - .1 Maintenance Tasks and Schedules
  - .2 Spare Parts
  - .3 Suppliers and Contractors
  - .4 Tags and Directories
  
- .3 Maintenance Tasks and Schedules: organize data according to system category, with further breakdown into individual systems as used in operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturers maintenance brochures, for each component of each system in following format:
  - .1 Daily
  - .2 Weekly
  - .3 Monthly
  - .4 Semi-annually
  - .5 Annually
  - .6 When required

- .4 Spare Parts List: organize data according to system category, with further breakdown into individual systems as used in operations division of manual. Provide section index and divider tabs for each system category. Summarize from manufacturers maintenance brochures recommended spare parts for each component of each system.
- .5 Suppliers and Contractors List: provide summary of Suppliers and Contractors for each component of each system. List Company name, address and telephone number of each.
- .6 Tags and Directories: provide a copy of tag and other directories.

**6. CONTRACT DOCUMENTATION DIVISION**

- .1 Organize operation and maintenance data into sections, with divider tabs, as follows:
  - .1 Drawings List
  - .2 Shop Drawings and Product Data
  - .3 Certifications
  - .4 Warranties and Bonds
  - .5 Maintenance Brochures
  - .6 Reports
- .2 Drawings List: provide a list of all drawings used in performance of the construction contract.
- .3 Shop Drawings and Product Data: provide final copies of all shop drawings and product data. Include section index and divider tabs. Maximum of twenty-five sheets or one shop drawing per tab.
- .4 Certifications by Contractor: provide copies of Contractor certifications for performance of products and systems, and test reports verifying performance of products and systems. Include section index and divider tabs with maximum of twenty-five sheets or one report per tab.
- .5 Certifications by Inspection Agency: collect and include copies of following inspection certification reports:
  - .1 Plumbing and Gas Standards
  - .2 Building Standards and Fire Prevention
  - .3 Boilers and Pressure Vessel Standards
  - .4 Solar Performance Certification
- .6 Warranties and Bonds: include one copy each of the Contractor's warranty, Manufacturers' warranties longer than one year, the bond, and any service contract provided by the Contractor. Provide section index.
- .7 Maintenance Brochures: include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. Provide section index and divider tabs. Maximum of twenty-five sheets or one brochure per tab.

- .8 Field Reports: collect and include field reports. Include section index and divider tab for each report:
  - .1 Chemical treatment and cleaning reports specified in Sections 15185, 15186, and 15189.
  - .2 Start-up and testing reports specified in Sections 15951, and 15952.
  - .3 Testing, Balancing and Adjusting reports specified in Section 15954.

**7. STANDARDS DIVISION**

- .1 Allow 25mm binder space for standards. The Owner will supply and insert these standards in operation and maintenance manual.

**END OF SECTION**

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**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

.1 Spare Parts and Maintenance Materials: Division 1.

**2. PRODUCTS**

**2.1 SPARE PARTS AND MAINTENANCE MATERIALS SCHEDULE**

Item	Quantity
Pump Seals:	One for each pump type and size
Air Filters:	
Air system - complete replacement set of air filters	Four for each system
MUAs, RTUs, Air Compressors	Four for each unit
Lubricating oil for:	
Air cooled condensing units:	Amount equal to 100% of initial charge for each system.
Belt Driven Equipment:	
Belts:	Two sets of belts for each drive type and size.
Fire Sprinklers:	
Sprinklers	Four of each type used.

**2.2 EQUIPMENT AND TOOLS**

- .1 Unless specified otherwise, provide one of each of the following equipment and tools to facilitate proper operation and maintenance of mechanical equipment and systems:
- .1 Keys for non-freeze hose bibbs. Provide one key for each hose bibb.
  - .2 Five keys for air vents and drain cocks.
  - .3 Gas cock wrenches. Provide one wrench for each gas cock.
  - .4 One key/screwdriver for security grille access.
  - .5 One thermostat adjustment kit.
  - .6 One of each type of thermometer and pressure gauge for use with Pete's Plugs.

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**3. EXECUTION**

**3.1 DELIVERY**

- .1 Deliver spare parts and maintenance materials to project site or other location designated by Owner.

**END OF SECTION**

**1. GENERAL**

**1.1 REFERENCE DOCUMENTS**

- .1 Pipe supports shall meet the requirements of ANSI/ASME B31.1-1995, Power piping.
- .2 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

**1.2 GENERAL REQUIREMENTS**

- .1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.
- .2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .4 Fasten hangers and supports to building steel or inserts in concrete construction.
- .5 Provide and set sleeves required for equipment, including openings required for placing equipment.
- .6 Dielectrically isolate dissimilar metals.
- .7 Pipe, duct and conduit supports are not all necessarily shown on the Contract Drawings. The Contractor is responsible to ensure sufficient supports are supplied, fabricated, and installed to properly secure all pipe, fittings, and equipment to satisfy manufacturer's recommendations.

**1.3 APPROVALS**

- .1 Obtain approval from the Engineer prior to drilling for inserts and supports for piping systems.
- .2 Obtain approval from the Engineer prior to using percussion type fastenings.
- .3 Use of perforated band iron, wire or chain as hangers is not permitted.

**2. PRODUCTS**

**2.1 INSERTS**

- .1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

- .2 Size inserts to suit threaded hanger rods.

## **2.2 PIPE HANGERS AND SUPPORTS**

- .1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.
- .2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.
- .3 Hangers: Hot Pipe Sizes 150 mm: Adjustable steel yoke and cast iron roll.
- .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.
- .5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.
- .6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.
- .7 Vertical Support: Steel riser clamp.
- .8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.
- .9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.
- .10 Design hangers so they cannot become disengaged by movements of supported pipe.
- .11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.
- .12 Insulate all piping from dissimilar metal supports.

## **2.3 HANGER RODS**

- .1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

## **2.4 DUCT HANGERS AND SUPPORTS**

- .1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.
- .2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.
- .3 Vertical Support at Floor: Rolled angle.



**2.5 FLASHING**

- .1 Steel Flashing: 0.55 mm galvanized steel.
- .2 Lead Flashing: sheet lead, as follows:
  - .1 For Waterproofing: 25 kg/m<sup>2</sup>.
  - .2 For Soundproofing: 5 kg/m<sup>2</sup>.
  - .3 Lead Sheet Size:
    - .1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.
    - .2 Floor Drains: minimum 920 x 920 mm and as specified.
    - .3 Other Locations: as specified.
- .3 Safes: 25 kg/m<sup>2</sup> sheet lead or 200 micrometre neoprene.
- .4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

**2.6 SLEEVES**

- .1 Pipes through Floors: Form with 1.2 mm galvanized steel.
- .2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.
- .3 Round Ducts: Form sleeves with galvanized steel.
- .4 Rectangular Ducts: Form sleeves with galvanized steel or wood.
- .5 Size large enough to allow for expansion with continuous insulation.

**2.7 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS**

- .1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

**3. EXECUTION**

**3.1 INSERTS**

- .1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

- .2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.
- .3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- .4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

**3.2 PIPE HANGERS AND SUPPORTS**

- .1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

- .2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.
- .3 Place a hanger within 300 mm of each horizontal elbow.
- .4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.
- .5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.
- .6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.
- .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .8 Where practical, support riser piping independently of connected horizontal piping.

### **3.3 LOW VELOCITY DUCT HANGERS AND SUPPORTS**

- .1 Hanger Minimum Sizes:
  - .1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.
  - .2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.
- .2 Horizontal Duct on Wall Supports Minimum Sizes:
  - .1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.
  - .2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.
- .3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:
  - .1 Up to 610 mm wide: 40 x 1.6 mm.
  - .2 640 to 900 mm wide: 25 x 25 x 3 mm.
  - .3 940 to 1200 mm wide: 30 x 30 x 3 mm.
- .4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:
  - .1 Up to 1520 mm wide: 40 x 40 x 3 mm.

### **3.4 EQUIPMENT BASES AND SUPPORTS**

- .1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.
- .2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- .3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

### **3.5 FLASHING**

- .1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.
- .2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.
- .3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

- .4 Provide curbs for mechanical roof installations, minimum 200 mm high.
- .5 Attach counterflashings to mechanical equipment and lap base flashings on roof curbs.
- .6 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.
- .7 Screw vertical flange section of roof jacks to face of curb.
- .8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

**3.6 SLEEVES**

- .1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- .2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.
- .3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.
- .4 Install chrome plated escutcheons where piping passes through finished surfaces.

**END OF SECTION**

**1. GENERAL**

**1.1 REFERENCE STANDARD**

- .1 Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.

**1.2 SUBMITTALS**

- .1 Provide vibration isolation shop drawings showing isolator locations, load on each isolator, inertia slab dimensions.

**1.3 GENERAL REQUIREMENTS**

- .1 Supply vibration isolation equipment and materials by one supplier. Consider side loading of equipment and inertia bases when calculating maximum loads on isolators.
- .2 Ensure equipment is sufficiently rigid for isolator point loading.

**1.4 INSPECTION**

- .1 Provide inspection services by vibration isolation equipment and materials manufacturer's representative for final installation and provide written report that installation is in accordance with specifications and manufacturer's recommendations.

**2. PRODUCTS**

**2.1 INERTIA BASES**

- .1 Type A: Integral structural steel fan and motor base with motor slide rails.
- .2 Type B: Slung structural steel base with gusseted brackets.
- .3 Type C: Reinforced 20 MPa concrete base with full depth perimeter structural channel frame, with gusseted brackets and anchor bolts.
- .4 Type D: Reinforced 20 MPa concrete base with chamfered edges without channel frame.

**2.2 VIBRATION ISOLATORS**

- .1 Type 1: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- .2 Type 2: Open spring mount with iso-stiff springs (horizontal stiffness equal to vertical stiffness).
- .3 Type 3: Open spring mount with iso-stiff springs, heavy mounting frame and limit stop.

- .4 Type 4: Closed spring mount with iso-stiff springs and limit stop.
- .5 Type 5: Closed spring hanger with acoustic washer.
- .6 Type 6: Closed spring hanger with 25 mm thick acoustic isolator.
- .7 Type 7: Elastomer mount with threaded insert and hold down holes.
- .8 Type 8: Neoprene jacketed pre-compressed moulded fiberglass.
- .9 Type 9: Rubber waffle pads, 30 durometer, minimum 12 mm thick, maximum loading 280 kPa. Use neoprene in oily locations or outdoors.
- .10 Type 10: Rubber-steel-rubber pads, 12 mm thick rubber waffle pads bonded to 6 mm thick steel plate.
- .11 Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.
- .12 Colour code spring mounts, springs selected to operate at no greater than 2/3 solid deflection and have 6 mm ribbed neoprene pads.

### **3. EXECUTION**

#### **3.1 APPLICATION**

- .1 Provide vibration isolators for mechanical motor driven equipment throughout, unless specifically noted otherwise.

#### **3.2 INSTALLATION**

- .1 Set steel bases for 15 mm clearance between housekeeping pad and base. Set concrete inertia bases for 50 mm clearance. Adjust equipment level.
- .2 Provide spring isolators on piping connected to isolated equipment as follows: up to 100 mm diameter, first 3 points of support; 125 mm to 200 mm diameter, first 4 points of support; 250 mm diameter and over, first 6 points of support. Static deflection of first point shall be twice deflection of isolated equipment.

#### **3.3 PERFORMANCE**

- .1 Install inertia bases of type and thickness, and isolators of type and static deflection.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 15010.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 1 for requirements pertaining to product options and substitutions.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Comply with requirements of Section 15010.
- .2 Submit an insulation schedule, including the following information for each application:
- .1 Material
  - .2 "k" value
  - .3 Thickness
  - .4 Density
  - .5 Finish
  - .6 Jacket
- .3 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

**1.4 DEFINITIONS**

- .1 For the purposes of this section, the following definitions apply:
- .1 Concealed: ductwork and equipment in shafts, furring, suspended ceilings and attics.
  - .2 Exposed: ductwork and equipment in mechanical rooms or otherwise not "concealed".
  - .3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

**1.5 FLAME/SMOKE DEVELOPMENT RATINGS**

- .1 Duct insulation, recovery materials, vapour barrier facings, tapes and adhesives shall have maximum flame spread ratings less than or equal to 25 and maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC S102-1988, NFPA 255-1996 or ASTM E84-96a.

- .2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411-82.

## **2. PRODUCTS**

### **2.1 HOT DUCT INSULATION**

#### **.1 Hot Duct Insulation - Round and Oval:**

- .1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
- .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
- .3 Service Temperature: 20°C to 65°C.
- .4 Specified material:
  - .1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

#### **.2 Hot Duct Insulation - Rectangular**

- .1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
- .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
- .3 Service Temperature: 20°C to 65°C.
- .4 Specified material:
  - .1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

### **2.2 COLD DUCT INSULATION**

#### **.1 Cold Duct Insulation - Round and Oval:**

- .1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
- .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
- .3 Service Temperature: -40°C to 65°C.
- .4 Specified material:
  - .1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation



- .2 Cold Duct Insulation - Round (Exposed to Outdoors):
  - .1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
  - .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
  - .3 Service Temperature: -40°C to 65°C.
  - .4 Specified material:
    - .1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation
- .3 Cold Duct Insulation - Rectangular:
  - .1 Material: formaldehyde-free, flexible glass fiber blanket insulation and aluminum foil reinforced with fiber glass scrim to CAN/CGSB-51-GP-11M.
  - .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
  - .3 Service Temperature: 20°C to 65°C.
  - .4 Specified material:
    - .1 Manufacturer: John Manville/ Microlite XG Formaldehyde Free Fiber Glass Duct Wrap Insulation

### **2.3 ACOUSTIC DUCTWORK INSULATION**

- .1 Material: flexible duct liner insulation made from strong, glass fibers bonded with a thermosetting resin.
- .2 Acoustic Properties: minimum NRC or 0.75 for 25 mm thickness.
- .3 "k" Value: maximum 0.035 W/m°C at 24°C mean temperature.
- .4 Service Temperature: -40°C to 65°C.
- .5 Surface Finish: air stream side coated to prevent fibre erosion. Surface roughness not exceeding 0.58 mm.
- .6 Specified material:
  - .1 Manufacturer: John Manville/ Linacoustic RC Fiber Glass Duct Liner with Reinforced Coating System.

### **2.4 ACCESSORIES**

- .1 FSK Tape: vapour barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self adhesive.

- .2 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self adhesive.
- .3 Contact Adhesive: quick setting, adhesive to adhere flexible or rigid mineral fibre insulation to ducts.
- .4 Lap Seal Adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.
- .5 Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.
- .6 Finishing Cement: to CAN/CGSB-51.12-95, Type 1 - mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

## **2.5 RECOVERY MATERIALS**

- .1 Interior: Aluminum Jacket reinforced with fiber glass scrim laminated to UL rated kraft, secured with mechanical fastener.
- .2 Exterior: Embossed 22 gauge Aluminum c/w stainless steel fasteners. Sealed with weather elastomer sealant. Lap edges to shed water.

## **3. EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- .1 Dimensions shown are clear inside free area measurement regardless of insulation placement. Fabricate ducts accordingly.
- .2 Apply insulation after required duct system tests have been completed and inspected by the Owner.
- .3 Ensure duct surfaces are clean and dry before installing insulation.
- .4 Install insulation over entire surface of duct, for full length of duct run including portions of duct passing penetrations through walls and floors.
- .5 Install insulation in a manner to insure hangers and standing duct seams do not penetrate insulation.
- .6 Locate finished seams in least visible location.
- .7 Do not insulate ductwork with external thermal insulation where acoustic duct insulation has been specified.
- .8 Install insulation at ambient temperatures within acceptable ratings for tapes, sealants and adhesives.

**3.2 COLD DUCT INSULATION APPLICATION**

- .1 Adhere mineral fibre insulation to round and oval ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside until mastic sets then remove bands.
- .2 Butt mineral fibre insulation and seal joints with lap seal adhesive; cover joint with FSK tape.
- .3 Secure rigid insulation on rectangular ducts with 50% area coverage of adhesive and impale on pins located 400 mm on centre and secure in place with the retaining clips.
- .4 Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.

**3.3 ACOUSTIC DUCT INSULATION APPLICATION**

- .1 Line ducts with flexible or rigid acoustic insulation. Line plenums with rigid acoustical insulation. Adhere insulation to duct with 100% coverage of contact adhesive and pins located 400 mm OC each way. Secure in place with retaining clips. Remove excess length of pins and cover with brush coat of lap seal adhesive.
- .2 Bevel corners at joints and butt together. Brush coat all cut edges with lap seal adhesive. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.
- .3 Where duct velocities exceed 20 m/s, cover insulation with 0.8 mm perforated galvanized steel with 24% free area.

**3.4 EXPOSED DUCTS**

- .1 Finish ducts exposed to outdoors with aluminum jacket. Caulk all joints on jacket for weathertight finish.

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**3.5 INSULATION TYPE AND THICKNESS SCHEDULE**

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Service Type	Insulation Type	Insulation Thickness (mm)
Exhaust and relief ducts within 3 m of exterior openings	Hot duct	25
Relief ducts and plenums	Hot duct	25
Supply ducts and plenums	Hot duct	25
Outside air	Cold duct	50
Mixing plenums	Cold duct	50
Supply air plenums	Cold duct	25
Medium pressure supply ducts	Cold duct	25
Low pressure supply ducts	Cold duct	25
Supply and return ducts exposed to outdoors	Cold duct	50
Ventilation equipment	Cold duct	50

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**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 15010.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 1 for requirements pertaining to product options and substitutions.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Comply with requirements of Section 15010.
- .2 Submit an insulation schedule. For each application include the following information:
  - .1 Materials
  - .2 "k" value
  - .3 Thickness
  - .4 Density
  - .5 Finish
  - .6 Jacketing
- .3 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

**1.4 DEFINITIONS**

- .1 For the purposes of this Section, the following definitions apply:
  - .1 Concealed: piping systems and equipment in trenches, shafts, furring, and suspended ceilings.
  - .2 Exposed: piping systems and equipment in mechanical rooms or otherwise not "concealed".
  - .3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

**1.5 FLAME/SMOKE DEVELOPMENT RATINGS**

- .1 Pipe insulations, recovery materials, tapes, vapour barrier facings and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed rating of 100 except in plenum spaces and air handling systems where maximum smoke development rating shall be 50, when tested in accordance with CAN/ULC-S102, NFPA 255, or ASTM E84.

- .2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C441.

## 2. PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

- .1 Fiberglas, Manson, Owens Corning, Knauf, Johns Mannville, Armaflex, Rubatex, Imcoa, Roxul Calsilite, Kingspan “Koolphen K”.

### 2.2 HOT PIPE INSULATION

- .1 Hot Pipe Insulation - Mineral Fibre:
  - .1 Material: Hi-Lo Temp Formaldehyde Free fiber glass insulation to CAN/CGSB-51.9.
  - .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
  - .3 Service Temperature: up to 150°C.
  - .4 Jacket: PVC jacket thickness of 0.5 mm – indoor piping.  
Aluminum jacket thickness of 0.5 mm – outdoor piping
  - .5 Specified material:
    - .1 Manufacturer: Johns Manville / Zeston 2000 PVC insulated fitting covers and jacketing.

### 2.3 COLD PIPE INSULATION

- .1 Cold Pipe Insulation: Mineral Fibre:
  - .1 Material: Hi-Lo Temp Formaldehyde Free fiber glass insulation to CAN/CGSB-51.9-92.
  - .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
  - .3 Service Temperature: -14°C to 100°C.
  - .4 Jacket: PVC jacket thickness of 0.5 mm.  
Aluminum jacket thickness of 0.5 mm – outdoor piping.
  - .5 Specified material:
    - .1 Manufacturer: Johns Manville / Zeston 2000 PVC insulated fitting covers and jacketing.

### 2.4 ENGINE EXHAUST INSULATION

- .1 Material: Fibreglass removable jacket insulation rated for 650 degrees C (or as required by manufacturer’s instructions) with stainless steel lacing hooks and wires, jacket to be enclosed on the inside by stainless steel mesh with outside cover silicone coated or aluminized fibreglass cloth meeting Canadian Coast Guard approval as Incombustible Materials No. 164.009/94/0 and Canadian Board of Steamship Inspection No. 100/F3-5 and 100/F3-9; or Calcium Silicate removable insulation with temperature rating as specified above and exterior stainless steel protective cover and fastenings.

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- .2 "k" Value: maximum 0.059 W/m.°C at 93°C mean temperature.
- .3 Service Temperature: up to 750°C.

## 2.5 ACCESSORIES

- .1 For mineral fibre insulation materials:
  - .1 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self adhesive.
  - .2 Adhesive: quick setting adhesive for joints and lap sealing.
- .2 Finishing Cement: to CAN/CGSB-51.12-95 Type 1 - mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.
- .3 Equipment Insulation: For all valves and fittings provide flexible removable insulation jackets.

## 2.6 RECOVERY MATERIALS

- .1 Aluminum: to 0.5 mm thick with longitudinal slip joints and 50 mm end laps, 0.4 mm thick die shaped fitting covers with factory attached protective liner on interior surface.
- .2 PVC: to CAN/CGSB-51.53-95, 0.38 mm thick for interior use, off-white in colour with one-piece premoulded fitting covers.

## 3. EXECUTION

### 3.1 INSTALLATION, GENERAL

- .1 Apply insulation after required piping system tests have been completed and inspected by the Owner's Representative.
- .2 Ensure piping surface is clean and dry before insulating.
- .3 Locate cover seams in least visible locations.
- .4 Stagger butt joints where multi-layered insulation is used.
- .5 On vertical piping with diameters 25 mm and larger, use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Repeat supports on 4.5 m centers and at each valve and flange.
- .6 Tightly fit insulation sections to pipe to make smooth and even surfaces. Cut insulation for proper fit where weld beads protrude. Bevel away from studs and nuts to allow their removal without damage to insulation. Trim closely and neatly around extending parts of pipe saddles, supports, hangers, clamp guides and seal with insulating/finishing cement.

### 3.2 HOT PIPE INSULATION APPLICATION

- .1 Apply mineral fibre insulation when pipe surface temperatures are 50°C to 60°C.
- .2 Apply mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Seal butt joints with 100 mm wide ASJ tape.
- .3 Terminate mineral fibre insulation at each end of unions and flanges. Trowel finishing cement into bevel.
- .4 Cover fittings and valves with equivalent thickness of finishing cement. Apply finishing cement over exposed fittings and valves before applying canvas recovering.
- .5 Cut mineral fibre insulation layers straight on 10 m centers with 25 mm gap to allow for expansion between terminations. Pack void tightly with insulation and protect joints with aluminum sleeves.
- .6 Recover exposed mineral fibre insulated piping with PVC.
- .7 Recover mineral fibre insulated piping exposed to outdoors with aluminum.
- .8 Do not insulate the following piping system components:
  - .1 Hot water heating piping in radiation cabinets.
  - .2 Unions, flanges, strainers, expansion joints, flexible piping connectors
  - .3 Condensate trap assemblies and drip legs.
  - .4 Chrome plated or stainless steel piping.
  - .5 Valve bonnets on domestic water systems.

### 3.3 COLD PIPE INSULATION APPLICATION

- .1 Insulate final 3 m portion of plumbing vents measured from exterior penetration. Do not insulate remaining vent piping.
- .2 Insulate storm piping throughout. Insulate final 3 m portion from outlet drain back with 25 mm insulation.
- .3 Apply mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Apply adhesive to ends of butt joints and seal joint seams with 100 mm wide strips of joint tape.
- .4 Insulate complete system including valves, unions, flanges, strainers. Cover fittings and valves with equivalent thickness of finishing cement. Cover finishing cement with open mesh glass cloth and adhesive. Seal lap joints with 100% coverage of joint tape and seal the assembly with adhesive.
- .5 Recover exposed mineral fibre insulated piping with PVC jacket.



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- .6 Recover mineral fibre insulated piping exposed to outdoors with aluminum.

**3.4 COLD EQUIPMENT INSULATION APPLICATION**

- .1 Tightly butt edges and stagger joints. Seal joints with 100 mm wide FSK tape.
- .2 Cover insulation with 25 mm galvanized hexagonal mesh and 12 mm coat of finishing cement. Finish with a final 12 mm coat of finishing cement and recover with canvas.

**3.5 INSULATION TYPE AND THICKNESS SCHEDULE**

Service Type and Nominal Pipe Diameter (mm)	Insulation Type	Insulation Thickness (mm)
Heating and Solar System piping		
50 and smaller	Hot pipe	25
65 and larger	Hot pipe	40
Equipment	Hot Equipment	25
Domestic Hot Water and recirculation		
50 and smaller	Hot pipe	25
65 and larger	Hot pipe	40
Domestic cold water		
40 and smaller	Cold pipe	12
50 and larger	Cold pipe	25
Plumbing vents within 3 m of Exterior		
All sizes	Cold pipe	25
Storm Drains within 3 m of Exterior		
All sizes	Cold pipe	25
Hot water storage tanks	Hot equipment	50
Condenser water piping indoors		
25 and smaller	Cold pipe	25

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 20 00 13.

**1.2 ALTERNATIVES**

- .1 Pipe and pipe fitting products are specified by system in Piping Schedule at end of this Section. Unless otherwise specified, where schedule specifies more than one type of material for a single system, select any one of the specified alternative materials.

**1.3 REFERENCE DOCUMENTS**

- .1 Fabricate piping systems in accordance with Alberta Regulation 49, Safety Codes Act, Pressure Equipment Safety Regulation:
  - .1 Natural gas and propane to CSA B149.1.
  - .2 Propane liquid phase to ANSI B31.3.
  - .3 Refrigerant systems to ANSI/ASME B31.5.
  - .4 Plumbing systems to National Plumbing Code.
  - .5 Oil piping to CSA B139.

**1.4 WELDING QUALIFICATIONS**

- .1 Conform to ASME Section IX and Alberta Boilers Safety Association (ABSA).
- .2 Use only ABSA certified pressure welders and procedures on high pressure steam piping work.

**1.5 WELDING PROCEDURES**

- .1 Conform to ANSI/ASME B31.9 Building Services Piping, ANSI/ASME B31.1, ANSI B16.25.
- .2 Conform to ASME B31.1 Power Piping for High Pressure Steam Piping Installations.

**1.6 SUBMISSIONS**

- .1 Prepare and submit applications to Alberta Boilers Safety Association (ABSA) for registration, consistent with Alberta Regulation 49 Safety Codes Act, Pressure Equipment Safety Regulation (latest edition).

**1.7 CONTRACTOR'S QUALITY CONTROL**

- .1 For the following joint systems:
  - .1 Mechanically Formed Connections
  - .2 Grooved Joints
- .2 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
  - .1 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
- .3 Retain services of joint system supplier to:
  - .1 Prior to proceeding with work, review piping system with Consultant and instruct the workmen installing the piping on the correct use of the jointing system. Review support, anchor, guide, requirements and provisions for expansion.
  - .2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)
  - .3 Inspect [ten] random samples of installed joints.
  - .4 Submit a report describing findings of the inspection to the Consultant.

**1.8 COORDINATION**

- .1 Coordinate piping installation routes and elevations with installation of sprinkler, sheet metal and electrical work.

**2. PRODUCTS**

**2.1 STEEL PIPE SYSTEM COMPONENTS**

- .1 Pipe:
  - .1 Black Steel, Schedule 40: electric resistance welded, ASTM A53, Grade B.
  - .2 Black Steel, Schedule 80: electric resistance welded, ASTM A53, Grade B.
  - .3 Galvanized Steel, Schedule 40: electric resistance welded, ASTM A53, Grade B.

- .4 Stainless Steel, Schedule 10S: Type 304/304L [316/316L], ASTM A312.
- .2 Joint and Fitting Components:
  - .1 Threaded Fittings: malleable iron to ANSI/ASME B16.3.
  - .2 Welded Fittings: wrought steel, butt welding type to ANSI B16.9.
  - .3 Mechanical Grooved Couplings: two ductile-iron housing, synthetic rubber gasket of central cavity pressure-responsive design; with ASTM A449 electroplated steel nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings. Couplings shall comply with ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications, and CSA B242 – Standard for Groove and Shoulder Type Mechanical Couplings.
    - .1 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, with Victaulic Style 107H/107N (Quick-Vic™), Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade “EHP” EPDM designed for operating temperatures from -34° C to +120° C.
    - .2 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source. Victaulic Style 177 (Quick-Vic™), Installation Ready or Style 77 flexible coupling.
    - .3 Victaulic AGS Mechanical Couplings, DN350 through DN1500: Couplings shall consist of two ASTM A-536 ductile iron housing segments with lead-in chamfer on housing key and a wide-width elastomer pressure responsive gasket. Victaulic Style W07 AGS Rigid and Style W77 AGS Flexible Coupling.
  - .4 Mechanical Grooved Fittings: to ASTM A536 ductile iron; ASTM A234 wrought steel; or factory fabricated from ASTM A53 steel pipe; fittings with grooves or shoulders designed to accept grooved end couplings.

## **2.2 CAST IRON SOIL PIPE COMPONENTS**

- .1 Pipe: cast iron soil pipe to CAN/CSA-B70.
- .2 Mechanical Joint Components: hubless fittings, elastomeric gaskets and stainless steel mechanical joint couplings to CAN/CSA-B70.

**2.3 EPOXY COATED CAST IRON SOIL PIPE COMPONENTS**

- .1 Pipe: epoxy coated cast iron soil pipe to CAN/CSA-B70.
- .2 Mechanical Joint Components: hubless fittings, elastomeric gaskets and stainless steel mechanical joint couplings to CAN/CSA-B70.
- .3 Epoxy Coating: interior surfaces of cast iron pipe and fittings coated with 250 um fusion bonded epoxy, meeting the following requirements:
  - .1 Adhesion: to ASTM D1002.
  - .2 Penetration Resistance: to ASTM G17.

**2.4 COPPER PIPE COMPONENTS**

- .1 Pipe:
  - .1 Copper Water Tube: to ASTM B88.
  - .2 ACR Copper Tube: to ASTM B280.
  - .3 DWV Copper Tube: to ASTM B306.
- .2 Joint and Fitting Components:
  - .1 Wrought Copper Fittings: to ANSI B16.22.
  - .2 Cast Copper, Brass & Bronze Fittings: to ANSI B16.18.
  - .3 Solder Joints: to ASTM B32.
  - .4 Brazed Joints: to ASTM B664.
  - .5 Mechanical Grooved Couplings: two ductile iron housing segments cast with offsetting, angle-pattern, bolt pads, with Grade "EHP" EPDM designed for operating temperatures from -34° C to +120° C. Installation ready rigid coupling for direct stab installation without field disassembly. Standard of Acceptance: Victaulic Style 607H.
  - .6 Mechanical Grooved Fittings: Wrought copper to ANSI B16.22 or cast bronze to ANSI B16.18, manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Standard of Acceptance: Victaulic Copper-Connection.

**2.5 STAINLESS STEEL COMPONENTS**

- .1 Pipe: ASTM A312, Type 304/304L, Schedule 10S, with plain ends for use with the Vic-Press piping system.

- .2 Fittings: Precision, cold drawn, stainless steel with elastomer O-ring seals, suitable for working pressure to 500-psig (3450-kPa). Victaulic Vic-Press for Schedule 10S Pipe.
- .3 Joints: Victaulic Series PFT-510 tool with the proper sized jaw for pressing.

**2.6 ABS PIPE COMPONENTS**

- .1 Pipe: ABS Plastic Pipe: to CAN/CSA-B181.1.
- .2 Joint and Fitting Components:
  - .1 Fittings: ABS fittings to CAN/CSA-B181.1.
  - .2 ABS Solvent Cement: to ASTM D2235.
  - .3 ABS - PVC Solvent Cement: to ASTM D3138.

**2.7 PVC PIPE COMPONENTS**

- .1 Pipe: PVC plastic pipe to CAN/CSA-B181.2, NSF 61, and/or CAN/CSA B139 based on the application
- .2 Joint and Fitting Components:
  - .1 Fittings: PVC fittings to CAN/CSA-B181.2.
  - .2 PVC Solvent Cement: to ASTM D2564.
  - .3 ABS-PVC Solvent Cement: to ASTM D3138.

**2.8 UNIONS AND FLANGES**

- .1 Pipe size 50 mm and smaller: 1035 kPa and as follows:
  - .1 Ferrous piping: malleable iron unions with bronze to iron ground joint to ANSI/ASME B16.39.
  - .2 Copper piping: bronze unions.
- .2 Pipe size 65 mm and larger: 1035 kPa and as follows:
  - .1 Ferrous piping: forged steel slip-on flanges to ANSI/ASME B16.5 with 1.6 mm thick preformed neoprene bonded to asbestos for general applications, neoprene gasket for gas service.
  - .2 Copper piping: bronze flanges.
  - .3 Unions and flanges for servicing and disconnect are not required in installations with grooved mechanical joint couplings. (The couplings shall serve as disconnect points.)

**3. EXECUTION**

**3.1 INSTALLATION REQUIREMENTS**

- .1 Install piping systems in accordance with the following:
  - .1 Natural gas and Propane distribution system: to CAN/CGA B149.1 and Alberta amendments.
  - .2 Oil burning equipment installation: to CSA B139.
  - .3 Plumbing and drainage system: to National Building Code of Canada 2010 and Alberta Regulation 119/2007 – Plumbing Code Regulation.
  - .4 Heating and cooling system: to comply with recommendations of ASHRAE Guide.
  - .5 Refrigeration system: to CSA B52.
- .2 Install piping to allow for expansion and contraction without exceeding maximum allowable stresses for pipe and equipment flanges.
  - .1 For water systems, Victaulic flexible couplings may be used to accommodate thermal growth, contraction, and for the elimination of expansion loops. (In accordance with the manufacturer’s written recommendations.) Where loops are required, use flexible couplings on the loop.
- .3 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.
- .4 Provide all offsets necessary to install piping systems within the physical limitations of the building.

**3.2 ROUTES AND GRADES**

- .1 Route piping in an orderly manner and maintain proper grades.
- .2 Install piping to conserve headroom and space.
- .3 Route above grade piping parallel to walls.
- .4 Where practicable, group piping at common elevations. Provide adequate clearances to allow for insulation.
- .5 Install concealed pipes close to building structure to keep furring to a minimum.
- .6 Slope hydronic and domestic water system piping at 0.2% and drain at low points.

- .7 Slope steam piping at 0.5% and condensate piping at 0.7% down in direction of flow. Provide drip trap assembly at low points and at points where condensate lines from traps to nearest condensate receiver. Where condensate lines form a trap, provide vent loop over trapped section.
- .8 On closed loop water systems, equip low points with 20 mm drain valves and hose nipples. At high points, provide collecting chambers and high capacity float operated automatic air vents.
- .9 Make reductions in water piping with eccentric reducing fittings to provide complete drainage and venting.

**3.3 STEEL PIPING SYSTEM - GENERAL**

- .1 Use only long radius elbows.
- .2 Connections for 50 mm piping may be either screwed or welded.
  - .1 Pipe diameters less than 50 mm use screwed connections.
  - .2 Pipe diameters greater than 50 mm use welded connections.
  - .3 On galvanized piping systems use only screwed fittings.
- .3 Ream piping and tubing. Clean off scale and dirt inside and outside before assembly. Remove welding slag or other foreign material from piping.
- .4 Protect galvanized pipe threads with pipe paste.

**3.4 STEEL PIPING SYSTEM - TEEING OFF MAIN LINE**

- .1 Mains 150 mm and smaller:
  - .1 Use saddle type connections where main is at least one size larger than branch.
  - .2 Use direct connection where branch is at least three sizes smaller than main.
- .2 Mains 200 mm and larger:
  - .1 Use saddle type connections where main is at least two sizes larger than branch.
  - .2 Use direct connection for branches 65 mm and smaller.
  - .3 Do not project branch pipe inside main line.

**3.5 NON-FERROUS PIPING CONNECTIONS**

- .1 Use non-toxic joint compound on potable water lines.



- .2 Provide non-conducting type connections wherever joining dissimilar metals. Brass adaptors and valves are acceptable.
- .3 Coat brass fittings used underground with an asphaltic compound to prevent dezincification.
- .4 Sleeve copper piping buried under building so that pipe can move freely; joints are not allowed in piping buried under building.

### **3.6 COPPER PIPING - MECHANICALLY FORMED CONNECTIONS**

- .1 Mechanically formed tee connections with brazed joints may be used in lieu of tee fittings in copper tubing provided they meet the following:
  - .1 Size and wall thickness of main tube and branch tube are listed by manufacture of forming equipment as an acceptable application.
  - .2 Height of drawn collar is not less than three times wall thickness of main tubing.
  - .3 End of branch tube is notched to conform to inner curve of tube and dimpled to set exact penetration depth into collar.
  - .4 Resulting joint is brazed and is minimum of three times as long as thickness of thinner joint member.

### **3.7 GROOVED PIPING SYSTEMS**

- .1 Use grooved mechanical piping systems only in mechanical room spaces and as approved by the engineer.
- .2 Use Victaulic roll grooving tools to groove pipe to manufacturer's specifications. Provide regular bi daily checks to confirm depth of groove is within manufacturer's tolerances. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe as provided by Victaulic.
- .3 Confirm pipe ends are clean and free from indentations, projections or roll marks from pipe end to groove to ensure proper gasket sealing.
- .4 Confirm that gasket style and grade are suitable for the intended service.
- .5 Lubricate Victaulic gaskets with a thin coat of Victaulic lubricant; apply to gasket lips and exterior to ease installation and avoid pinching the gasket.
- .6 The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

- .7 Submit manufacturers' quality control report.

**3.8 UNIONS AND FLANGES**

- .1 Make connections to equipment and branch mains with unions or flanges.
- .2 Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)
- .3 Unions 50 mm and smaller:
  - .1 Malleable iron unions, 1035 kPa with bronze to iron ground joint union for threaded ferrous piping.
  - .2 Bronze unions for copper piping.
  - .3 Provide air tested unions for gas service.
- .4 Unions 65 mm and larger:
  - .1 Forged steel slip on flanges for ferrous piping (1030 kPa).
  - .2 Bronze flanges for copper piping (1030 kPa).
  - .3 For gas service, provide synthetic rubber.

**3.9 GAS PIPING**

- .1 Use isolating gas cocks on primary gas line installed with isolating union at outlet.
- .2 Bond interior gas piping to electrical system ground conductor to maintain gas piping at electrical system ground.
- .3 For piping which will be buried, use piping with welded fittings with factory or site applied plastic jacketing.
- .4 Apply heat shrink plastic jacketing to joints on buried piping.
- .5 Install gas piping in open or ventilated spaces. Pitch lines and provide drip legs for condensation and dirt at appliance connection. Where gas piping is run in a concealed space, provide ventilation grilles to CAN/CSA B149.1.

**3.10 BELOW GROUND PETROLEUM PRODUCT PIPING**

- .1 Pressure test secondary containment pipe to withstand 35 kPa air pressure and test primary pipe to withstand 415 kPa prior to backfill.
- .2 Arrange for piping manufacturer to review the installation prior to backfill, witness pressure test and submit a report to certify correct installation.

**3.11 PLASTIC PIPE INSTALLATION**

- .1 Note PVC-DWV is not permitted to be installed in the following applications:
  - .1 High buildings, as defined in the Alberta Building Code.
  - .2 A ceiling plenum used for return air.
  - .3 A vertical shaft.
- .2 Comply to all requirements defined in the Alberta Building Code.

**3.12 PIPING SCHEDULE**

System	Pipe	Fitting	Joint
Hydronic heating and cooling up to 120°C and 1035 kPa	Black steel Schedule 40, 50 mm or less	Threaded	Screwed
		Welding	Welded
		Mechanical grooved	Clamped
	Black steel, Schedule 40, greater than 50 mm	Welding	Welded
		Mechanical grooved	Clamped
		Stainless steel pressfitting 50 mm or less	Stainless steel pressfitting
	Copper water tube type L, Drawn temper	Wrought copper	Soldered, 95-5 tin-antimony
		Cast copper	Soldered, 95-5 tin-antimony
		Mechanical grooved	Clamped
	Condenser water	Black steel, Schedule 40, 50 mm or less	Threaded
Welding			Welded
Mechanical grooved			Clamped
Black steel, Schedule 40, greater than 50 mm		Welding	Welded
		Mechanical grooved	Clamped
Stainless steel pressfitting 50 mm or less		Stainless steel pressfitting	Compression
Copper water tube type L, drawn temper		Drawn cast brass	Soldered, 95-5 tin-antimony

Continued on next page.

**3.12 PIPING SCHEDULE (CONT'D)**

System	Pipe	Fitting	Joint
		Wrought copper	Soldered, 95-5 tin-antimony
		Mechanical grooved	Clamped
Low pressure steam	Black steel, Schedule 40 50 mm or less	Threaded	Screwed
		Welding	Welded
	Black steel, Schedule 40 Greater than 50 mm	Welding	Welded
Steam condensate up to 1035 kPa	Black steel, Schedule 80 50 mm or less	Threaded	Screwed
		Welding	Welded
	Black steel, Schedule 80 greater than 50 mm	Welding	Welded
Equipment drains and overflows	Galvanized steel, Schedule 40, ASTM A53-96 only	Galvanized threaded	Screwed
	Copper water tube, Type L, drawn temper	Wrought copper	Soldered, 95-5 tin-antimony
Refrigerant	ACR copper	Wrought copper	Brazed
		Cast copper	Brazed
Domestic water below grade	Copper water tube type K, drawn temper	Wrought copper	Soldered, 95-5 tin-antimony
Domestic water above grade	Copper water tube type L, drawn temper	Wrought copper	Soldered, 95-5 tin-antimony
		Cast copper	Soldered,

95-5  
tin-antimony

**3.12 PIPING SCHEDULE (CONT'D)**

System	Pipe	Fitting	Joint
		Mechanical Grooved	Clamped
	Stainless steel pressfitting 50 mm or less	Stainless steel pressfitting	Compression
	PVC 50 mm or greater	PVC	Solvent Weld
Compressed air	Galvanized steel, Schedule 40, ASTM A53-96 only	Galvanized, threaded	Screwed
	Copper water tube type L, drawn temper	Wrought copper	Soldered, 95-5 tin-antimony
		Cast copper	Soldered, 95-5 tin-antimony
		Mechanical grooved	Clamped
	Stainless steel pressfitting 50 mm or less	Stainless steel pressfitting	Compression
DWV above grade and buried	Cast iron	Hubless cast iron	Clamped
	DWV copper (above grade only)	Cast bronze	Soldered, 50-50 tin-lead
		Wrought copper	Soldered, 50-50 tin-lead
	ABS	ABS	Solvent
	PVC	PVC	Solvent welded
Storm sewer, above grade	Cast iron	Hubless cast iron	Clamped

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DWV copper	Cast bronze	Solder, 50-50 tin-lead
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Continued on next page.

**3.12 PIPING SCHEDULE (CONT'D)**

System	Pipe	Fitting	Joint
		Wrought copper	Solder, 50-50 tin-lead
	ABS	ABS	Solvent welded
	PVC	PVC	Solvent welded
Special waste	Epoxy coated cast iron	Hubless cast iron	Clamped
	ABS	ABS	Solvent welded
	PVC	PVC	Solvent welded
Natural gas low pressure less than 1400 kPa, inside building	Black steel, Schedule 40 50 mm or less	Threaded	Screwed
		Welding	Welded
	Black steel, Schedule 40 greater than 50 mm	Welding	Welded
Natural gas high pressure greater than 1400 kPa, inside building	Black steel, Schedule 40, ASTM A53-96 Grade B only	Welding	Welded
Oil piping	Black steel, Schedule 40	Threaded	Screwed

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Welding

Welded

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**END OF SECTION**



**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 15010.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 1 for requirements pertaining to product options and substitutions.

**1.3 VALVE SIZES**

- .1 Valves sizes are specified in preferred metric sizes.

**1.4 ABBREVIATIONS**

- .1 OS&Y: Outside Screw and Yoke.

**1.5 SOURCE OF SUPPLY**

- .1 Valves of same type shall be by a single manufacturer.

**1.6 SHOP DRAWINGS**

- .1 Comply with requirements of Section 15010.  
.2 Submit valve schedule before ordering.

**1.7 IDENTIFICATION**

- .1 Valves shall bear the following information permanently marked on valve body:  
.1 Manufacturer's name or trademark.  
.2 Pressure rating.  
.3 Flow direction.

**2. PRODUCTS**

**2.1 GLOBE VALVES**

- .1 Throttling Service 50 mm and smaller:  
.1 Body: bronze with union bonnet.  
.2 Stem: rising.  
.3 Disc and Seat Ring: stainless steel.  
.4 Connections: soldered or screwed ends.

- .2 Throttling Service 65 mm and larger:
  - .1 Body: cast iron body.
  - .2 Trim: bronze.
  - .3 Stem: rising OS&Y.
  - .4 Disc: bronze or cast iron bevelled.
  - .5 Connection: flanged ends.

## **2.2 BALL VALVES**

- .1 Throttling Service 50 mm and smaller:
  - .1 Body: bronze with union bonnet.
  - .2 Stem: rising.
  - .3 Disc and Seat Ring: stainless steel.
  - .4 Connections: soldered or screwed ends.
- .2 Throttling Service 65 mm and larger:
  - .1 Body: cast iron body.
  - .2 Trim: bronze.
  - .3 Stem: rising OS&Y.
  - .4 Disc: bronze or cast iron bevelled.
  - .5 Connection: flanged ends.

## **3. EXECUTION**

### **3.1 INSTALLATION**

- .1 Install valves with stems in upright or horizontal position. Do not install stems in inverted position.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 Mechanical General Requirements: Section 15015.

**1.2 SHOP DRAWINGS**

- .1 Comply with requirements of Section 15015.  
.2 Provide tank mounting details and special backfill requirements for buried tanks.

**1.3 CERTIFICATES**

- .1 Submit inspection certificate for tanks that require inspection under the Alberta Safety Codes Act, Design, Construction and Installation of Boilers and Pressure Vessels Regulations.

**2. PRODUCTS**

**2.1 DOMESTIC HOT WATER EXPANSION TANK - BLADDER TYPE (ET-1)**

- .1 Body Construction: steel pressure vessel outer tank, bladder type for permanent separation of air and water.  
.2 Support: steel skirt for vertical floor support.  
.3 Fittings: air side charge connection; water side inlet connection.

**2.2 DOMESTIC WATER HEATER TANK (DWH-1)**

- .1 Body Construction: Chromium molybdenum – titanium ferritic 444 stainless steel alloy..  
.2 Heat exchanger: Single wall 1” O.D. stainless steel coil.  
.3 Insulation: 2” CFC-free foam insulation for energy efficiency.  
.4 Accessories:  
.1 Thermometer.  
.2 Chlorine resistant stainless steel screwed fittings.  
.3 T&P relief valve.  
.5 Tappings: HWS inlet, HWR outlet, drain pressure relief valve, DHW outlet, and water make-up.

**3. EXECUTION**

**3.1 DOMESTIC WATER HEATER TANK**

- .1 Provide pressure relief valve; pipe discharge to drain. Set relief valve for tank rated pressure specified in schedule.
- .2 Provide thermometer on inlet and discharge pipes.
- .3 Provide valved tank drain; pipe to floor drain.
- .4 Support tank on steel saddle directly to floor.

**3.2 DOMESTIC HOT WATER EXPANSION TANK**

- .1 Provide pressure relief valve; pipe discharge to drain. Set relief valve for tank rated pressure specified in schedule.
- .2 Provide valved tank drain; pipe to floor drain.
- .3 Support tank on steel saddle directly to floor.
- .4 Operating temperature – 116° C Max.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Mechanical General Requirements: Section 15010.

**1.2 ABBREVIATIONS**

- .1 NPSHR: Net Positive Suction Head Required.  
.2 EEMAC: Electrical Equipment Manufacturers Association of Canada.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Comply with requirements of Section 15010.  
.2 Submit following information:  
.1 Certified pump performance curves showing performance characteristics with system operating point plotted and NPSHR curve.  
.2 Details of pump drive motor.  
.3 Details of drive assembly, including the rated capacity of the drive at the specified r/min.  
.4 Details of bearings including manufacturers ratings of full load operating hours.  
.5 Details of pump seals, listing maximum operating temperatures and material limitations.  
.6 Complete data showing pump materials, dimensional data and ratings.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into the manual.  
.2 Maintenance data to include the following:  
.1 Manufacturer's name, type, model year, capacity and serial number.  
.2 Details of operation, servicing, and maintenance.  
.3 Recommended spare parts list with names and addresses.  
.4 As-built wiring diagrams.  
.5 Performance curves.

**2. PRODUCTS**

**2.1 PUMPS - GENERAL**

- .1 Balance all rotating parts.

- .2 Pump construction shall permit complete servicing without disassembly of piping or motor connections.
- .3 Pump Connections: flanged pump connections.

### **3. EXECUTION**

#### **3.1 INSTALLATION SYSTEMS**

- .1 Provide pipe size shut-off valve and strainer on suction, pipe size spring loaded check valve and valve for throttling on discharge. Factory designed combination valve inlet and discharge fittings may be used if certified by pump manufacturer.
- .2 Decrease from pipe size with long radius reducing elbows or reducers. Install to Hydraulic Institute recommended practices.
- .3 Support pipe adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge lines 100 mm and over.
- .4 Support "in-line" circulators directly from inlet and discharge pipe. Do not use flexible connections.
- .5 Install pumps to allow maintenance and removal of component parts.
- .6 Install flow sleeve and pitless adapter in advance on the submersible pumps in accordance with manufacturer's instructions.

#### **3.2 PERFORMANCE**

- .1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation and operate within 75% of the maximum published efficiency, unless otherwise indicated.
- 2 Provide pumps labeled on the drawings to the performance and quality standards scheduled

**END OF SECTION**

**1. GENERAL**

**1.1 REFERENCE DOCUMENTS**

- .1 Plumbing fixtures shall meet or exceed CAN/CSA-B45 Series-02, Plumbing Fixtures.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Section 01621 for requirements pertaining to product options and substitutions.

**1.3 REGULATORY REQUIREMENTS**

- .1 Plumbing fixtures shall be approved by the authority having jurisdiction.

**1.4 CERTIFICATIONS**

- .1 Plumbing fixtures shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labeled, provide written approval by the authority having jurisdiction.

**1.5 SOURCE OF SUPPLY**

- .1 Each of the following products shall be by a single manufacturer:
  - .1 Fixtures of the same type or group.
  - .2 Fittings of the same type.

**1.6 COORDINATION**

- .1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

**2. PRODUCTS**

**2.1 FIXTURE BRASS AND ACCESSORIES**

- .1 Visible parts of fixture brass and accessories shall be heavily chrome plated.

**2.1 PERFORMANCE**

- .1 Refer to mechanical drawings schedules for products used as the basis of design and representing the performance requirements.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install each fixture with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.
- .2 Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers and escutcheons.
- .3 Rigidly attach floor mounted water closets to floor with lag screws. Lead flashing shall not hold closet in place.
- .4 Install hose and faucets and hose connections with vacuum breakers.
- .5 Provide on lab sinks polyethylene or PVC-DWV drain and vent lines with glass 450 mL bottle trap. Run plastic drain to floor and approved piping under slab. Run plastic vents to main header on roof terminal.

**3.2 PROTECTION**

- .1 Protect fixtures against use and damage during construction.

**3.3 FIXTURES ROUGH-IN SCHEDULE**

- .1 Rough-in fixture piping connections in accordance with following table of minimum sizes or as required for particular fixtures.



---

Product	Hot Water mm	Cold Water mm	Waste mm	Vent mm
Service Sinks	15	15	50	40
Floor Drains	--	--	100	40
Shower	15	15	30	30
Water Closet with Direct- flush valve	--	25	100	50
Sink	15	15	40	40
Lavatory	15	15	40	40
Hose Bibbs	20	20	--	--
Emergency Shower (to mixing valve)	20	20	40	--

---

**END OF SECTION**

**1. GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes and as specified herein.
- .2 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Owner.
- .3 Provide an approved water meter and bypass installation conforming to Local Codes and Standards.

**2. PRODUCTS**

**2.1 CLEAN-OUTS AND CLEAN-OUT ACCESS COVERS**

- .1 Provide caulked or threaded type extended to finished floor or wall surface. Provide bolted coverplate clean-outs on vertical rainwater leaders only. Ensure ample clearance at clean-out for rodding of drainage system.
- .2 Floor cleanout access covers in unfinished areas shall be round with nickel bronze scoriated frames and plates. Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Wall cleanouts to have chrome plated caps.

**2.2 TRAP SEAL PRIMERS**

- .1 Serving 1 or 2 drains:
  - .1 Diaphragm operated primer with distribution unit,
  - .2 Automatically operated by a pressure drop of 5 to 10 psi (35 to 70 kPa) in supply line to fixture.
  - .3 Standard of Acceptance
    - .1 Precision Plumbing Products Model PR-500
    - .2 Mifab M-500 with MI-DU
- .2 Serving 3 to 30 drains:
  - .1 Electric, manifolded units.
  - .2 Components factory assembled in 16 ga recessed metal cabinet with hinged stainless steel lockable access door.
  - .3 Atmospheric vacuum breaker.
  - .4 Preset 24 hr clock.
  - .5 Manual over ride switch.
  - .6 120 Volt solenoid valve.
  - .7 NPS ¾ ( 20 mm) or NPS ½ ( 15 mm) valved inlet water connection.
  - .8 Calibrated water distribution manifold.
  - .9 NPS ½ ( 15 mm) outlet compression fittings.

- .10 Standard of Acceptance
  - .1 Precision Plumbing Products Model PT-3 thru PT-30
  - .2 Mifab MI-100

### 2.3 FLOOR DRAIN

- .1 Floor drain shall have lacquered cast iron body with double drainage flange, weep holes combined two piece body reversible clamping device, low profile drain where depth is limited and adjustable nickel/bronze strainer.
- .2 Floor drain shall have polished bronze funnel type strainer.

### 2.4 WATER HAMMER ARRESTERS

- .1 Fit water supply to each fixture or group of fixtures with an air chamber. Provide air chambers same size as supply line or 20 mm minimum, and minimum 450 mm long.
- .2 Install stainless steel bellows type water hammer arresters on water lines connected to solenoid valves, flush valves and to fixture or group of fixtures complete with accessible isolation valve. Model: **Zurn Shoktrol Water Hammer Arrestors** or approved alternate.

### 2.5 ROOF DRAINS

- .1 Flow Characteristics: Full open flow. Controlled flow drains are not acceptable.
- .2 Material: All major components including body, flashing clamping flange, under deck clamping ring and dome strainer shall be Dura-coated cast iron. Bolts shall be galvanized or prime painted steel.
- .3 Body:
  - .1 Sump: 250 mm internal diameter, minimum 75 mm deep.
  - .2 Discharge: nominal 100 non-threaded MJ.
  - .3 Bosses: solid, integrally cast, for under deck clamping ring and flashing flange bolts.
  - .4 Deck flange: nominal 300 mm outside diameter, minimum 50 mm width.
- .4 Flashing Clamping Flange: Outside diameter same as outside diameter of deck flange; Vnotched positive draining gravel stop lip, 15 mm high.
- .5 Dome Strainer: Minimum 150 mm high; 8 mm to 15 mm slotted openings, sides and top. Model: **Zurn Z121**.

### 2.6 BACK-FLOW PREVENTERS – REDUCED PRESSURE PRINCIPLE (RP)

- .1 Conforming to CSA B.64.4 ( 2011)

- .2 NPS ¾" (20 mm) and larger:
  - .1 Two independent check valves with intermediate relief valve,
  - .2 OS&Y ULC listed resilient seated gate valves,
  - .3 ball test cocks, and
  - .4 air gap drain.
  - .5 Standard of Acceptance
    - .1 Watts No.909 series
    - .2 Cla-val Company Model RP-1
    - .3 Conbraco 40200 & 40100 Series
  
- .3 NPS ¼ ( 8 mm) and ½ ( 15 mm):
  - .1 Two independent check valves with intermediate relief valve,
  - .2 quarter turn full port resilient seated ball valves,
  - .3 inlet strainer,
  - .4 ball test cocks, and
  - .5 air gap drain.
  - .6 Standard of Acceptance
    - .1 Watts No.909QT series

### **3. EXECUTION**

#### **3.1 INSTALLATION**

- .1 Lubricate clean-out plugs with mixture of graphite and linseed oil. Prior to building turnover remove clean-out plugs, re-lubricate and reinstall using only enough force to ensure permanent leak proof joint.
- .2 Install vacuum breakers on plumbing lines where contamination of domestic water may occur. Generally necessary on boiler make-up lines, hose bibs and flush valves.
- .3 Where floor drains are located over occupied areas, provide waterproof installation.
- .4 Install trap primer where required by Codes and/or where indicated on drawings.
- .5 Drainage lines shall grade 2 mm per 100 mm unless otherwise indicated on drawings.
- .6 Install pressure reducing valves to limit maximum static pressure at plumbing fixtures to 550 kPa.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Supply and install air compressor(s) and associated equipment as indicated on the Contract Drawings and in this Specification. All equipment listed in this section is to be supplied by Approved Supplier.
- .2 The compressed air system shall supply ISO 8573.1 Class 2.4.1 classification of oil free and instrument air.
- .3 Approved Manufacturers:
  - .1 Sullair Corporation
  - .2 Approved Alternates:  
Quincy Compressor

**1.2 RELATED SECTIONS**

- .1 Section 01340 - Shop Drawings, Product Data and Samples
- .2 Section 15010 - Mechanical General Requirements
- .3 Section 15021 – Mechanical O&M Manual
- .4 Section 15110 - Valves

**1.3 REFERENCE STANDARDS**

- .1 ANSI Standards:  
B-16.5 Pipe Flanges and Flanged Fittings
- .2 OH&S Standards:  
Applicable Standards

**1.4 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 01340.
- .2 Shop drawings and product data to include the following:
  - .1 Outline and arrangement drawings.
  - .2 Cross-section drawings.
  - .3 Materials of construction.

- .4 Details of stuffing box or mechanical seal arrangement.

## **1.5 QUALITY ASSURANCE**

- .1 Ensure that installations conform with all applicable local, Provincial, and/or Federal codes, standards, and regulations in effect at time of bid.
- .2 Comply with the requirements of the following organizations, at minimum:
  - .1 CSA, Canadian Standards Association.
  - .2 NEC, National Electric Code.
  - .3 NEMA, Standards of National Electrical Manufacturers Association.
  - .4 ANSI, American National Standards Institute.
  - .5 ASTM, American Society for Testing and Materials.
  - .6 AISI, American Iron and Steel Institute.
  - .7 AGMA, American Gear Manufacturer's Association.
  - .8 AISC, American Institute of Steel Construction
  - .9 AWS, American Welding Society.
  - .10 ASME, American Society of Mechanical Engineers
  - .11 NSF, National Sanitation Foundation

## **1.6 MATERIALS**

- .1 All materials to be new, free from defects and conforming to applicable reference standards.
- .2 All materials, linings and coatings in contact with water to be NSF approved for potable water.
- .3 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

## **2. PRODUCTS**

### **2.1 SCREW AIR COMPRESSORS**

- .1 General:
  - .1 The compressors shall be a single stage, heavy duty, flood lubricated, asymmetrical lobe, rotary screw type capable of providing compressed air for the water treatment plant compressed air supply system. The unit shall be equipped with tapered roller bearings for extended bearing life. The compressors shall be self-contained, complete with air receivers, dryers, filters, etc.

**2.2 ACCESSORIES**

- .1 Provide all anchor bolts, shims and miscellaneous accessories necessary for installation of the equipment and drivers.
  
- .2 Provide the following spare parts, to be delivered to the site and handed over to the Owner at the time of commissioning:
  - .1 Sufficient lubricating oils and greases of correct grade and specification for 12 months operation of all equipment requiring such. Use food grade lubricants only.
  
  - .2 Any other spares which may be required to comply with the manufacturer's operating and maintenance instructions and recommendations during the course of the first 12 months of operation.

**3. EXECUTION**

**3.1 MARKING, PACKING, AND PACKAGING**

- .1 Equipment shall be marked to identify the product, date (month and year) of manufacture, capacity, and serial number. Equipment shall be shipped with a label containing equipment description, manufacturing order number, part number, serial number, manufacturer, and date.
  
- .2 The proper caution or warning signs as prescribed by OH&S standard shall be customer determined and supplied.
  
- .3 All packing, packaging, and marking provisions of ASTM Practice D3892 shall apply to this standard.

**3.2 SHIPPING, RECEIVING AND STORAGE**

- .1 Various sections of the equipment to be properly match-marked to assist in positioning and assembly at the site.
  
- .2 The equipment shall be shipped to site assembled to the greatest extent possible to reduce installation and start-up costs.
  
- .3 Provide instructions on storage and protection well in advance of shipping. If any special instructions are necessary covering safe storage, give them to the Contractor.

- .4 The Contractor will sign the carrier's bill of lading to indicate receipt of the required number of crates, packages, etc., and will note thereon any apparent shortages of or visible damage to such crates, packages, etc. The supplier shall furnish to the Contractor, lists showing the contents of the said crates, packages, etc., complete with all necessary handling and off-loading instructions. Such lists shall be furnished sufficiently early so that copies will be available at the site when delivery of the said equipment and appurtenances is made. Within seven days after the date of delivery to the site, the Contractor will notify the Supplier in writing of shortages or damage in equipment delivered.
- .5 The Contractor will provide unloading facilities and place the equipment in location or storage. The Contractor will be responsible for off-loading at site, for storing the equipment, appurtenances and materials and for protection against weather loss, damage, or theft. The supplier shall provide full instructions of all precautions to be observed in connection with the handling, storing and protection of the equipment.

### **3.3 INSTALLATION**

- .1 Install all equipment in strict accordance with manufacturer's and supplier's instructions.
- .2 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor's responsibility.
- .3 Make equipment installation and connections by skilled tradesmen to the best standard.
- .4 Carry out work to produce a neat, accurate, secure, functional installation.
- .5 Repair at own expense, any damage done to the installation of materials while carrying out the work.
- .6 Install anchor bolts and concrete bases in advance of equipment installation in accordance with manufacturer's instructions.
- .7 Set sole plates in place and shim to correct alignment. Grout as required.
- .8 Upon completion of installation, fill, add to, and check equipment requiring lubricating oils, greases and coolants. Types and amounts to be in strict accordance with manufacturer's recommendations.

### **3.4 EQUIPMENT TESTING PROCEDURE**

- .1 Submit a thorough description of the procedures to be employed in testing this equipment. The procedure will be reviewed by the Engineer for suitability and should be submitted 3 weeks prior to any testing.



**3.5 FIELD TESTING**

- .1 When equipment installation has been completed to the standards indicated by these specifications, arrange for the services of the equipment manufacturer's technical representative.
- .2 The equipment manufacturer's technical representative shall inspect the installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, correct the deficiencies indicated by the technical representative. Start, run and adjust equipment at this time. The technical representative shall then advise the Engineer in writing that the installation has been checked, has been installed correctly and is in working order.
- .3 Bear all the costs of the equipment manufacturer's technical representative.
- .4 Use only personnel who have taken an active part in the actual installation of the system. Do not designate a subtrade as representative at any time during the construction prior to final inspection.

**3.6 EQUIPMENT MANUFACTURER'S REPRESENTATIVE**

- .1 The equipment manufacturer's technical representative shall be familiar with the equipment supplied and shall come prepared with both knowledge and equipment to perform and interpret the test, inspections and procedures recommended by the manufacturer for the starting of equipment that has not previously been run.
- .2 The equipment manufacturer's technical representative shall, immediately after completion of the inspection, convey to the Engineer in writing, confirmation of the tests and inspections carried out and the result of this examination of the work.
- .3 If the inspection reveals defects in the work, correct as soon as possible and repeat the entire inspection procedure. Repeat until the work passes the inspection.
- .4 Document the results of the inspection by the equipment manufacturer's representative.
- .5 Ensure the installation meets all manufacturer's requirements for durable and trouble-free operation.

**3.7 FIELD INSPECTION**

- .1 Final inspection will be made by the Engineer only after the equipment manufacturer's technical representative has advised that equipment installation is in order and the Contractor has advised in writing that the system can be operated.

- .2 The Engineer will request that the equipment be operated to demonstrate that it will perform as specified. The Engineer will note deficiencies, and if possible, the deficiency will be corrected immediately by the Contractor. All deficiencies that cannot be corrected at the time of inspection will be noted by the Engineer who will advise the Contractor of these deficiencies in writing. Correct the deficiencies as soon as possible and advise the Engineer of their correction. Should the deficiencies be of a sufficiently serious nature to require the work to be re-inspected, the cost of the inspection will be borne by the Contractor.

**3.8 OPERATOR TRAINING**

- .1 Supplier shall provide the services of a skilled technical representative for a minimum period of one half (1/2) day at the site to instruct plant personnel in the operation and service of the equipment.

**END OF SECTION**

**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Provide controls for mechanical systems capable of performing the functions specified.

**2. PRODUCTS**

**2.1 ROOFTOP UNIT CONTROLS**

- .1 Provide the necessary components to connect supplied controls with equipment where such controls are specified.
- .2 Provide room thermostats with celsius scale, single temperature, auto-heat/cool changeover, gradual-acting adjustable sensitivity compatible with the supplied zone-control system and able to operate in a fan-only mode for constant ventilation as defined by the occupied mode interlocks.
- .3 Provide necessary interlocks to operate equipment in conjunction with exhaust fans as identified in equipment schedule.
- .4 Rooftop Unit 1 (RTU-1) is to be supplied with a Carrier Zone Control system complete with the main main controller, any additional add-on panels required, supply duct temperature and pressure sensors, zone thermostats, dampers, and actuators, bypass damper and actuator, and any other required components for a complete zone control system in accordance with the information included on the drawings.

**2.1 MAKE-UP AIR UNIT CONTROLS**

- .1 Unit to be complete with necessary controls to allow for temperature setpoint adjustment from remote control panel, two-stage operation with control by gas detectors and interlock with exhaust fans for each stage.

**2.2 RADIANT HEATER THERMOSTATS**

- .1 Provide programmable thermostats for nighttime setback with Celsius scale, single temperature, gradual-acting, adjustable sensitivity. Provide covers with exposed set point adjustment, set point indication and with thermometer.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats 1.5 m above floor.

**END OF SECTION**

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**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Conform to requirements of CSA, Provincial and Municipal Codes and be CSA listed.

**1.2 DRAWINGS AND DESIGN**

- .1 The drawings are intended to show the major details of the mechanical work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Owner's Representative any discrepancies or interferences which may occur.

**1.3 OPERATION & MAINTENANCE DATA**

- .1 Provide operating & maintenance data for incorporation into manual specified in Section 01790 – Operation and Maintenance Manual.

**2. PRODUCTS**

**2.1 TYPE**

- .1 Provide natural gas-fired, fan-type, separated combustion, power-vented unit heater.
- .2 Unit heater to be supplied with factory installed orifices for high altitude surface and field installed vertical inlet air/vent terminal kit.

**2.2 APPROVED PRODUCT**

- .1 Reznor Model UDAS or acceptable alternate.

**2.3 CONSTRUCTION**

- .1 Cabinet: Heavy gauge galvanized steel c/w hinged access door and individually adjustable louvers.
- .2 Heat Exchanger: tubular, aluminized steel construction.
- .3 Burner Rack: aluminized steel construction.
- .4 Burners: inshot design.
- .5 Fan: Propeller type c/w fan guard - driven by 120 VAC motor c/w internal overload protection.

**2.4           REQUIRED CONTROLS**

- .1     Direct spark ignition with 100% shutoff.
- .2     Single-stage combination gas valve.
- .3     High temperature limit control.
- .4     Combustion air pressure switch to verify flow.
- .5     24 V control voltage transformer.
- .6     24 V thermostat.

**3.            EXECUTION**

**3.1          INSTALLATION**

- .1     Installation to be performed in accordance with manufacturer's instructions and with Natural Gas Installation Code.
- .2     Unit heaters to be suspended by (4) threaded rods.

**3.2          PERFORMANCE**

- .1     Refer to mechanical drawing schedules for performance requirements.

**END OF SECTION**

**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Conform to Provincial and Municipal Codes and be CSA listed.

**2. PRODUCTS**

**2.1 TYPE**

- .1 Provide a complete gas fired tubular radiant heating system with a power burner housed in a burner control box firing into a 4" diameter combustion chamber tube, vacuum exhauster, radiant tube controls, reflector & mounting brackets.

**2.2 CONSTRUCTION**

- .1 Radiant Tubes: 16 gauge HRS, compression coupling tube connections.
- .2 Combustion Chamber: 16 gauge aluminized steel.
- .3 Reflector: Highly polished, non-tarnishing type.

**2.3 BURNER**

- .1 Gas Burner: Forced draft type with adjustable combustion air supply, equipped with single stage combination gas valve, and sight glass for burner observation.

**2.4 BURNER OPERATING CONTROLS**

- .1 Low voltage, adjustable room thermostat to maintain room temperature setting.
- .2 24 V transformer, a multi-try direct spark ignition with 100 % lockout, differential air pressure switch to measure combustion air, diagnostic indicator light, pre & post purge firing, and terminal board for connection of remote thermostat.

**2.5 VACUUM EXHAUSTER**

- .1 Dynamically balanced forward inclined fan wheel constructed of stainless steel with a cast iron hub.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Suspend from structure at spacing & clearances from combustibles as per manufacturer's recommendations.

- .2 Suspension system as well as gas and electrical connections shall allow for horizontal deflection due to expansion & contraction.

**3.2 PERFORMANCE**

- .1 Refer to mechanical drawing schedules for radiant heater performance requirements. (Gas input capacities are sea level ratings.)

**END OF SECTION**

**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Comply with local and Provincial Regulations and have CSA approval.
- .2 Factory tested to check construction, controls and operation of unit and provide certification.
- .3 Operationally tested after installation.
- .4 Provide a complete and operational paint booth which is compliant all local and province codes. Coordinate all installation components for startup and commissioning of operational system.

**1.2 REFERENCE DOCUMENTS**

- .1 National Research Council of Canada (NRC):
  - .1 MNECB 1997, Model National Energy Code for Buildings

**2. PRODUCTS**

**2.1 GENERAL CONSTRUCTION**

- .1 Construct heater casing and components of 1.3 mm steel panels, reinforced with structural angles and channels to ensure rigidity under normal handling. Provide access panels to burner and blower motor assemblies from either side of unit.
- .2 Locate observation port on burner section for observing main and pilot flames.
- .3 Insulate inlet components to burner profile plate with 25 mm neoprene faced fibrous glass insulation.
- .4 Finish casing and components with heat resistant baked enamel.
- .5 For suspended installations, provide service platforms complete with handrails and access ladder.
- .6 For outdoor installation, provide weatherproofed casing with intake louver or hood.

**2.2 FILTERS**

- .1 Provide filter section complete with removable 50 mm thick high velocity permanent filters in metal frames.



**2.3 BURNER**

- .1 Provide raw gas burner suitable for natural gas and capable of modulating turn down ratio of 25:1. Burner assembly and gas piping arrangement to include electric modulating main gas valve, motorized shutdown valve, main and pilot gas regulators, pilot electric gas valve, manual shut-off valve, and pilot adjustment valve.
- .2 Furnish gas burner with electrically ignited supervised pilot. Pilot automatically ignited by spark rod through high voltage ignition transformer.
- .3 Provide motorized damper complete with end switch to prove position before burner will fire.

**2.4 FAN**

- .1 Provide statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning pre-lubricated ball bearings and V-belt drive with matching motor sheaves and belts.

**2.5 CONTROLS**

- .1 Pre-wire unit completely so connection of power supply and field wiring from unit to remote control panel shall make unit operative.
- .2 Remote control panel shall contain on-off, auto switch, supply temperature setpoint control potentiometer, summer-winter switch, room temperature override, indicating lights for supply fan and exhaust fan, pilot operation, burner operation, clogged filter indication and lockout indication.
- .3 Interlock unit to start when exhaust fan is running. Interlock burner to operate when flow switch located in exhaust duct proves flow.
- .4 Fan discharge thermostat shall control modulating gas valve to maintain supply air temperature. Provide room thermostat to reset discharge thermostat minimum of three temperature levels.
- .5 Provide time clock to operate fan system off at night.
- .6 Interlock with CO monitoring system to operate fan on high volume when pre-determined CO concentration detected.
- .7 Provide safety controls to provide correct air flow before energizing pilot and to sense pilot ignition before activating main gas valve.
- .8 Provide manual reset low and high limit controls to maintain supply air temperature between set points and shut fan down if temperatures are exceeded.

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- .9 Provide purge period timer to delay burner ignition and automatically bypass low limit control.

**3. EXECUTION**

**3.1 PERFORMANCE**

- .1 Refer to mechanical drawing schedules for performance requirements.

**END OF SECTION**

**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Meet the requirements of CSA, Provincial and Municipal Codes and be CSA listed.
- .2 Units shall be products of manufacturers who provide local service personnel from factory representative, franchised dealer or certified maintenance service shop.

**1.2 SHOP DRAWINGS**

- .1 Comply with requirements of Section 15010.

**2. PRODUCTS**

**2.1 TYPE**

- .1 Provide roof mounted type units with gas burner and electric refrigeration.
- .2 Units shall be self-contained, packaged, factory assembled and prewired consisting of a cabinet and frame, supply fan, heat exchanger and burner, control, air filter, refrigerant cooling coil, and compressor, condenser coil and fan.

**2.2 CONSTRUCTION**

- .1 Cabinet: Heavy gauge steel with baked enamel finish, easily removed access doors or panels with quick fastener. Structural members shall be minimum 1.3 mm, with removable panels minimum 1.0 mm.
- .2 Insulation: Neoprene coated glass fiber on surfaces where conditioned air is handled. Protect edges from erosion.
- .3 Heat Exchangers: Aluminized steel of welded construction.
- .4 Supply Fan: Centrifugal type rubber mounted V-belt or direct drive. Complete fan assembly shall be isolated.
- .5 Air Filters: 50 mm thick glass fiber disposable media in metal frames arranged for easy replacement.

**2.3 BURNER**

- .1 Gas Burner: Forced or induced draft or atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device and automatic 100% shut-off.

- .2 Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven. Stop gas flow on ignition failure. Energize blower motor. After air flow proven and slight delay, gas valve is allowed to open.
- .3 High Limit Control: With fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature and energized burner when temperature drops to lower safe value.
- .4 Control supply fan in accordance with bonnet temperatures and independent of burner controls. Include switch for continuous fan operation.

**2.4 EVAPORATOR COIL**

- .1 Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection, capillary tubes and expansion valve.

**2.5 COMPRESSOR**

- .1 Provide hermetic or semi-hermetic compressor, 3600 r/min maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, service valves and filter drier.
- .2 Timed off-circuit shall limit number of compressor starts to 12 per hour.

**2.6 CONDENSER**

- .1 Provide copper tube aluminum fin coil assembly with sub-cooling rows.
- .2 Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- .3 Provide refrigerant pressure switch to cycle condenser fans.

**2.7 SUPPLY/RETURN CASING**

- .1 Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fall to closed position. Relief dampers may be gravity balanced.
- .2 Provide tight fitting dampers with neoprene or suitable edge gaskets.
- .3 Damper Operator: 24 V, spring return.
- .4 Mixed Air Controls: Maintain selected mixed air temperature, lock out compressor below approximately 14 °C ambient, return dampers to minimum position above approximately 14 °C ambient.

**2.8 OPERATING CONTROLS**

- .1 To the requirements of Section 15510 – Control Systems.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install units in strict accordance with manufacturer’s recommendations and all applicable code requirements.
- .2 Mount units on curbs to provide watertight enclosure to protect ductwork.

**3.2 PERFORMANCE**

- .1 Refer to drawing schedules.

**END OF SECTION**

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**1. GENERAL**

1.1 Not applicable.

**2. PRODUCTS**

**2.1 MECHANICAL ASSEMBLY**

- .1 Self-contained, recessed, factory-assembled unit complete with heating elements, fan, driving motor, casing with inlet and outlet grilles and terminals for line wire connections.
- .2 Stainless steel tubular heating element.
- .3 Centrifugal type direct drive fan, statically and dynamically balanced.
- .4 Standard built-in thermostat control.
- .5 Specified Product: Ouelette model OAC02008 or approved equal.
- .6 Unit shall have CSA or ULC approval.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Wall mounted in accordance with manufacturers recommendations. Mounting location shall not interfere with process equipment or operation.

**END OF SECTION**

**1. GENERAL**

**1.1 ALTERNATIVES**

- .1 Size round ducts installed in place of rectangular ducts indicated from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

**1.2 DEFINITIONS**

- .1 Low Pressure: Static pressure in duct less than 0.5 kPa and velocities less than 10 m/s.
- .2 Medium Pressure: Static pressure in duct less than 1.5 kPa and velocities greater than 10 m/s.
- .3 Duct Sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

**1.3 SUBMITTALS**

- .1 Submit shop drawings and samples of duct fittings for approval, including particulars such as thicknesses, welds and configurations prior to start of work.
- .2 Submit shop drawings for fibrous glass ducts including manufacturer's fabrication and installation manual.
- .3 Submit written inspection report of manufacturer's acceptance of fabrication and installation of fibrous glass ductwork. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards. Inspection shall occur at beginning of installation.

**1.4 QUALITY ASSURANCE**

- .1 Ductwork shall meet the requirements of NFPA 90A-1996, Air Conditioning and Ventilating Systems.
- .2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Ducts: Galvanized steel lock forming quality, having galvanized coating to ASTM A653M-96, G90 designation for both sides.
- .2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

- .3 Sealant: Water resistant, fire resistive, compatible with mating materials.
- .4 Flexible Ducts: Corrugated aluminum or fabric supported by helically wound steel wire or flat steel strips.

## 2.2 FABRICATION

- .1 Complete metal ducts with themselves with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.
- .2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
- .3 Construct tees, bends, and elbows with radius of not less than 1 1/2 times width of duct on centre line. Where not possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fiberglass inside.
- .4 Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degree and 45 degree convergence downstream.
- .5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.
- .6 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.
- .7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than  $\pm 15^{\circ}\text{C}$  under all operating conditions.
- .8 Fabricate continuously welded medium pressure round and oval duct fittings of one gauge heavier than gauges indicated for duct size. Joints shall be 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard  $45^{\circ}$  take-offs unless otherwise indicated where conical  $90^{\circ}$  tee take-off connections may be used. Adequately brace with truss couplings or comparison angle flanges with asbestos gaskets bolted at 150 mm centers.
- .9 Fabricate plenums and casings to configurations shown on drawings. Construct plenums of galvanized panels joined standing seams on outside of casing riveted or bolted on approximately 300 mm centers. Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.
- .10 Reinforce door frames with angle iron tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.



- .11 Fabricate acoustic plenums of galvanized steel. Provide 1.6 mm back facing and 0.8 mm perforated front facing with 3 mm diameter holes on 4 mm centers. Construct panels 75 mm thick packed with 72 kg/m<sup>3</sup> minimum fibrous glass media, on inverted channels of 1.6 mm.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pivot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- .2 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.
- .3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .4 Set plenum doors 150 mm to 300 mm above floor. Arrange door swings so that fan static holds door in closed position.
- .5 Connect terminal units to medium pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.
- .6 Connect diffusers to low pressure ducts with 1.5 m maximum length of flexible duct. Hold in place with caulking compound and strap or clamp.

**3.2 LOW PRESSURE DUCT THICKNESSES (MINIMUM)**

.1	Rectangular Ducts	
	Maximum Width	mm
	Up to 300 mm	0.6
	330 mm to 760 mm	0.8
.2	Round Ducts	
	Duct Diameter	mm
	Up to 330 mm	0.6
	350 mm to 550 mm	0.8

**3.3 MEDIUM PRESSURE DUCT THICKNESS**

.1	Rectangular Ductwork Maximum	mm
	Up to 460 mm	0.8
	480 mm to 1220 mm	0.8

**3.4 MEDIUM & HIGH PRESSURE DUCT THICKNESSES**

		Spiral Lock Seam mm	Longitudinal Seam mm
.1	Round Ducts		
	Up to 200 mm	0.6	0.8
	230 to 560 mm	0.8	0.8
	580 to 910 mm	0.8	1.0

**3.5 OVAL DUCTWORK (FACTORY MADE WITH SPIRAL LOCK SEAMS)**

	Maximum Width	mm	Centers	Reinforcement
.1	Up to 500 mm	0.8		none
	280 to 500 mm	0.8	1220 mm	L50 x 50 x 3 mm
	530 to 1020 mm	1.2	760 mm	L50 x 50 x 5 mm

**3.6 PLENUM GAUGES**

- .1 Fabricate fan plenums and plenums downstream of fan in accordance with duct gauges.
- .2 Fabricate plenums upstream of fan between apparatus of 1.6 mm.
- .3 Fabricate plenums upstream of filters of 1.2 mm

**END OF SECTION**

**1. GENERAL**

**1.1 SUBMITTALS**

- .1 Submit shop drawings for Engineer review.

**1.2 QUALITY ASSURANCE**

- .1 Fire dampers shall be UL listed and constructed in accordance with CAN/ULC-S112-1990, Fire Test of Fire Damper Assemblies.
- .2 Fusible links on fire dampers shall be constructed to ULC S505-1974.
- .3 Demonstrate resetting of fire dampers to authorities having jurisdiction.
- .4 Access doors shall be UL labelled.
- .5 Accessories shall meet the requirements of NFPA 90A-1996, Installation of Air Conditioning and Ventilating Systems.
- .6 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

**2. PRODUCTS**

**2.1 ACCESS DOORS**

- .1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Install minimum 25 mm thick insulation with suitable sheet metal cover frame for insulated ductwork.
- .2 Fabricate with two butt hinges and two sash locks for sizes up to 450 mm, two hinges and two compression latches with outside and inside handles for sizes up to 600 x 1200 mm .

**2.2 FIRE DAMPERS**

- .1 Fabricate of galvanized steel or prime coated black steel weighted to close and lock in closed position when released by fusible link.
- .2 Fire dampers in low pressure ductwork may be multi-blade, offset butterfly or curtain type.
- .3 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.
- .4 Fire dampers in medium and high pressure ductwork shall be curtain type.

- .5 Curtain type fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.
- .6 Fusible links shall be set for 72°C.

**2.3 BALANCING DAMPERS**

- .1 Fabricate of galvanized steel, minimum 1.6 mm, and provide with quadrants or adjustment rod and lock screw.
- .2 Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration. Size on basis of straight air volume proportioning.
- .3 Construct damper blades for medium pressure systems to block air passage 70% maximum. Provide complete with locking type handles.

**2.4 FLEXIBLE CONNECTIONS**

- .1 Fabricate of approved neoprene coated flameproof fabric approximately 50 mm wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 150 mm intervals.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.
- .2 Provide 100 x 100 mm quick opening access doors for inspection at balancing dampers.
- .3 Provide fire dampers at locations indicated on drawings. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.
- .4 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.
- .5 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

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- .6 Install ducts associated with fans and equipment subject to forced vibration with flexible connections, immediately adjacent to equipment and where indicated on the drawings.
- .7 For connections to medium and high pressure fans, install 12 mm thick neoprene pad over fabric and hold in place with additional metal straps.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 General Mechanical Starting and Testing Requirements: Section 15951.

**1.2 PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Division 1.
- .2 Substitute products shall not decrease motor wattage, decrease efficiency, increase noise level, increase tip speed by more than 10%, or increase inlet air velocity by more than 20%, from that specified.

**1.3 SUBMITTALS**

- .1 Submit with shop drawings acoustical data and fan curves showing fan performance with fan and system operating point plotted on curves.

**2. PRODUCTS**

**2.1 GENERAL**

- .1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.
- .2 Provide balanced variable sheaves for motors 10 kW and under and fixed sheave to 15 kW and over.
- .3 Fans shall be capable of accommodating static pressure variations of  $\pm 10\%$  with no objectionable operating characteristics.
- .4 Coordinate discharge louver sites for all sidewall fans.
- .5 Coordinate damper size requirements for all exhaust fans. Continuous service fans to come with gravity dampers.

**2.2 CENTRIFUGAL FANS**

- .1 Fabricate with multi-blade wheels in heavy gauge steel housing reinforced for service encountered.
- .2 Provide V-belt drives with fan and motor mounted on reinforced, rigid steel base with adjustable motor mount.
- .3 Provide heavy duty, self-aligning, anti-friction bearings with external lubrication.
- .4 Provide where indicated variable inlet vanes.

- .5 Provide access door and drain connection to scroll.
- .6 Except for packaged air units, belted vent sets and as otherwise noted, centrifugal fans over 430 mm diameter shall have die formed air foil blades welded to side and back plate.

### **2.3 PROPELLER FAN**

- .1 Directly connect steel or aluminum blade fans with heavy hubs to motor.
- .2 Motor shall have self-aligning ball or sleeve bearings with adequate lubricating arrangements.
- .3 Mountings shall be cast or die formed to smooth curves. Supply size to fit openings provided.
- .4 Provide safety screens in inlet.
- .5 Use neoprene vibration isolation between fan assembly and mounting plate.

### **2.4 ROOF MOUNTED FANS**

- .1 Provide V-belt drives with fan and motor mounted to main housing through neoprene anti-vibration pads.
- .2 Heavy aluminum dome type housings shall be reinforced as necessary on sizes with 500 mm wheel and larger.
- .3 Provide with multi-blade, rattle free, motorized damper with felt lined blade edges, birdscreen, disconnect switch and curb caps.

### **2.5 CEILING CIRCULATION FANS**

- .1 Provide ceiling mounted circulation fans. Fan shall be the models scheduled with the capacities indicated.
- .2 The fan shall be equipped with 3, painted steel blades. The blades shall be connected by means of 2 locking bolts per blade.
- .3 The fan motor shall be direct drive, variable speed and shall operate at 120V and 60 Hz. Fan motor shall be reversible to provide winter destratification and summer time ventilation.

**3. EXECUTION**

**3.1 PERFORMANCE**

- .1 Fan performance based on sea level conditions.
- .2 Refer to Fan Schedule.

**3.2 INSTALLATION**

- .1 Where inlet or outlet is exposed, provide safety screen.
- .2 Provide belt guards on belt driven fans.
- .3 Supply and install sheaves as necessary for final air balancing.

**3.3 PRIMING**

- .1 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

**3.4 STARTING AND TESTING**

- .1 Start and test fans as specified in Section 15951.

**END OF SECTION**



**1. GENERAL**

**1.1 QUALITY ASSURANCE**

- .1 Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes and ASHRAE standards.
- .2 Unit ratings shall be approved by ADC.
- .3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

**2. PRODUCTS**

**2.1 GENERAL**

- .1 Base air outlet application on space noise level of NC 35 maximum.
- .2 Provide supply outlets with sponge rubber seal around the edge.
- .3 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

**2.2 LOUVERED SUPPLY GRILLES**

- .1 Ceiling supply grilles shall have streamlined and individually adjustable curved blades to discharge air along face of grille. Units shall have two-way deflection.
- .2 Provide 32 mm margin frame with countersunk screw holes.
- .3 Fabricate of heavy aluminum extrusions.
- .4 Provide grilles with integral, gang-operated opposed blade dampers with removable key operator, operable from face.
- .5 Finish in factory baked enamel finish.

**2.3 RETURN AND EXHAUST GRILLES**

- .1 Sidewall and ceiling exhaust grilles shall have streamlined blades, depth of which exceeds 20 mm spacing. Provide spring tension or other device to set blades. Provide units with horizontal face.
- .2 Provide 32 mm margin frame with countersunk screw holes].
- .3 Fabricate of steel with 1.0 mm minimum frames and 0.8 mm minimum blades, steel and aluminum with 1.0 mm minimum frame, or heavy aluminum extrusions.

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- .4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed blade dampers with removable key operator, operable from face.
- .5 Finish in factory baked enamel finish.

**2.4 GRID CORE RETURN AND EXHAUST GRILLE**

- .1 Fabricate fixed grilles of 12 x 12 x 12 mm louvres.
- .2 Provide lay-in frame for suspended grid ceilings.
- .3 Fabricate of aluminum.
- .4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed bladedampers with removable key operator, operable from face.

**2.5 DOOR GRILLES**

- .1 Fabricate of V-shaped louvers of 1.0 mm steel, 25 mm deep on 12 mm centers.
- .2 Provide 1.0 mm steel frame with auxiliary frame to give finished appearance on both sides of door.
- .3 Factory finish in prime coating.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Positions indicated on drawings are approximate only. Check location of outlets and make necessary adjustments in position to conform to architectural features, symmetry and lighting arrangement.

**3.2 SIZING**

- .1 Size air outlets as indicated on drawings.

**END OF SECTION**

**1. GENERAL**

**1.1 SUBMITTALS**

- .1 Submit louver and damper product data and shop drawings.
- .2 Submit damper actuator product data shop drawings.

**2. PRODUCTS**

**2.1 FIXED LOUVERS**

- .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.
- .4 Frame, head, sill, and jamb: 100 - 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at maximum 1500 mm centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvre in formed U-frame.
- .8 Finish: factory applied enamel, prime coated. Colour to match building trim.
- .9 Specified Product: Ventex 2590.

**2.2 DAMPERS – ACTUATED**

- .1 Material: extruded aluminum (6063T5) damper frame is not less than 2.03 mm in thickness.
- .2 Blades: extruded aluminum, internally insulated with expanded polyurethane foam and thermally broken
- .3 Blade seals are extruded EPDM. Frame seals are extruded silicone. Seals are secured in an integral slot within the aluminum extrusions.

- .4 Linkage: installed in frame side and constructed of aluminum and corrosion resistant, zinc plated steel.
- .5 Specified product: Tamco 9000 Series Dampers or equal.
- .6 Actuator: Belimo AF-120. No Alternatives.

**2.3 FIRE DAMPERS**

- .1 Frame: 108mm wide, 22gage roll formed G-60 galvanized steel.
- .2 Blades: Curtain type interlocking blades, 22 gage roll-formed G-60 galvanized steel.
- .3 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.
- .4 Fire dampers in medium and high pressure ductwork shall be curtain type.
- .5 Specified Product: Nailor Model 0120V.
  - .1 Fusible link: 74°C standard.
  - .2 Spring: Stainless Steel.

**2.4 DAMPERS - GRAVITY**

- .1 Damper: galvanized steel frame, roll formed aluminum blades c/w felt seals on the closing edge, full length zinc plated axles mounted in acetal bushings
- .2 Specified Product: Greenheck WD-400 series c/w all required accessories.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Supply and install louvers and dampers to the sizes indicated on the design drawings, frame thickness appropriate to the wall in which it is installed.
- .2 Install in accordance with manufacturers instructions.
- .3 Fire dampers of 22 gauge galvanized steel integral sleeve shall be of the same gauge or heavier as the duct to which is attached. Gauges shall conform to SMACNA or ASHRAE duct standards.

**3.2            OPERATION**

- .1        Install dampers as required to operate in accordance with Section 15830 and division 13.
- .2        Verify fail position of damper
- .3        All moving parts of the fire dampers must be inspected and cycled at intervals not greater than every six months and in accordance with the latest edition of NFPA.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 Contractor Start-Up Report Forms: Division 1.
- .2 Balancing and Adjusting of Mechanical Equipment and Systems: Section 15954.

**1.2 OWNER'S WITNESSING OF TESTS**

- .1 Owner may witness selected starting, testing, adjusting, balancing and cleaning procedures.
- .2 Advise the Owner in advance that starting, testing, adjusting, balancing or cleaning processes are ready to commence. Provide advanced notice prior to commencement of each procedure or series of procedures to allow Owner to arrange for witnessing of tests.

**1.3 STARTING AND TESTING COSTS**

- .1 Pay costs associated with starting, testing, adjusting, balancing and cleaning, including supply of instruments, equipment, supplies, and consumable materials.

**1.4 START-UP REPORTS**

- .3 Submit Start-Up reports as part of Operation and Maintenance Manual specified in Section 15021.

**1.5 REPORTS**

- .1 Submit Contractor Start-Up Report forms in accordance with Section 01335 documenting starting and testing procedures performed, and observed tests results obtained.

**1.6 QUALITY ASSURANCE**

- .1 Use personnel for starting, testing, adjusting and balancing procedures who have experience in mechanical equipment and systems commissioning, and are able to interpret results of readings and tests and report state of systems in a clear and concise manner.

**1.7 MANUFACTURER'S RECOMMENDATIONS**

- .1 Prior to starting equipment or systems, obtain and review manufacturer's installation, starting and operating instructions. Read in conjunction with procedures specified herein.
- .2 Use manufacturer's and supplier's trained personnel where necessary to maintain validity of manufacturer's warranty.
- .3 Compare actual installation with manufacturer's recommended installation. Record discrepancies. Correct deviations detrimental to equipment performance prior to starting equipment.

**1.8 REGULATORY REQUIREMENTS**

- .1 To facilitate expedient turnover of facility at Interim Acceptance of the Work, arrange for regulatory authorities to witness those specified starting procedures that duplicate tests required by regulatory authorities.
- .2 Obtain certificates of approval and for compliance with regulations from authorities having jurisdiction. Include copies of certificates with start-up reports.

**2. PRODUCTS**

**2.1 TESTING INSTRUMENTS AND EQUIPMENT**

- .1 Provide testing instruments and equipment and ancillary equipment such as two-way radios and ladders required to perform starting, testing, adjusting and balancing of mechanical equipment and systems.
- .2 Use instruments supplied or calibrated by approved laboratory or manufacturer.
- .3 Recalibrate instruments at frequency recommended by instrument manufacturer or, in absence of manufacturer's recommendations, as required by Associated Air Balance Council (AABC).
- .4 Use testing instruments and equipment which meet following accuracy requirements:

Device	Range	Accuracy
Air Temperature	-40 to 75°C	±0.10°C
Hydronic temperature	-40 to 120°C	±0.10°C
Stack Temperature	-40 to 300°C	±1.00°C
Air Velocity Pressure	0 to 250 Pa	±2% of reading
Air Pressure	0 to 2500 Pa	±12.5 Pa
Hydraulic Pressure	0 to 1400 KPa	±2% of gauge
Air Velocity	0.1 to 20 m/s	±2% of gauge
Sound Meter	35 to 130 dB	ANSI S 1.4 Type 2
Octave Band Filters	63 to 8000 Hz	ANSI S 1.11
		Class II
Humidity	10 to 90% RH	±3.0%

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.6 Following testing instruments and equipment makes and models are also acceptable:

Equipment	Make	Model
Sound Level Meter	Quest	2700
Octave Band Filters	Quest	OB-50
Flue Gas Analyzer	Kane May	KM 9002
Stack Thermometer	Bacharach	12-7018
Tachometer (contact)	Ono-Sokki	HT-331
Tachometer (strobe)	Ono-Sokki	HT 441
Belt Tension Tester	Woods	
Inclined Manometer	Dwyer	400-10
Air Pressure Gauge	Magnahelic	
	-125 to 125 Pa	2300-250 Pa
	0 to 250 Pa	2000-250 Pa
	0 to 1000 Pa	2000-1 KPa
Fluid Pressure Gauge	Marsh	0 to 60 psi
	Marsh	0 to 160 psi
	Marsh	30"Hg - 60 psi
Thermometer	Palmer	MS-13
Digital Thermometer	Fluke Multi-meter	8062A with 80T-150 surface probe 80PK-5 piercing
Digital Anemometer	ITM Instruments	DA 4000
Micromanometer	Shortridge	8420
Flow Hood	Shortridge	8400 with 8420 meter
Air Quality Monitor	Armstrong	AMC-1013P

**3. EXECUTION**

**3.1 USE OF INSTRUMENTS SUPPLIED UNDER CONTRACT**

- .1 Use "Calibrated Air Flow Measuring Stations" to measure air flow during system balancing and coil performance testing.
- .2 Use balancing valve pressure tappings, orifice plates, pitot tube fittings, etc. to measure fluid flow rates.
- .3 Calibrated temperature, humidity and pressure sensors may be used to gather Contractor Start-up Program system performance data provided, confirms that sensor calibrations have been completed and approved.



**3.2 INSPECTION**

- .1 Do not conceal or cover equipment or systems until inspected, tested and approved by Owner.

**3.3 COMPLIANCE WITH DEFINED PROCEDURES**

- .1 Failure to follow specified instructions pertaining to correct starting procedures may result in re-evaluation of equipment by independent testing agency selected by the Owner at Contractor's expense. Should results reveal equipment has not been started in accordance with specified requirements, equipment may be rejected. If rejected, remove equipment from site and replace. Replacement equipment will also be subject to full starting procedures, using same procedures specified for originally installed equipment.

**3.4 CHECK SHEETS, FIELD REPORTS AND DATA**

- .1 Record all data gathered on site on start-up report forms.
- .2 Make copies of all starting and testing data before equipment and system start-up personnel leave site. Maintain one copy of all data taken during starting on site.
- .3 Maintain one copy of all final starting, testing, adjusting and balancing reports on site up for reference purposes.

**3.5 COORDINATION**

- .1 Prior to commencement of each particular testing procedure, coordinate all sub-trades, manufacturers, suppliers and other specialties to ensure all phases of work are properly completed. Establish necessary manpower requirements.

**3.6 STARTING AND TESTING PHASES**

- .1 Starting and testing program generally consists of following five distinct phases:
  - .1 Pre-Starting: visual inspection
  - .2 Starting: actual starting procedure.
  - .3 Post-Starting: operational testing, adjusting or balancing and equipment run-in phase.
  - .4 Pre-Interim Acceptance of the Work: final cleaning, re-testing, balancing and adjusting and maintenance.
  - .5 Post-Interim Acceptance of the Work: retesting and fine-tuning of system to prove all deficiencies have been corrected.
- .2 After each distinct phase of work has been completed, correct deficiencies before commencing the next phase.

**3.7 SPECIALTY AGENCIES AND TESTING LABORATORIES**

- .1 Arrange for reports prepared by special testing agencies and testing laboratories to be submitted directly to the Owner. Include a copy of each report in Contractor Start-Up Program report.
- .2 Agencies and testing laboratories shall have facilities and qualifications acceptable to the Owner.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Inspect, start and test each piece of mechanical equipment. Verify that equipment has been properly installed and is operating at a level which meets specified requirements.

**1.2 RELATED SECTIONS**

- .1 Contractor Start-Up Report Forms: Division 1.
- .2 Mechanical General Requirements: Section 15015.
- .3 Operation and Maintenance Manual: Section 15021.
- .4 General Mechanical Starting and Testing Requirements: Section 15951.
- .5 Balancing and Adjusting of Mechanical Equipment and Systems: Section 15954.

**1.3 FACTORY TRAINED REPRESENTATIVES**

- .1 Use factory trained representatives and submit manufacturer's check sheets for starting following specialty equipment:
  - .1 Air handling unit.
  - .2 Boilers.
  - .3 Control components.
  - .4 Chemical cleaning and treatment.
  - .5 Air cooled condensing unit.
  - .6 Solar system.
- .2 Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.

**2. PRODUCTS**

Not Used

**3. EXECUTION**

**3.1 FUEL FIRED EQUIPMENT - BOILERS**

- .1 Pre-Starting:
  - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.

- .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
  - .1 Boiler is level
  - .2 Flue and chimney installed without visible damage.
  - .3 No visible damage to boiler jacket.
  - .4 Check PRVs for correct operation and specified relief pressure. Adjust as required.
  - .5 Clearances have been provided and piping is flanged for easy removal and servicing.
  - .6 Heating circuit pipes have been connected to correct ports.
  - .7 Labels are clearly visible.
  - .8 Boiler, burner and flue completely clean and free of construction debris.
  - .9 Pressure and temperature gauges installed.
  - .10 Controls completed.
- .3 Ensure pumps are operational.
- .4 Check for proper operation of pressure reducing valve on gas train, including venting.
- .5 Ensure boiler fluid level, flow switch and high temperature interlocks are in place.
- .6 Obtain following from manufacturer and submit as specified in Section 15010:
  - .1 All equipment performance selection tables.
  - .2 Manufacturer's equipment start-up sheets.
- .2 Starting:
  - .1 Start pumps.
  - .2 Perform starting of boilers and adjustment of burners using manufacturer's factory trained personnel.
  - .3 Fill out start-up sheets and attach copy with Contractor Start-Up Report.
  - .4 Check and record performance of all factory provided boiler protection devices, and firing sequences.
  - .5 Check and record performance of boiler fluid level, flow switch and high temperature interlocks.
  - .6 Run-in as recommended or required by manufacturer.

- .3 Post Starting:
  - .1 Perform following tests for each firing rate for high/low burners and for 100%, 66%, and 33% load for modulating burners. Adjust boiler combustion efficiency (%) at each firing rate to that specified or advertised by manufacturer, if latter is higher.
    - .1 Measure gas pressure on manifold.
    - .2 Measure combustion air temperature at inlet to burner.
    - .3 Measure flue gas temperature at boiler discharge.
    - .4 Perform flue gas analysis. Measure and record flue gas CO<sup>2</sup> and O<sup>2</sup> concentration.
    - .5 Measure natural flue draft.
  - .2 Measure water flow rate, pressure drops, and temperature rise through each boiler.
  - .3 Inspect expansion tank, make-up water meter, tank pressure, PRV, water level and backflow preventer.

### 3.2 FLUID HANDLING EQUIPMENT - PUMPS

- .1 Pre-Starting:
  - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.
  - .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
    - .1 Pump is level.
    - .2 Isolation valves, strainers, check valve, pressure gauges, by-pass filter and flow meter are installed properly.
    - .3 Pump suction has sufficient length of straight run piping.
    - .4 Air has been completely bled off piping system.
    - .5 Expansion tank is charged and on-line.
    - .6 Strainers have clean screens in place.
    - .7 Where specified for large pumps, check pump base vibration isolation and flexible connections on water pipes are properly installed.
    - .8 Nameplate is readily visible.
    - .9 Check clearance space is adequate for pump servicing and removal.
- .2 Starting:
  - .1 Start as recommended by manufacturer.
  - .2 Fill out start-up sheets and attach copy with Contractor Start-Up Report.
  - .3 Check impeller is rotating in correct direction.

- .3 Post Starting:
  - .1 Run-in pumps for minimum 12 continuous hours.
  - .2 Ensure flows through parallel pumps are equally balanced.
  - .3 Ensure mechanical seals do not leak, or packing gland type seals are wetted.
  - .4 Check pump NPSH - net positive suction head.
  - .5 Where vibration isolation is specified, check for correct static deflection of unit vibration isolators, and that start up and shut down deflection is within resilience limits of isolators and flexible connections.
  - .6 Verify that motor has sufficient air flow through casing to provide cooling.

### 3.3 FLUID HANDLING EQUIPMENT - COILS

- .1 Pre-Starting:
  - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.
  - .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
    - .1 Pipe connections have been correctly made for counter current heat exchange between air and fluid.
    - .2 Clearances have been provided and piping is flanged for easy removal and servicing.
    - .3 Coil air vent and drain valve and deadleg drain valves have been provided.
    - .4 Coil is sloped to ensure complete drain down.
    - .5 Pressure and temperature tappings, Pete's plugs, have been provided.
    - .6 Fins inspected and combed straight as required.
    - .7 Cooling coil drain pan and trapped drain line installed correctly.
    - .8 Labels are clearly visible
    - .9 Control valve piping is connected for correct flow through valve body and for required fail safe action of valve.
- .2 Starting:
  - .1 Check operation of cooling coil condensate drain with supply fan at maximum air flow. Ensure that condensate will drain away against maximum suction pressure of supply fan. Check for and eliminate condensate carry over at maximum air velocity.
- .3 Post-Starting: refer to Section 15954 - Balancing and Adjusting of Mechanical Equipment and Systems.

### 3.4 FLUID HANDLING EQUIPMENT - MISCELLANEOUS

- .1 Gauges and Thermometers:
  - .1 Confirm all gauges and thermometers can be read from the floor level and are installed as recommended by manufacturer.
  - .2 Calibrate.
- .2 Verify following equipment is installed as recommended by manufacturer. Fill out manufacturer's start-up sheets:
  - .1 PRVs.
  - .2 Air eliminators.
  - .3 Strainers.
  - .4 Check valves.
  - .5 Balancing valves.
  - .6 Plumbing fixtures.
  - .7 Backflow preventers.
  - .8 Vacuum breakers.

### 3.5 AIR HANDLING EQUIPMENT - AIR HANDLING UNITS

- .1 Pre-Starting:
  - .1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.
  - .2 Complete manufacturer's installation and start-up check sheets including following:
    - .1 Air blender, mixing baffles.
    - .2 Fresh, Exhaust and Recirculation air motorized dampers, operation and size.
    - .3 Filters.
    - .4 Check that fan base vibration isolation and flexible connections to ductwork are properly installed.
    - .5 Special features, access doors, liners, inlet vanes, labels.
    - .6 For variable volume systems, ensure variable volume/speed controller is operational.
    - .7 Ensure silencers are installed.
  - .2 Lubricate bearings on fans as recommended by manufacturer. Ensure fan wheels rotate in correct direction without binding. Adjust belts to proper alignment and tension.
  - .3 Vacuum clean air systems.
  - .4 Ensure temporary filters are installed. **Never** operate system without filters installed.

- .5 Ensure all balancing and fire dampers are open and ductwork is complete. For VAV systems ensure at least 60% of boxes are open.
- .6 Ensure all coils are in operation. If outside air temperature is less than 2°C ensure coils are dry or filled with glycol.
- .7 On parallel fan systems ensure backdraft dampers are installed.
- .8 Ensure electrical connections are complete and system disconnects are within sight of unit.
- .9 Ensure controls are operational.
- .10 Ensure inlet and discharge duct geometry is correct.
- .2 Starting:
  - .1 Follow manufacturer's recommendations.
- .3 Post-Starting:
  - .1 Start fan, for variable speed fans run up to maximum speed, and check for vibration free operation.
  - .2 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.
  - .3 Run for one day and check filters, coils, and humidifier for bypass. Seal as required.
  - .4 Check that bearings are not overheating.

### **3.6 AIR HANDLING EQUIPMENT - FANS**

- .1 Pre-Starting:
  - .1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.
  - .2 Complete manufacturer's installation and start-up check sheets including following:
    - .1 Motorized dampers.
    - .2 Accessories.
    - .3 Special features.
    - .4 Check that fan base vibration isolation and flexible connections to ductwork are properly installed.
  - .3 Lubricate bearings on fans as recommended by manufacturer.



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- .4 Ensure fan wheels rotate in correct direction without binding.
- .5 Adjust belts to proper alignment and tension.
- .6 Ensure ductwork and fan casing is free of dirt or foreign material.
- .7 Ensure electrical connections are complete and disconnect is within sight of fan.
- .8 Ensure inlet and discharge duct geometry is correct.
- .2 Starting:
  - .1 Follow manufacturer's recommendations.
- .3 Post-Starting:
  - .1 Start fan, for variable speed fans run up to maximum speed, and check for vibration free operation.
  - .2 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.
  - .3 Check that bearings are not over heating.

### **3.7 AIR HANDLING EQUIPMENT - UNIT AND CABINET HEATERS**

- .1 Pre-Starting:
  - .1 Check each installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:
    - .1 Piping connections.
    - .2 Unit vibration isolation.
    - .3 Ducting connections.
    - .4 Controls.
    - .5 Disconnect switches.
    - .6 Unit clean.
- .2 Starting: as recommended by manufacturer.
- .3 Post-Starting: refer to Section 15954.

### **3.8 TANKS**

- .1 Pre-Starting:
  - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:
    - .1 Tank is level on housekeeping base.

- .2 No visible damage to vessel.
  - .3 Check PRVs for correct operation and specified relief pressure. Adjust as required.
  - .4 Clearances have been provided and piping is flanged for easy removal and servicing.
  - .5 Labels are clearly visible.
  - .6 Controls, gauges, alarm devices, etc. are operational.
  - .7 Access ports/manholes provided.
  - .8 Piping sizes - inlet/outlet are correct.
  - .9 Lining is intact and not damaged.
  - .10 Tank has dielectric unions on piping connections.
- .2 Starting: not applicable.
- .3 Post-Starting:
- .1 Verify operation of:
    - .1 Drain line.
    - .2 Make-up line if applicable.
    - .3 Gauge glass.
    - .4 Diaphragm if applicable.

### 3.9 AIR COOLED CONDENSERS

- .1 Pre-Starting:
- .1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.
  - .2 Complete manufacturer's installation and start-up check sheets including following:
    - .1 No physical damage to unit has occurred.
    - .2 All access doors move freely and are weathertight.
    - .3 Unit is free of foreign debris.
    - .4 All bolts, screws are tight.
    - .5 Condenser base vibration isolation and flexible connections on refrigerant pipes are properly installed.
    - .6 Controls complete.
    - .7 Check acoustic insulation.
    - .8 Fan guards are installed.
  - .3 Lubricate bearings on fans as recommended by manufacturer.
  - .4 Ensure fan wheels rotate in correct direction without binding.
  - .5 Adjust belt to proper alignment and tension.

- .2 Starting:
  - .1 Start in accordance with manufacturer's instructions.
  - .2 Complete manufacturers starting check sheet.
  
- .3 Post-Starting:
  - .1 Ensure all fan guards are tight.
  - .2 Check air flows over coils.
  - .3 Check operation of condenser capacity control device.
  - .4 Ensure vibration isolation and flexible connections to unit properly damp vibration transmission to structure.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Inspect, start-up and commission each system to prove that each system meets its specified operating criteria.

**1.2 RELATED SECTIONS**

- .1 Construction Schedules: Division 1.
- .2 Contractor Start-up Report Forms: Division 1.
- .3 Cleaning and Chemical Treatment of Hydronic System: Section 15186.
- .4 General Mechanical Starting and Testing Requirements: Section 15951.
- .5 Mechanical Equipment Starting and Testing: Section 15952.
- .6 Balancing and Adjusting of Mechanical Equipment and Systems: Section 15954.
- .7 Pressure Testing: Section 15955.

**1.3 FACTORY TRAINED REPRESENTATIVES**

- .1 Use factory trained representatives for starting of the following specialty systems:
  - .1 Heat pipes
  - .2 Solar system
- .2 Use manufacturers' representatives where required to maintain manufacturers' warranties.

**2. PRODUCTS**

Not Used.

**3. EXECUTION**

**3.1 OPERATIONAL TESTS**

- .1 Conduct operational tests after mechanical installations have been completed and pressure tested to demonstrate that equipment and systems meet specified performance requirements. Conduct these tests as soon as conditions permit. Make changes, repairs, adjustments, and replacements required as tests may indicate.
- .2 Conduct pre-operational tests, processes and inspections in presence of the Owner.
- .3 Conduct final operational tests in presence of the Owner. Vary loads to illustrate start-up and shut down sequences. Simulate emergency conditions for safety shut downs, with automatic and manual reset. Repair and retest defects until satisfactory results are achieved. Make final adjustments to suit exact building conditions.

**3.2 AIR SYSTEMS**

- .1 Inspect air systems including ductwork layout, support, and vibration isolation before pressure testing any section of ductwork. Notify Owner when work is ready for inspection.
- .2 Pressure test sections of ductwork, in accordance with Section 15955, prior to application of insulation or concealment.
- .3 Test drop fire dampers in accordance with Section 15954. Notify Owner two working days prior to fire damper testing.
- .4 Air Handling Unit: start-up and performance verification using manufacturer's representative. Provide two working days notice to the Owner.
- .5 Start up coil circulators, exhaust air systems, etc.
- .6 Demonstrate operation of mixing section, blender, filters, freeze protect, fire alarm interlocks, etc.
- .7 Performance test fans, coils, etc. in accordance with Section 15954.
- .8 Balance air systems in accordance with Section 15954. Complete and submit Air Systems balance report to Owner.
- .9 If necessary change pulley drives to correct volume up or down on constant volume systems, and to correct volume up on variable volume systems.
- .10 Perform acoustic survey in accordance with Section 15954. Rectify any noise problems encountered.
- .11 Conduct Mechanical Systems Demonstration and Instruction in accordance with Section 15958.

**3.3 HYDRONIC SYSTEMS**

- .1 Inspect piping layout, pipe support, expansion provisions, slope for draining and venting, vibration isolation, etc. before pressure testing any section of pipework. Notify Owner when work is ready for inspection.
- .2 Pressure test sections of pipework, in accordance with Section 15955, prior to application of insulation or to concealment.
- .3 Pressure test each completed system, in accordance with Section 15955, before any equipment is started. Notify Owner two working days prior to any system pressure test.
- .4 Start-up pumps.
- .5 Heating appliance: perform start-up and performance verification.

- .6 Rough balance system to ensure fluid circulation in every circuit. Rough balance cooling systems by velocity or pressure drop measurements at each circuit or component. Rough balance heating systems by temperature drop measurement.
- .7 Chemically treat water and glycol filled systems in accordance with Section 15186.
- .8 Fine balance systems in accordance with Section 15954. Complete and submit Hydronic Systems balance report.
- .9 Check system for fluid or pump noise in pipes. Rectify as necessary.
- .10 Provided the flow rate exceeds that specified, shave impeller on pumps larger than 1.5 kW if current draw exceeds motor full load amps or if there is excess flow which results in excessive pipe noise in adjacent occupied areas.
- .11 Complete and submit Hydronic systems Start-up report as specified in Section 15951.
- .12 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15958.

**3.4 DOMESTIC WATER SYSTEMS**

- .1 Inspect domestic water systems including piping layout, pipe support, expansion provisions, and slope for draining and venting, before pressure testing any section of pipework.
- .2 Pressure test sections of pipework, in accordance with Section 15955, prior to application of insulation or to concealment.
- .3 Pressure test each completed system, in accordance with Section 15955, before any equipment is started.
- .4 Start domestic hot water systems' circulator pumps.
- .5 Domestic hot water heating appliance: perform start-up and performance verification. Provide two working days notice to the Owner.
- .6 Balance Domestic Hot Water system return circulation circuits by temperature drop measurement.
- .7 Ensure all air chambers and expansion compensators are properly installed.
- .8 Ensure entire system can be completely drained.
- .9 Check operation of water hammer arrestors. Let one outlet run for ten seconds, then shut water off quickly. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.
- .10 Complete and submit Domestic Water systems Start-up report as specified in Section 15951.

- .12 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15958.

**3.5 PLUMBING DRAINAGE SYSTEMS**

- .1 Inspect plumbing drainage systems including above ground drainage piping layout, pipe support, slope, venting, before pressure testing or concealing any section of the work.
- .2 Hydraulically test above ground installations within buildings in accordance with Section 15955.
- .3 Ensure all traps are fully primed.
- .4 Ensure all fixtures are properly anchored and connected to system.
- .5 Flush each valve, drain each sink and operate each fixture to ensure drainage and trap anti-siphon venting is effective.
- .6 Open each cleanout, cover with linseed oil and reseal each cleanout. Ensure each cleanout is fully accessible and access doors are properly installed.
- .7 Ensure roof drain metal domes are installed. Ensure storm piping is free of debris or roof insulation ballast. Remove caps as required. Verify insulation on piping is as specified in Section 15082.
- .8 Complete and submit Drainage systems Start-up report as specified in Section 15951.
- .9 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15958.

**END OF SECTION**

**1. GENERAL**

**1.1 INTENT**

- .1 Test, adjust and balance mechanical equipment and systems so that entire system produces the results for which it was designed. This includes, but is not limited to, all supply air, exhaust air, air exchange and hydronic equipment.

**1.2 RELATED SECTIONS**

- .1 Contractor Start-Up Report Forms: Division 1.
- .2 Mechanical Operation and Maintenance Manual: Section 15021.
- .3 General Mechanical Starting and Testing Requirements: Section 15951.

**1.3 TESTING/ADJUSTING/BALANCING REPORT DATA**

- .1 Organize balancing data in accordance with AABC - Associated Air Balancing Council, report format. Report data in SI units.

- .2 Air Systems: Include both specified and measured data.

- .1 Air Handling Equipment:

- .1 Maximum air flow volume.
- .2 Fan total pressure.
- .3 Motor volts, amps and power.
- .4 Minimum outside air volume.
- .5 Fan rotational speed.
- .6 Fan Power, calculate fan efficiency.
- .7 Inlet and outlet dry and wet bulb temperatures.
- .8 Equipment static pressure profile.

- .2 Duct Air Quantities - Mains and Branches:

- .1 Duct size.
- .2 Number of pressure/velocity readings per traverse.
- .3 Sum of velocity measurements.
- .4 Average velocity.
- .5 Duct air flow volume.
- .6 Barometric pressure and duct air temperature.

- .3 Air Outlets:

- .1 Outlet location and designation.
- .2 Manufacturers catalogue identification and type.
- .3 Air outlet flow factors. Use 1.0 when flowhood is used.
- .4 Air flow volumes.
- .5 Deflector vane or diffuser cone settings.



- .4 Emergency Generator:
  - .1 Air flow volume. Air flow volume includes cooling plus combustion air.
  - .2 Static pressure profile.
- .3 Hydronic Systems: Include both specified and measured data.
  - .1 Pumps:
    - .1 Discharge and suction pressures, at design flow and no flow.
    - .2 Fluid flow rate. Calculate from pump curves if metering not provided.
    - .3 Motor volts, amps, power.
  - .2 Heating Equipment:
    - .1 Equipment type, location and designation.
    - .2 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
    - .3 Fluid flow rate.
    - .4 Fluid Specific Heat, at mean temperature.
    - .5 Fluid Specific Gravity, at mean temperature.
    - .6 Fluid entering and leaving temperatures and pressures.
    - .7 Heat transfer rate.
  - .3 Heat Exchanger:
    - .1 Heating fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
    - .2 Heating fluid flow rate.
    - .3 Heating fluid Specific Heat, at mean temperature.
    - .4 Heating fluid Specific Gravity, at mean temperature.
    - .5 Heating fluid entering and leaving temperatures and pressures
    - .6 Primary side heat transfer rate.
    - .7 Heated fluid used. Identify fluid used; water, % water/ethylene glycol mixes, etc.).
    - .8 Heated fluid flow rate.
    - .9 Heated fluid Specific Heat, at mean temperature.
    - .10 Heated fluid Specific Gravity, at mean temperature.
    - .11 Heated fluid entering and leaving temperatures and pressures.
    - .12 Secondary side heat transfer rate.
  - .4 Air Heating and Cooling Coils:
    - .1 Coil type and identification, location and designation.
    - .2 Entering and leaving air dry and wet bulb temperatures.
    - .3 Air static pressure drop.
    - .4 Air flow volume.
    - .5 Barometric pressure.

- .6 Air side heat transfer rate.
- .7 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
- .8 Fluid flow rate.
- .9 Fluid Specific Heat, at mean temperature.
- .10 Fluid Specific Gravity, at mean temperature.
- .11 Fluid entering and leaving temperatures and pressures
- .12 Fluid side heat transfer rate.

.5 Unit and Cabinet Heater:

- .1 Start unit and check for noise or vibration.
- .2 Check unit performance for each fan speed:
  - .1 Air flow and temperature rise.
  - .2 Water temperature drop.

**2. PRODUCTS**

Not Used

**3. EXECUTION**

**3.1 BALANCING AND ADJUSTING PREPARATION**

- .1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been properly completed in accordance with Sections 15952 and 15953.
- .2 Perform balancing during heating and cooling season of first year of operation, to ensure proper settings of controls under both summer and winter peak load conditions.
- .3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.
- .4 Perform work using measuring instrumentation conforming to requirements specified in Section 15951.

**3.2 GENERAL PROCEDURES**

- .1 Perform balancing to following accuracy:
  - .1 Air - terminal outlets ± 10%
  - .2 Air - central equipment ± 5%
  - .3 Hydronic - terminal outlets ± 10%
  - .4 Hydronic - pumps and central equipment ± 5%

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- .2 Permanently mark settings on splitters, valves, dampers or other adjustment devices.
- .3 Subsequent to correcting work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

### 3.3 FIRE DAMPER/FIRE STOP FLAP VERIFICATION

- .1 Visually inspect all fire dampers/fire stop flaps to verify that:
  - .1 Installation is straight and level.
  - .2 Wall angles are properly installed.
  - .3 Duct has break away connection.
  - .4 Fire stopping material, where used, is properly installed.
  - .5 Access is adequate.
  - .6 Adequate clearance exists between sleeve and wall.
  - .7 ULC label is visible.
  - .8 Blades are out of air stream.
  - .9 Temperature rating of linkages are correct.
- .2 Inspect and clean all fire damper blades and tracks prior to function test.
- .3 Function test each damper, by detaching fusible link chain. Verify that damper blade drops properly and is tightly sealed within frame. Reset each damper.
- .4 If fire damper does not close properly, repair installation and retest.
- .5 All fire damper tests shall be witnessed by two parties, certified by Contractor and endorsed by testing personnel.
- .6 Write to authority having jurisdiction prior to testing dampers. Invite authority to witness tests as required.

### 3.4 AIR SYSTEM PROCEDURE

- .1 Perform testing, adjusting and balancing only after all suspended ceilings and partitions are complete, with doors and windows in place and closed.
- .2 Adopt following procedures for central systems:
  - .1 Test drop and reset all fire dampers.
  - .2 Verify that dampers and volume control devices are in fully open position.
  - .3 Initially balance central plant to  $\pm 10\%$  air flow.
  - .4 Calibrate air flow measuring stations.
  - .5 Balance mains and branches to  $\pm 10\%$  air flow.
  - .6 Recheck central plant.
  - .7 Balance all terminal air outlets to  $\pm 10\%$ .
  - .8 Rebalance central plant to  $\pm 5\%$ .
  - .9 Recheck all air outlets.
  - .10 Measure performance of coils and humidifier.

- .11 Measure air pressure change across each component of central plant.
- .12 Take sound pressure level readings.
- .3 Take air flow measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. Take the number of readings as set out in ASHRAE Fundamentals Chapter 13 "Measurement and Instruments". If readings are inconsistent across duct, relocate by two duct diameters / widths and redo traverse.
- .4 Following precedence applies to air flow measuring devices and methodology:
  - .1 Pitot tube traverses in straight sections of duct have precedence over anemometer or velometer traverses of filters, coils, ducts, etc.
  - .2 Micromanometer flowhood measurements at air outlets have precedence over anemometer or velometer readings at air outlets.
  - .3 A pitot tube traverse in a straight duct section at inlet to a variable volume box has precedence over a box air flow sensor reading.
  - .4 Variable volume box air flow sensor may be used to set up box maximum and minimum air volumes but, unless otherwise agreed with the Owner, the sum of micromanometer flowhood readings at all air outlets has precedence over a box flow sensor reading.
- .5 Use volume control devices at air outlets to regulate air quantities only to extent that adjustments do not create objectionable air motion or noise. Effect volume control primarily by duct internal devices such as dampers and splitters.
- .6 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- .7 Balance air systems at design minimum supply air temperature.
- .8 When balancing constant volume systems:
  - .1 Rough balance furthest outlet and then balance sequentially back to source,
  - .2 Fine balance furthest outlet back to source.
- .9 When balancing variable air volume systems:
  - .1 Check factory settings and reset each box maximum and minimum air volumes as necessary.
  - .2 Measure inlet static pressure to box at maximum volume.
  - .3 Individually set each box to maximum, rough balance furthest outlet and then balance sequentially back to box.
  - .4 Fine balance from furthest outlet back to box.
  - .5 Check damper stroke over box range, minimum to maximum.

- .6 With all boxes at minimum volume progressively open boxes in a clockwise direction until maximum design air volume is achieved, or until branch static pressure can no longer be maintained. Check that each opened box is delivering specified maximum volume by checking and recording if the inlet static pressure is adequate to operate the box at maximum volume. Record airflow measuring station volume. Determine minimum duct static pressure at sensor that will provide adequate inlet pressure at every box.
- .7 With all boxes at maximum volume, progressively close boxes in a clockwise direction until branch static pressure is achieved. Check that each opened box is delivering specified maximum volume. Record system volume. Determine minimum duct static pressure at sensor that will provide adequate inlet pressure at every box.
- .10 Upon completion of balancing, recheck and record data from central Air Handling Unit (refer to Section 15952) including following:
  - .1 Motor data.
  - .2 Coil, filter, humidifier data.
  - .3 Static pressure profile across all components.
  - .4 Damper controls.
- .11 Final balanced condition of each area shall include testing and adjusting of pressure conditions. Test, adjust and record building and zone pressurization levels. For variable volume systems check pressurization throughout full range of fan delivery for both heating and cooling conditions. For multi-story buildings test pressure conditions at ground, intermediate and upper levels. Check front doors, exits and elevator shafts for air flow so that exterior conditions do not cause excessive or abnormal pressures. Document abnormal building leakage conditions noted.
- .12 Complete balancing to achieve positive building pressure unless otherwise instructed.

### **3.5 MISCELLANEOUS AIR HANDLING DEVICES**

- .1 Motorized and Gravity/Barometric Dampers:
  - .1 Review installation to ensure:
    - .1 No cracks around damper frame.
    - .2 Blades close and seals engage completely.
    - .3 Damper strokes fully open to fully closed with no binding of blades at any part of stroke.
    - .4 Suitable access and identification.
  - .2 Air Outlets:
    - .1 Review installation to ensure:
      - .1 Air outlet is clean.

- .2 Air outlet is located as shown on drawings.
- .3 Balancing Dampers:
  - .1 Check installation to ensure:
    - .1 Damper can open and close fully.
    - .2 Access is clearly marked.
    - .3 Damper is not located in a turbulent air stream.

### **3.6 BALANCING AND ADJUSTING OF DOMESTIC WATER SYSTEMS**

- .1 Adjust PRV on main line to 570 kPa maximum.
- .2 Balance domestic hot water circulating system piping to ensure flow from all points in system. Ensure all hot and cold supply shut off valves are fully open.

### **3.7 BALANCING REPORT**

- .1 Provide three copies of final report for inclusion in Operation and Maintenance Manual.
- .2 Include types, serial number and dates of calibration of instruments.
- .3 Submit with report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and manufacturer's flow factors.
- .4 Organize report as follows:

#### **Air Systems**

- .1 Summary
- .2 Procedure
- .3 Instrumentation
- .4 Drawings
- .5 Equipment Summary
- .6 Fan Data Sheets
- .7 Fan Curves
- .8 Air Handling Unit Profile Data
- .9 Air Flow Measuring Station Data
- .10 Traverse Data and Schedule
- .11 Terminal Unit Summary
- .12 Outlet Data Summary and Schematic, per system
- .13 Building Pressurization Data
- .14 Diagnostic

**END OF SECTION**

**1. INTENT**

- .1 Provide instruction and demonstration sessions to familiarize the Owner with the building's mechanical systems.

**2. DEMONSTRATIONS**

- .1 Demonstrate specific starting and general maintenance requirements for each piece of equipment. Ensure all labelling and identification is completed.

- .2 Demonstrate following systems:

- .1 Air Systems
- .2 Controls Systems
- .3 Cooling Systems
- .4 Heating Systems
- .5 Plumbing Systems
- .6 Solar System

- .3 Demonstrate following pieces of equipment:

- .1 Makeup Air Unit
- .2 Rooftop Unit and Zone Control System
- .3 Radiant Heaters
- .4 Compressors
- .5 Anti-strat fans
- .6 Garage sump

**3. SITE TOURS**

- .1 Provide a series of guided tours of facility to allow operators to familiarize themselves with building's mechanical systems.

- .2 Coordinate timing of tours with the Owner. Allow for tours at approximately the following times:

- .1 95% complete stage or three weeks prior to Total Performance of the Work.

**END OF SECTION**

**1. REGULATORY REQUIREMENTS**

- .1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code.
- .2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.
- .3 All electrical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labeled, provide written approval by the authority having jurisdiction.
- .4 Submit to authority having jurisdiction and Utility Company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.
- .5 Submit to Owner, copy of electrical permit obtained from authority having jurisdiction.
- .6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

**2. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

- .1 Submit shop drawings, product data and samples, as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials.

**3. OPERATION AND MAINTENANCE DATA**

- .1 Provide the following for all systems and components:
  - .1 Manufacturer's product data, including performance curves and schematic and wiring diagrams for all electrical control systems.
  - .2 Manufacturer's installation instructions.
  - .3 Manufacturer's operation instructions.
  - .4 Manufacturer's maintenance instructions, including complete parts list for all serviceable components.
- .2 Provide a comprehensive list of Subcontractors, Sub-subcontractors and suppliers who supplied and installed systems and components.
- .3 Provide copies of all inspection certification reports from authorities having jurisdiction.



**4. RECORD DRAWINGS**

- .1 Record actual locations of all pull boxes, panelboards, luminaires, feeders, electrical equipment and electrical site services.
- .2 Record any changes to circuit designations. Record any changes to control circuit wiring.
- .3 Include on record drawings, revisions due to engineering change orders, site alterations, additions and field ordered changes made during construction.

**5. COORDINATION**

- .1 Coordinate work specified in Division 16 with work specified in other Divisions. Ensure that proper arrangements and provisions are made for work specified in Division 16.

**6. SOURCE OF SUPPLY**

- .1 All like materials shall be by a single manufacturer.

**7. REFERENCE STANDARDS**

- .1 Comply with standards of following organizations:
  - .1 Electrical and Electronic Equipment Manufacturers Association of Canada (EEMAC).
  - .2 Institute of Electrical and Electronic Engineers (IEEE).

**8. PRODUCT OPTIONS AND SUBSTITUTIONS**

- .1 Refer to Section 01621 for requirements pertaining to product options and substitutions.

**9. TESTING**

- .1 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.

**10. AMBIENT ENVIRONMENT**

- .1 Unless otherwise indicated, supply equipment enclosures, boxes, electrical materials and products suitable for ambient environment of the following areas:

	Area	General Classification	Equipment Enclosure Type
1.	Outdoor Areas and Lower 3m of Apparatus Bay	Wet	NEMA 3R

**END OF SECTION**

**1. GENERAL**

**1.1 REQUIREMENTS**

- .1 The Electrical Contractor shall be responsible for the disconnection, removal, relocation, reconnection, etc., of electrical devices, equipment, material, etc., as indicated on the drawings and/or as required by renovations to existing building and the installation of new facilities.
- .2 All electrical devices and equipment which are disconnected, removed from service, etc., and which are not reused on the job and not required to be retained by the Owner shall be removed from the site.

**2. PRODUCTS**

**2.1 MANUFACTURERS & COMPONENTS**

- .1 Manufacturers of existing devices and equipment, where known, are indicated on the drawings or in the specifications.
- .2 Material and equipment added in renovation area shall match existing wherever possible unless otherwise noted.

**3. EXECUTION**

**3.1 GENERAL**

- .1 Visit site prior to submitting Tender and make survey of renovation areas. Verify locations and operation of all systems and be aware of all requirements involved in changes and modifications to systems. Consult maintenance staff for any information regarding type and operation of systems. Take into account and allow for all work required to existing facilities to meet requirements as indicated on the drawings and in the specifications, including overall project schedule requirements.
- .2 Verify and be aware of work requirements of the project. This includes reading of the specifications and verifying and coordinating with General Contractor to ensure that all requirements are covered and allowed for and that all necessary existing facilities are maintained and operational during construction period.

**3.2 DEMOLITION**

- .1 Provide all labour and equipment required to remove existing electrical facilities in the area to be renovated. All miscellaneous conduit, boxes, wiring, etc., no longer required shall be removed.

**3.3 PHASING OF WORK**

- .1 Disconnection, relocation, reconnection, etc. of existing facilities will be required to accommodate phasing of the work and the installation of new facilities. Be aware of all requirements, including overall project schedule requirements, and make all allowances to accommodate these requirements.

**3.4 INSTALLATION**

- .1 Provide all labour and materials required to revise existing electrical facilities as indicated on the drawings and/or as required by building renovations and for installation of new facilities.
- .2 Existing facilities shall remain operational as much as possible during construction period. When renovations are complete, all facilities shall be checked and tested and shall be left in a proper working order and to the satisfaction of Owner's Representative.
- .3 Where walls, ceilings, floors, etc. containing electrical devices, material and equipment, etc., are removed and the deletion of outlets in said areas disrupts service to adjacent devices and equipment, then conduit and wiring shall be provided to pick up adjacent devices and equipment to maintain continuity of service.

**END OF SECTION**

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**1. GENERAL**

**1.1 INTENT**

- .1 Contractor shall obtain all specified operation and maintenance data. Using this data, Contractor shall prepare and submit operation and maintenance manuals as specified.

**1.2 RELATED REQUIREMENTS**

- .1 Comply with requirements of Operation and Maintenance Data and Manual requirements specified in Division 01.

**1.3 GENERAL VOLUME ORGANIZATION**

- .1 Include the following in each volume:
  - .1 Title page.
  - .2 Table of contents. Identify volume number where listed information is located.
  - .3 Ten percent free space for additional data.
  - .4 Present textual information, schematics and data on 21.5 X 28 cm, 75 g/m2, white bond paper.
  - .5 Enclose title sheet, labeled "Operating and Maintenance Data Manual", project name, date and list of contents.

**1.4 MANUAL CONTENTS ORGANIZATION**

- .1 Manual to include at minimum the following sections:
  - .1 Power
  - .2 Data and Telephone
  - .3 Lighting
  - .4 Fire Alarm
  - .5 Security
- .2 For each major equipment, system, materials or finishes area, organize operation and maintenance data as follows:
  - .1 Operation Division: include the following, as applicable:
    - .1 System Design Criteria.
    - .2 System and Controls Descriptions.
    - .3 System and Controls Schematics.
    - .4 Operating Instructions.
  - .2 Maintenance Division: include the following, as applicable:
    - .1 Maintenance Tasks and Schedules.
    - .2 Spare Parts.
    - .3 Suppliers and Contractors.

- .4 Tags and Directories.
- .3 Contract Document Division: include the following, as applicable:
  - .1 Drawings List.
  - .2 Shop Drawings and Product Data.
  - .3 Certifications.
  - .4 Warranties and Bonds.
  - .5 Maintenance Brochures.
  - .6 Report

## **1.5 DOCUMENT BINDING METHODS**

- .1 Standard 21.5 X 28 cm sheets: punch sheets to fit binder.
- .2 Sheets up to 28 X 41.5 cm: punched and neatly folded to allow use without removing from binder.
- .3 Drawings larger than 28 X 41.5 cm: insert drawings in sturdy vinyl envelopes with reinforced binding holes, open on one side and overall folded size not exceeding 21.5 X 28 cm. Do not punch holes in drawings.

## **1.6 BINDERS**

- .1 Include all electrical documentation in the Binders provided under Division 1.

**END OF SECTION**

**1. GENERAL**

Not Applicable.

**2. PRODUCTS**

**2.1 CONDUIT**

- .1 Provide conduit of types and sizes indicated. Refer to Conduit Schedule at end of Section. Where sizes are not indicated, select proper sizes to suit intended use, fulfill wiring requirements, and comply with CEC.
- .2 EMT: to CSA C22.2 No.83-M1985. Provide rain-tight fittings in weatherproof and damp areas.
- .3 Rigid Metal: to CSA C22.2 No.45-M1981.
- .4 Flexible Metal Conduit: to CSA C22.2 No. 56-1977.
- .5 Flexible Plastic Underground Power Cable Ducting: to CSA C22.2 No. 211.1 1984.

**2.2 WIRE AND CABLE**

- .1 Building Wiring: to CSA C22.2 No. 75-M1983, copper conductor, 600 V RW90 X-link insulation. Use in all locations, except for underground wire which shall be RW90 X-Link -40°C or TWU75 -40°C.
- .2 Wire Sizing: according to CEC except where otherwise indicated. Minimum wire size shall be #12 AWG.
- .3 Do not use metallic or non-metallic sheathed cables or wire with aluminum conductors, except where otherwise indicated.

**2.3 BOXES AND FITTINGS**

- .1 Provide boxes and fittings suitable for intended use and area installed and as follows:
  - .1 Outlet Boxes: to CSA C22.2 No. 18-92. Sheet steel, galvanized for concealed boxes and cast metal for surface and weatherproof boxes.
  - .2 Pull and Junction Boxes: to CSA C22.2 No. 40-M1989. Sheet steel with screw-on covers and barriers as required.
  - .3 Bushings, Knockout Closures, and Locknuts: to CSA C22.2 No. 18-92.

## **2.4 WIRING DEVICES**

- .1 Specification grade and as follows:
  - .1 Switches: to CSA C22.2 No. 111-M1986, toggle type, 15 A, 125 V, full load rated, white colour.
  - .2 Receptacles: to CSA C22.2 No. 42-M1984, duplex, 15 A, 125 V, U-ground, colour.
  - .3 Cover Plates: Stainless steel.

## **2.5 DISCONNECTS**

- .1 Disconnects: to CAN/CSA C22.2 No.4-M89, heavy duty, lockable, non-fused, with poles, voltage, amperage, kw ratings and enclosures as indicated on drawings and required by CEC to suit application.

## **2.6 CABINETS AND ENCLOSURES**

- .1 Cabinets and Enclosures: to CSA C22.2 No. 40-M1989, and as follows:
  - .1 Interior Cabinets: EEMAC-1 sheet steel with hinged cover, flush lock and latch.
  - .2 Backboards: 19 mm GIS plywood, as indicated on drawings, painted as specified in Section 09906.
  - .3 Exterior Enclosures: EEMAC-3R insulated sheet steel with hinged doors, hasp and lock, drip lid, mounting posts and electric heater as indicated on drawings.

## **2.7 GROUNDING EQUIPMENT**

- .1 Grounding Equipment: to CSA C22.2 No. 41-M1987 and as follows:
  - .1 Ground Rods: 20 mm x 3 m, copper clad steel.
  - .2 Conductors: copper, stranded, bare or insulated as indicated.
  - .3 Connectors: thermaweld where underground or exposed to moisture, compression type bolt-on in other locations.

## **2.8 SUPPORTING DEVICES**

- .1 Provide metal brackets, frames, clamps, channels, straps and related devices to adequately support weight of equipment and raceways.



**3. EXECUTION**

**3.1 CONDUIT**

- .1 Except where otherwise indicated, install all wiring in conduit.
- .2 Where practicable, install conduit concealed in walls, floors, ceilings above suspended ceilings and underground.
- .3 Install conduit parallel or at right angles to building lines; minimize crossovers and conserve space and headroom.
- .4 Install underground conduit minimum 1 m below finished grade.
- .5 Mount conduit on underside of metal roof deck by fastening to bottom of metal flutes.

**3.2 BOXES**

- .1 Install boxes flush where practicable and for vertical mounting of devices. Install to nearest course line in masonry walls.
- .2 Except where otherwise indicated, mount boxes at following heights to centreline of device:
  - .1 Switches: 1200 mm.
  - .2 Receptacles in unfinished areas: 1200 mm.
  - .3 Receptacles in finished areas: 300 mm.
  - .4 Telephone: 300 mm.
  - .5 Manual Breakglass Stations: 1400 mm.
  - .6 Alarm Bells: 2100 mm.
- .3 Owner may change location of outlets prior to installation, with no change in Contract Price, provided that distance does not exceed 2 m from originally indicated location.

**3.3 WIRING DEVICES**

- .1 Install devices and covers flush and level.
- .2 Ensure that outlet boxes are clean prior to installing devices.

**3.4 GROUNDING**

- .1 Provide service ground grid consisting of two ground rods spaced at least 1 m apart and connected by a #6 bare conductor as indicated on drawings.

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- .2 Provide separate, insulated ground conductor in conduit installed underground, in slabs poured on grade or exposed to moisture and in non-metallic conduit.
- .3 Ground all metal parts of building structure and mechanical equipment including piping systems.

**3.5 SUPPORTS**

- .1 Do not fasten supports to piping, ductwork or mechanical equipment.

**END OF SECTION**

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**1. GENERAL**

- .1 Not applicable.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Grounding and bonding equipment: to CSA C22.2 No. 41-M1987 and as follows:
- .1 Ground Rods: 20 mm x 3 m copper clad
  - .2 Ground Conductors: as specified in Section 16121.
  - .3 Ground Grid:
    - .1 No of ground rods: 3.
    - .2 Interconnect conductors: #6 awg bare copper.
    - .3 Ground conductors: #6 bare copper through the system neutral point and terminated to the Main Ground Busbar.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Comply with requirements of CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.
- .2 Install complete permanent grounding system including electrodes, conductors, connectors and accessories.
- .3 Protect exposed ground conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes using pressure connectors.
- .5 Use mechanical connectors for ground connection to equipment provided with lugs.
- .6 Do not solder joints.
- .7 Install bonding wire in flexible metal conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.
- .8 Install separate insulated ground conductor in conduit runs installed in concrete which is subject to moisture penetration and underground.
- .9 Install a separate insulated ground conductor in all RPVC conduit runs.

- .10 Install insulated copper ground conductor in all cable tray, mechanically fixed to the trays at a minimum of 2 meter intervals.

**3.2 SYSTEM GROUNDING**

- .1 Provide ground grid with one ground conductor from grid through the system neutral point and connected to the Main Ground Bus Bar
- .2 Provide ground conductor to water main ahead of water meter.
- .3 Provide flexible copper bonding jumper around water meter, associated unions and valves to ground building side of water system.

**3.3 GROUND CONDUCTORS**

- .1 Use bare ground conductors for the following:

Size

- .1 Service Entrance #6
- .2 Distribution Centres As Required
- .3 Emergency Generator #6
- .4 Gas Services #6
- .5 Water Service #6
- .6 Abandoned Water Service #6

- .2 Use green insulated ground conductors for the following:

Size

- .1 Circuit Ground Conductors #12
- .2 Bonding Jumpers #6
- .3 Fire Alarm System #12
- .4 Data System #6
- .5 Public Address System #12
- .6 Transformers As Indicated

**END OF SECTION**

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**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Basic Electrical Requirements: Section 16005.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Conduit: Section 16131.
- .2 Cable Trays, Wireways, and Surface Raceways: Section 16132.
- .3 Lighting: Section 16501.

**1.3 COORDINATION**

- .1 Coordinate installation of inserts with:
  - .1 Concrete work specified in Division 03.
  - .2 Suspended ceiling work specified in Division 09.
  - .3 Mechanical work specified in Divisions 15.

**2. PRODUCTS**

**2.1 SUPPORTING DEVICES**

- .1 Provide metal brackets, frames, hinges, clamps and related types of supporting devices and support systems adequate for weight of equipment and raceways, including wiring which they carry.
- .2 Straps: malleable iron.
- .3 Channels: 42 x 42.
- .4 Rod Hangers: 9.5mm galvanized steel.
- .5 Inserts: afterset expansion types.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install supporting devices to maintain headroom, neat mechanical appearance and to support equipment loads required.

- .2 Except where otherwise indicated, support equipment, conduit and cables using clips, spring loaded bolts, or cable clamps designed as accessories to base channel members.
- .3 Support exposed conduit and conduit installed in space above suspended ceilings and in crawl spaces using hangers, clamps or clips. Support conduit on each side of bends and on spacing in accordance with Canadian Electrical Code.
- .4 Where three or more conduits run parallel, install conduit on conduit racks. Size conduit racks to provide 25% spare capacity.
- .5 Support riser conduit at each floor level with clamp hangers.
- .6 Do not fasten supports to piping, ductwork, mechanical equipment or conduit.
- .7 Do not use shot driven pins.
- .8 Install surface mounted cabinets and panelboards with minimum of four anchors.
- .9 Bridge studs top and bottom with channels to support flush mounted cabinets and panel boards in stud walls.
- .10 Support teck cable on intervals not less than 900mm, and provide additional support to ensure cables adequately follow building structure.

**END OF SECTION**

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**1. GENERAL**

- .1 Not applicable.

**2. PRODUCTS**

**2.1 IDENTIFICATION MATERIALS**

- .1 Lamacoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
  - .1 Size 1: 12 mm high with 5 mm high letters.
  - .2 Size 2: 20 mm high with 8 mm high letters.
  - .3 Size 3: 25 mm high with 12 mm high letters.
- .2 Wire Identification Materials: Use one of the following:
  - .1 Heat shrink sleeves, blank.
  - .2 Clear plastic tape wrap-on strips with white writing section.
  - .3 Wrap-on strips, pre-numbered.
  - .4 Slip-on identification bead markers or sleeves, blank or pre-numbered.
- .3 Colour Banding Tape: Adhesive backed plastic tape, integrally coloured.
- .4 Receptacle Circuit Designations: Clear Adhesive tape with machine printed black lettering.

**3. EXECUTION**

**3.1 COLOUR IDENTIFICATION OF EQUIPMENT**

- .1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated in Equipment Identification Schedule.
- .2 Voltage colour identification for line voltage equipment shall be as follows:

	<b>Voltage</b>	<b>Colour</b>
.1	120/208 V or 120/240 V:	Grey
.2	277/480 V:	Grey

**3.2 NAMEPLATE IDENTIFICATION OF EQUIPMENT**

- .1 Identify equipment with lamacoid nameplates, as indicated in Equipment Identification Schedule.

**3.3 PANELBOARD DIRECTORIES**

- .1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

**3.4 COLOUR IDENTIFICATION OF WIRING**

- .1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.
- .2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.
- .3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

	<b>Voltage</b>	<b>Colour</b>
.1	120/208 V, 3 phase:	Red, black and blue.
.2	120/208 V emergency:	Red, black and blue with yellow tracer.
.3	277/480 V 3 phase:	Orange, brown and yellow.
.4	277/480 V emergency:	Orange, brown and yellow with red tracer.

- .4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.
- .5 Maintain phase sequence and colour coding throughout each system.

**3.5 RECEPTACLE IDENTIFICATION**

- .1 Identify the panel and circuit number or numbers of all the new and existing receptacles by attaching a type written label to the top portion of the cover plate.



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**3.6 EQUIPMENT IDENTIFICATION SCHEDULE**

Equipment	Colour	Nameplate Identification	Lamicoid Nameplate Size
Main Distribution Centre	Voltage Colour	- Building name, consulting engineer, date installed, amperage, voltage	3
		- Main breaker	
		- Metering cabinet	2
		- Instrument transformer enclosure	2
		- Loads controlled by each overcurrent protective device	1
Distribution Centres	Voltage Colour	- Distribution centre designation, amperage, and voltage	2
		- Loads controlled by each overcurrent protective device	1
Panelboards	Voltage Colour	- Panelboard designation	2
Motor Control Centres	Voltage Colour	- M.C.C. designation, amperage and voltage	2
		- Motors or loads controlled by each unit and mnemonics	1
		- Relay terminal and transformer compartments	1
Manual Motor Starters	N/A	- Load controlled and mnemonics	1
Ground Bus	N/A	- System Ground	1
On/Off Switches	N/A	- Load controlled	1

cont'd

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**3.6 EQUIPMENT IDENTIFICATION SCHEDULE (Cont'd)**

Equipment	Colour	Nameplate Identification	Lamicoid Nameplate Size
Disconnect Switches, Magnetic Motor Starters and Contactors:	Voltage Colour	- Voltage and equipment controlled and mnemonics	2
Transformers	Voltage Colour	- Transformer designation, secondary and primary voltages	2
Emergency Power Equipment	Voltage Colour	- Designation and voltage	2
Wireways	N/A	- Voltage and system designation	2
Line Voltage Cabinets and Enclosures	Voltage Colour	- Designation and voltage	2
Low Voltage Cabinets and Enclosures	System Colour	- System name; system name and number if more than one cabinet or enclosure - Major components within cabinets and enclosures	2 1
Communication Outlet and Outlet Assemblies	N/A	- Outlet Designation	1
Communication Panels	N/A	- Panel Designation	1
Communication Ports	N/A	- Port Designation	1

**END OF SECTION**

**1. GENERAL**

- .1 Not applicable.

**2. PRODUCTS**

**2.1 BUILDING WIRING**

- .1 Building Wiring: to CSA C22.2 No. 75-M1983 and as follows:
  - .1 Conductors: solid copper for No. 10 AWG and smaller, stranded copper for No. 8 AWG and larger.
  - .2 Insulation: RW90 X-link.
  - .3 Insulation Rating: 600V.
  - .4 Sizes: as indicated in Wire Size Schedule.

**2.2 CABLES**

- .1 Type TECK 90 Cable: to CSA C22.2 No. 131-M89 and as follows:
  - .1 Conductor: copper.
  - .2 Insulation: cross linked polyethylene (XLP).
  - .3 Rating: 600V.
  - .4 Size: as indicated.
  - .5 Configuration: as indicated.
  - .6 Inner Jacket: PVC -40°C.
  - .7 Armour: galvanized steel.
  - .8 Outer Jacket: PVC -40°C.
- 2 Control Cable for Class 2 Remote Control and Signal Circuits:
  - .1 Conductor: copper.
  - .2 Insulation: 300 V insulation, rated 60°C.
  - .3 Configuration: individual conductors twisted together, shielded, and covered with a PVC jacket.

**2.3 CONNECTORS**

- .1 Provide factory fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.

**3. EXECUTION**

**3.1 WIRING, GENERAL**

- .1 Splice only in junction or outlet boxes.
- .2 Conductor length for parallel circuits shall be identical.
- .3 Neatly train and lace conductors inside cabinets, equipment and panelboards.

**3.2 WIRING INSTALLATION IN RACEWAYS**

- .1 Swab raceway system before installing wiring.
- .2 Use pulling lubricant for conductors No. 4 AWG and larger.

**3.3 WIRE CONNECTIONS AND TERMINATIONS**

- .1 Use solderless pressure connectors with insulated covers for copper wire splices and taps, No. 8 AWG and smaller.
- .2 Use insulated spring wire connectors with plastic caps for conductors No. 10 AWG and smaller.
- .3 Use split bolt connectors for copper wire splices and taps, No. 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150% of insulation value of conductor.

**3.4 WIRE SIZE SCHEDULE**

- .1 Lighting Circuits: No. 12 AWG minimum.
- .2 Power Circuits: No. 12 AWG minimum.
- .3 Motor Circuits: No. 12 AWG minimum, except as otherwise indicated on drawings or in schedules.
- .4 Feeder Circuits: as indicated on drawings or in schedules.

**3.5 WIRING INSTALLATION IN CABLE TRAYS**

- .1 All teck cable shall be installed in the cable trays as indicated on the drawings and according to the Canadian Electrical Code.

- .2 When running 120VAC and higher cables in the same cable tray as 4-20mA signals, 24VAC, 24VDC and general data cables the 120VAC and greater cables shall be separated from the lower voltage cables via a grounded cable tray barrier.
- .3 4-20mA signal cables shall be separated from the 24VAC and 24VDC cables via a grounded cable tray barrier.
- .4 Cables of unlike signals and voltages shall cross at 90 degree angles to each other.
- .5 Teck cable drops to equipment shall be supported by vertical cable tray risers. Single or double teck cable drops may be run in vertical cantruss.
- .6 All power and lighting cables shall be separated in the cable tray according to the Canadian Electrical Code. It will be the responsibility of the Contractor to de-rate the conductors if the ventilation spacing requirements are not met.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- |    |                                |                |
|----|--------------------------------|----------------|
| .1 | Basic Electrical Requirements: | Section 16005. |
| .2 | Electrical Identification:     | Section 16075. |
| .3 | Wire and Cable:                | Section 16121. |
| .4 | Boxes and Fittings:            | Section 16135. |

**1.2 COORDINATION**

- .1 Coordinate with other work including wire and cable, boxes and fittings and panel work, as necessary to interface installation of conduit with other work.
- .2 Coordinate installation of conduit in concrete with work specified in Division 3.
- .3 Coordinate installation of conduit in masonry with work specified in Division 4.
- .4 Coordinate installation of conduit which penetrates roof or waterproofing membranes with work specified in Division 7.

**2. PRODUCTS**

**2.1 CONDUIT, GENERAL**

- .1 Except where otherwise required by Canadian Electrical Code (CEC), provide conduit of types specified in Conduit Installation Schedule and sizes indicated on drawings or specified.
- .2 Conduit embedded in concrete floors shall be maximum 53 mm size.
- .3 Where sizes are not indicated, select proper sizes to suit intended use, fulfill wiring requirements, and comply with Canadian Electrical Code (CEC).

**2.2 METAL CONDUIT AND TUBING**

- .1 Rigid Metal Conduit: to CSA C22.2 No. 45-M1981, and as follows:
  - .1 Galvanized Rigid Steel Conduit: zinc coated steel.
  - .2 Fittings: same material as conduit.

- .2 Electrical Metallic Tubing (EMT): to CSA C22.2 No. 83-M1985, with fittings as follows:
  - .1 Fitting Material for 25 mm size Conduit and Smaller: zinc alloy or zinc coated steel.
  - .2 Fitting Material for Conduit Larger than 25 mm Size: zinc coated steel.
  - .3 Type: compression, liquid tight for all areas.
- .3 Flexible Metal Conduit: to CSA C22.2 No. 56-1977, and as follows:
  - .1 Liquid-Tight Flexible Metal Conduit: continuous interlocked and double-wrapped steel, zinc coated inside and outside, coated with liquid-tight jacket of flexible PVC, minimum 12 mm diameter.
  - .2 Liquid-Tight Flexible Metal Conduit Fittings: cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings.
- .4 Miscellaneous Fittings: locknuts, bushings, reducers, chase nipples, 3 piece unions, split couplings, plugs, and expansion fittings specifically designed for their particular application.

### **2.3 NON-METALLIC CONDUIT**

- .1 Rigid PVC (Unplasticized) Conduit: to CSA C22.2 No. 211.2-M1984.

## **3. EXECUTION**

### **3.1 INSTALLATION OF CONDUIT, GENERAL**

- .1 Install conduit concealed, in walls, floors, ceilings, above suspended ceilings, and underground, except in following areas:
  - .1 Electrical Rooms
  - .2 Mechanical Rooms
  - .3 Maintenance Bays
  - .4 Lower Level
- .2 Where required to be concealed, install conduit neatly and close to building structure so as to minimize need for furring.
- .3 Installed conduit shall be free from dents, bruises and other damage.
- .4 Plug conduit ends to prevent entry of dirt and moisture.
- .5 Seal conduit with duct seal compound or fiberglass where conduit leaves heated area and enters unheated area.

- .6 Provide necessary flashing and pitchpockets, making watertight joints where conduit passes through roof or waterproofing membranes.
- .7 Where conduit crosses building expansion joints, install expansion fitting approved by authority having jurisdiction, complete with grounding jumper. Provide bend or offset in conduit adjacent to building expansion joint where conduit is installed above suspended ceilings.

### **3.2 INSTALLATION OF METAL CONDUIT AND TUBING**

- .1 Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- .2 Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

### **3.3 INSTALLATION OF RIGID METAL CONDUIT**

- .1 Cut conduit straight, properly ream, cut threads and brush threads clean.
- .2 Fasten conduit terminations in sheet metal enclosures with two locknuts and terminate with bushing. Install locknuts inside and outside enclosure.
- .3 Conduit installed underground shall be painted with two coats of corrosion inhibiting compound before backfilling.

### **3.4 INSTALLATION OF NON-METALLIC CONDUIT**

- .1 Make field bends and solvent cemented joints in accordance with manufacturer's instructions.

### **3.5 INSTALLATION OF EXPOSED AND SEMI-CONCEALED CONDUIT**

- .1 Comply with the following when installing conduit exposed in service areas, unfinished areas, finished areas, and in accessible spaces behind ceilings, walls and floors:
  - .1 Install conduit to conserve headroom and cause minimum interference in spaces through which conduit passes.
  - .2 Install conduit so as not to interfere with ceiling inserts, luminaires or ventilation ducts or outlets.
  - .3 Alter routing to avoid structural obstructions, keeping crossovers to a minimum.
  - .4 Install exposed conduit and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and structural members.
  - .5 Run conduit for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.



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**3.6 INSTALLATION OF LIQUID TIGHT FLEXIBLE METAL CONDUIT**

- .1 Liquid tight conduit is only permitted to be installed as a final connection to a device and when connecting to motors or other vibrating equipment.
- .2 The length of the liquid tight conduit shall be limited to 1.5 meters in length unless otherwise noted in the specifications or drawings.

**3.7 INSTALLATION OF CONDUIT IN CONCRETE SLABS**

- .1 Place conduit between bottom reinforcing steel and top reinforcing steel.
- .2 Separate conduit by not less than diameter of largest conduit to ensure proper concrete bond.
- .3 Ensure minimum 20 mm concrete cover.
- .4 EMT conduit is unacceptable in concrete slabs.

**3.8 CONDUIT SCHEDULE**

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Conduit Type	Locations
Rigid metal	Where exposed and subject to mechanical damage and in areas designated as hazardous. This includes all conduit runs penetrating above concrete slabs.
Rigid PVC (Unplasticized)	Except where otherwise indicated, install all wiring in RPVC conduit.
Flexible metal	Connections to luminaires, motors and subject to vibration. Allowed only as final connection to device. To be not more than 1.5 meters in length except with permission from Owners representative.
EMT	All other applications

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**END OF SECTION**

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**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Electrical General Requirements: Section 16005.
- .2 Electrical Identification: Section 16075.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Hangers and Supports: Section 16071.

**1.3 COORDINATION**

- .1 Coordinate with other work, including wire and cable, boxes and fittings and panel work, as necessary to interface installation of electrical raceways and components with other work.
- .2 Coordinate installation of cable trays and wireways which pass through fire rated walls, floors or ceilings with firestopping work specified in Division 07.

**2. PRODUCTS**

**2.1 RACEWAYS, GENERAL**

- .1 Provide raceways of types and sizes indicated.
- .2 Where not indicated, select proper types and sizes to fulfill wiring requirements and comply with Canadian Electrical Code (CEC).

**2.2 CABLE TRAYS**

- .1 Cable trays and fittings: to CSA C22.2 No. 126-M91 and EEMAC-F5-1, and as follows:
  - .1 Type: Basket.
  - .2 CSA class: C1.
  - .3 Size: 450mm wide x 150mm deep and 150mm wide x 105mm deep.
  - .4 Material: steel.
  - .5 Finish: galvanized
  - .6 Accessories and fittings: Horizontal elbows, end plates, dropouts, vertical risers, wall mount and drops, tees, wyes, expansion joints and reducers, manufactured for cable tray supplied. Provide barriers where different voltage systems are in the same cable tray.

- .7 Radii on Fittings: minimum 300 mm.

### **2.3 WIREWAYS**

- .1 Wireways, Auxiliary Gutters and Associated Fittings: to CSA C22.2 No. 26-1952 and as follows:
  - .1 Material: sheet steel.
  - .2 Finish: baked enamel.
  - .3 Cover: hinged
  - .4 Accessories: elbows, tees, couplings, and hanger fittings manufactured for wireway supplied. Provide barriers where required.

### **2.4 SURFACE RACEWAYS**

- .1 Surface Raceways and Fittings: to CSA C22.2 No. 62-93 and as follows:
  - .1 Type: Wiremold ALDS4000 Designer series, two piece steel assembly, snap-on cover.
  - .2 Size: 150mm x 54 mm
  - .3 Finish: corrosion resistant and non-abrasive, inside and outside. Colour to be selected by the Owner
  - .4 Accessories: corners, boxes and adapters, manufactured for raceway system supplied

## **3. EXECUTION**

### **3.1 INSTALLATION OF RACEWAYS, GENERAL**

- .1 Install raceways where indicated, in accordance with manufacturer's written installation instructions.
- .2 Where exposed, install raceways to conserve headroom and cause minimum interference in spaces through which they pass.

### **3.2 INSTALLATION OF CABLETRAYS**

- .1 Support cable trays with wall mounted manufacturer brackets and as specified in Section 16071, at all bends and tee fittings and at intervals as required by the manufacturer.

**3.3           INSTALLATION OF WIREWAYS**

- .1       Support wireways with trapeze style hangers as specified in Section 16071, at all bends and tee fittings and at intervals as required by the manufacturer.

**3.4           INSTALLATION OF SURFACE RACEWAYS**

- .1       Support surface raceways at maximum 900mm o.c.
- .2       Punch suitable openings for conduit offset for surface connections
- .3       Use surface raceways at following locations:
  - .1       Where conduit cannot be concealed in finished areas
  - .2       Under counters.

**END OF SECTION**

**1. GENERAL**

**1.1 COORDINATION**

- .1 Coordinate box locations with work specified in:
  - .1 Division 4, for installation of boxes in masonry.
  - .2 Division 9, for installation of boxes in locations where access panels are required.

**2. PRODUCTS**

**2.1 METAL OUTLET BOXES**

- .1 Outlet boxes: to CAN/CSA-C22.2 No. 18-92 and as follows:
  - .1 Sheet Steel Boxes: pressed sheet steel, galvanized, blanked for conduit, integral locating lugs.
  - .2 Cast Boxes: corrosion resistant cast aluminum, factory threaded hubs, weatherproof.

**2.2 NON-METALLIC OUTLET BOXES**

- .1 Outlet boxes: to CAN/CSA-C22.2 No. 85-M89 and as follows:
  - .1 Same as sheet steel boxes, except of rigid PVC material.

**2.3 PULL AND JUNCTION BOXES**

- .1 Surface mounted pull and junction boxes: to CSA C22.2 No. 40-M1989 and as follows:
  - .1 Type: NEMA 3.
  - .2 Material: 14 guage steel, continuously welded seams ground smooth.
  - .3 Covers: screw-on, closed cell, oil resistan neopreme gasket, stainless steel screws and clamps on four side of cover to assure water tight seal.
  - .4 Barriers: where indicated and required.
- .2 Recessed pull and junction boxes or surface mounted boxes in areas above 3000 AFF: to CSA C22.2 No. 40-M1989 and as follows:
  - .1 Material: sheet steel
  - .2 Covers: screw-on
  - .3 Barriers: where indicated.

**2.4 BUSHINGS, KNOCKOUT CLOSURES, AND LOCKNUTS**

- .1 Bushings, Knockout Closures and Locknuts: to CAN/CSA-C22.2 No. 18-92, corrosion resistant.

**2.5 AIR/VAPOUR HATS**

- .1 Air/vapour Hats: polyethylene, minimum 0.40 mm thick, with minimum 25 mm wide flanges, designed to be installed over electrical boxes and provide an effective air/vapour seal.

**3. EXECUTION**

**3.1 OUTLET BOX INSTALLATION**

- .1 Provide boxes where indicated and as required for:
  - .1 Splices.
  - .2 Taps.
  - .3 Wire pulling.
  - .4 Equipment.
  - .5 Device location.
- .2 Install boxes flush mounted were applicable.
- .3 Except where otherwise indicated, install boxes for vertical mounting of devices.
- .4 Support boxes independent from conduit.
- .5 Use metal outlet boxes, except in where subject to moisture or corrosive material where non-metallic outlet boxes shall be used.
- .6 Use cast boxes for all surface mounted boxes.

**3.2 LOCATION OF WALL OUTLET BOXES**

- .1 Outlets are indicated on drawings schematically. Consider locations indicated as approximate. Verify locations prior to rough in.
- .2 Confirm size and location of equipment supplied and installed under other Sections, prior to rough in.
- .3 Do not install boxes back to back. Allow minimum:
  - .1 150 mm separation in conventional walls.
  - .2 600 mm separation in acoustic rated walls.
- .4 Position boxes in masonry walls to suit masonry course lines.

- .5 Except where otherwise indicated, mount boxes at following heights:
  - .1 Local switches: 1200 mm
  - .2 Receptacles:
    - .1 General: 300 mm
    - .2 Maintenance Bays 1200 mm
    - .3 Above counters: 150 mm
    - .4 Above baseboard heaters: 200 mm
    - .5 Utility rooms 1200 mm
  - .3 Telephone or Data outlets:
    - .1 General: 300 mm
    - .2 Beside local Receptacle box
  - .4 Emergency Lighting Battery Receptacle 2400 mm
- .6 Measure mounting height from finished floor to centre line of device.
- .7 Owners representative reserves the right to change location of outlets prior to installation with no change in Contract Price, provided that distance does not exceed 3 m from originally indicated location.

**3.3 PULL AND JUNCTION BOX INSTALLATION**

- .1 Locate above accessible ceilings and in unfinished areas.
- .2 Locate so as to minimize need for access doors.
- .3 Support boxes independent from conduit.

**3.4 AIR/VAPOUR HAT INSTALLATION**

- .1 Install air/vapour hats around electrical boxes located in walls and ceilings.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Basic Electrical Requirements: Section 16005.

**1.2 SOURCE OF SUPPLY**

- .1 All cabinets and enclosures larger than 300 mm square and 100 mm deep shall be by a single manufacturer.

**1.3 COORDINATION**

- .1 Coordinate size and depth of cabinets and enclosures with systems specified in other Sections which require enclosures.
- .2 Coordinate installation and identification of cabinets and enclosures with painting of mechanical and electrical work specified in Division 9.

**2. PRODUCTS**

**2.1 CABINETS AND ENCLOSURES**

- .1 Cabinets and Enclosures: to CSA C22.2 No. 40-M1989 and as follows:
  - .1 Material: sheet steel
  - .2 Finish: galvanized
  - .3 Covers: hinged
  - .4 Hinges: concealed flush type
  - .5 Latches: flush lock and catch assembly.
- .2 Backboards for Mounting of Cabinets and Enclosures: as specified in Division 6.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install surface or flush mounted cabinets at locations and heights indicated on drawings.

**END OF SECTION**



**1. GENERAL**

**1.1 SOURCE OF SUPPLY**

.1 Each of the following shall be by a single manufacturer:

- .1 Switches.
- .2 Receptacles.
- .3 Cover plates.

**1.2 COORDINATION**

.1 Coordinate installation of wiring devices and cover plates with site painting and finishing work specified in Division 9.

**2. PRODUCTS**

**2.1 SWITCHES**

.1 Switches to CSA C22.2 No. 111-M1986 and as follows:

- .1 Rating: except where otherwise indicated or specified, 15 A 125/277V, full load rated for fluorescent and 80% for motor load.
- .2 Type: single pole, three-way or four-way as indicated.
- .3 Operation: toggle, quiet action.
- .4 Features:
  - .1 Totally enclosed, 2-piece phenolic case.
  - .2 Large silver cadmium oxide contacts.
  - .3 Rust resistant continuous steel mounting strip.
  - .4 Captive mounting screws.
  - .5 Large head terminal screws.
  - .6 Decora style

.2 Specification Grade Motion Switches to CSA C22.2 No. 111-M1986 and as follows:

- .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 Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aides, or electronic devices such as electronic white board readers. Acceptable programmable PIR/Microphonic Passive Dual Technology (PDT). Ultrasonic or Microwave based sensing technologies shall not be accepted.

- .3 Time Delay settings shall be factory set at 10 minutes, and shall not be field adjusted unless specifically instructed by Architect. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.
- .4 In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- .5 Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.
- .6 The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.
- .7 All applicable products must be UL Listed or other acceptable national testing organization.
- .8 Sensor shall recess into single gang switch box and fit a standard GFI opening.
- .9 Sensor must meet CEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- .10 Sensor shall use PIR sensing incorporating a nominal one half inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 10 feet.
- .11 Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and no switch as specified.

## 2.2 RECEPTACLES

- .1 Receptacles, plugs and similar wiring devices to CSA C22.2 No. 42-M1984.
- .2 Heavy Duty Specification Grade General Purpose Receptacles:
  - .1 Rating: : 15A, 125V except where otherwise indicated.
  - .2 Configuration: : 5-15R, 2 pole, 3 wire grounding.
  - .3 Features:
    - .1 Ground terminal and poles connected to continuous mounting yoke.
    - .2 Wiring terminals: 8 back-wired entrances, 4 side screws.
    - .3 Split feed operation.
    - .4 Nylon face.
    - .5 Triple wipe brass power contacts.

.6 Decora style

.3 Ground Fault Circuit Interrupter Receptacles: same as general purpose receptacles, except for the following features:

- .1 Solid state ground fault sensing and signaling.
- .2 5 milliamperes ground fault trip level.
- .3 Feed-through type.
- .4 Red Trip Indicator Light.

## **2.4 COVER PLATES**

- .1 Stainless Steel: 1.0 mm thick, protective release paper, stainless steel screws.
- .2 Weatherproof: Heavy duty die-cast zinc, dual self closing flip lids, resilient rubber or closed cell foam urethane gasket, four mounting screws.
- .3 Weatherproof In-Use: Heavy duty polycarbonate construction, self closing covers, closed cell foam, neoprene blend gasket, single receptacle plate, to accept 30A locking plugs, molded hinge covers.

## **3. EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- .1 Install wiring devices as indicated and in accordance with manufacturer's written instructions.
- .2 Install wiring devices only in electrical boxes which are clean.
- .3 Install devices and cover plates flush and level.
- .4 Except as specifically indicated otherwise install Weatherproof receptacle and switch covers on the exterior of buildings, vaults and all process areas
- .5 Use stainless steal cover plates for all office area recpetacles
- .6 Use weatherproof cover places for all welding receptacles

### **3.2 REPLACEMENTS**

- .1 Replace all wiring devices and cover plates damaged during construction.

**END OF SECTION**

**1. GENERAL**

**1.1 SYSTEM**

- .1 Provide emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with Canadian Electrical Code Section 46, and local inspection authority.
- .2 System to consist of a complete standby power supply unit, liquid air cooled, diesel engine directly coupled to ac alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, etc. as indicated for a complete operating system.
- .3 Provide full automatic operation such that upon power failure, unit is on line taking full required load within 10 seconds. On resumption of normal power after time delay on transfer switch, load shall re-transfer to normal power and after rundown time delay, generator unit shall automatically shut down and return to starting condition ready for another operating cycle.
- .4 This section includes packaged engine generator sets for standby power supply with the following features:
  - .1 Natural Gas
  - .2 Unit mounted cooling system
  - .3 Exhaust system
  - .4 Starting system
  - .5 System control and alarm panel
  - .6 Open Frame or Skin tight weather and sound enclosure
- .5 Equipment to be supplied and installed in accordance with the following standards:
  - .1 Alberta Building Code
  - .2 Canadian Electrical Code
  - .3 NFPA 110
  - .4 NFPA 30
  - .5 NFPA 37
  - .6 CSA-282

**1.2 RELATED SECTIONS**

- .1 Section 15060 – Hangers and Supports
- .2 Section 15081 – Ductwork and Breeching Insulation
- .3 Section 15082 – Piping and Equipment Insulation
- .4 Section 15811 – Ductwork
- .5 Section 15852 – Louvres and Dampers
- .6 Section 16005 – Basic Electrical Requirements
- .7 Section 16061 - Grounding
- .8 Section 16075 - Electrical Identification

- .9 Section 16237 - Automatic Transfer
- .10 Section 16443 - Over Current Protection
- .11 Section 16971 - Electrical Starting and Testing

### 1.3 SUPPLIER QUALIFICATIONS

- .1 Qualifications: service and parts facilities in close proximity with 24 hour service, experienced in installation and operation of set of comparable size.
- .2 The manufacturer shall supply factory trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of installation. Manufacturer to supply proof to owners representative that the aforementioned service is available.

### 1.4 SHOP DRAWINGS

- .1 Comply with requirements of Section 16005.
- .2 Submit full technical data and service and parts facilities complete with manufacturer's published h.p. data.
- .3 Provide at minimum the following information:
  - .1 Dimensional and elevation drawings of generator set and other associated equipment specified.
  - .2 Wiring diagrams for power, signal and control wiring.
  - .3 Generator set and associated equipment weights and point loads
  - .4 Installation instructions including required clearances.
  - .5 Heater sizing and voltage requirements
  - .6 Current Transformer ratio and model number and accuracy class
- .4 Alternate generator manufacturer/suppliers as noted in item 2.1, will be responsible for including a detailed load and sizing report specific to the project requirements and stepped loads. Program is to be created by generator manufacturer being submitted, competitor sizing program analysis for submitted design will not be acceptable.

### 1.5 FACTORY TESTING

- .1 It is the responsibility of the generator set supplier to provide a factory test report to the Owner's representative of the actual generator being installed on site **PRIOR** to shipping the generator. The Owner's representative will provide acknowledgement of the report and provide written consent to ship the generator set to site. The following information is required to be included in the factory test report:
  - .1 Perform torsional analysis test of engine and generator compatibility.
  - .2 Perform a four hour load test using a portable test bank. Perform test for four hours with load applied in 20% steps every 30 minutes until full load is applied. Record following at 30 minute intervals during the entire test:
    - .1 Kilowatts
    - .2 Amperes

- .3 Voltage
- .4 Frequency
- .5 Oil Pressure
- .6 Coolant Temperature

- .3 Upon completion of 4 hour test, run generator past 100% and record data as noted above indicating the point where the generator "unload protection" is enabled (anticipated 103-110%).
- .4 Test response of governor (droop or isochronous) applying 20% load and 100% load in one step. Use a Computer (plugged into ECU), storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test.
- .5 Test voltage regulator and compare for conformance to manufacturer's product data.
- .6 Record noise level measurements in dB at 3m and 7m intervals around all 4 sides of the generator
- .7 Submit certified tests results for approval by Owner Representative.

## 1.6 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Contract Acceptance Procedures" include the following:
  - 1. List of tools and replacement items recommended to be stored at the project location for ready access. Including part and drawing numbers, current prices, and source of supply.

## 1.7 MAINTENANCE MANUAL MATERIAL SUBMITTALS

- .1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every ten of each type and rating, but no less than one of each.
  - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
  - 4. Belts: One set of each generator and fan belt.

## 1.8 WARRANTY

- .1 The supplier of the generator and associated materials is to provide a two (2) year - 400 hour full parts and labor warranty for all equipment and materials supplied under this specification. The warranty time is to start upon date of substantial completion.

## 1.9 PROJECT CONDITONS

- .1 Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  1. Notify Owners representative no fewer than **seven (7) business days** in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without Owner's representative written permission.
  
- .2 Environmental Conditions: Engine driven system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability.
  - .1 Minimum outdoor ambient temperature: - 35°C
  - .2 Maximum generator operating temperature: 45°C
  - .3 Relative humidity: 0 - 95%
  - .4 Elevation: 815 meters
  
- .3 The following is a listing of special conditions and requirements for the specified generator set and equipment:
  - .1 Clearance from sides and back: 1200mm minimum from widest/longest point on the generator/frame to adjacent wall or nearest piece of equipment. Maintain 1200mm egress path.
  
- .4 Sizing conditions: The Manufacturer is to ensure the generator size specified in item 2.2.1 can adquatley handle the connected load based on the following conditions
  - .1 Minimum load allowed, % rated capacity: 10%
  - .2 Maximum load allowed, % rated capacity: 95%
  - .3 Maximum voltage dip: 35%
  - .4 Maximum frequency dip: 10%
  - .5 Elevation: See item 1.9.2
  - .6 Alternator temp rise: see item 2.6
  - .7 Fuel type: Natural Gas
  - .8 Frequency: 60Hz
  - .9 Phase: See item 2.2.1
  - .10 Duty: Standby
  - .11 Voltage: See item 2.2.1

## 1.10 CONNECTED LOAD

- .1 The Manufacturer is to ensure the generator size specified in item 2.2.1 can adquatley handle the following connected loads based on project conditions noted in item 1.9. It is the manufacturers responsibility to provide a LARGER genset if required.

- .2 The following values are to be applied to the load chart shown below
  - .1 Type:
    - .1 Resistive: 1.0 P.F.
    - .2 Light: Fluorescent
    - .3 Motor: Standard Nema B,C,D, 100 load factor
    - .4 Air Conditioning (AC):
  - .2 Control:
    - .1 Starter: Full voltage across the line
    - .2 Soft Start: Solid State, 350% current limit, 10 second starting
    - .3 VFD: 6 pulse with line reactor 35% THD

Load Chart

STEP	DESCRIPTION	TYPE	LOAD	CONTROL
1	Mechanical Load	Motors	17.5 kW	VFD
1	Building Load	Resistive	12 kW	None
1	Office/Meeting Rooms	Lighting	6 kW	None
2	Compressors	Motor	9.3 kW	None
2	Miscellaneous Mechanical Loads	Motor	5 kW	None

**2. PRODUCTS**

**2.1 MANUFACTURERS**

- .1 Basis of design product: Subject to compliance with requirements, provide Kolher 60kW that conforms to these specifications or a comparable product by one of the following:
  - .1 MTU Onsite Energy
  - .2 Cummins
- .2 If the Contractor chooses to use an alternate generator model than the basis of design product, the Contractor will be responsible for all architectural, structural, mechanical and electrical changes and alterations necessary to meet the Owner's requirements. The Contractor will be responsible for paying the Owner's representative for all additional engineering costs associated with the review and re-calculation of altered design variables. The additional review work shall include but not be limited to the following:
  - .1 Concrete pad thickness and/or additional support (columns, pillars, screw piles etc..)
  - .2 Natural gas supply (where applicable) including: pipe size, meter size, additional utility costs etc...
  - .3 Generator sizing. Manufacturer to provide detailed load report, Owners representative can provide step loads details during shop drawing submission only.
  - .4 Supplementary load voltage, current, cable requirements (heaters, battery charger etc...)



## 2.2 GENERATOR SET

- .1 Packaged generator set shall be coordinated assembly of compatible components capable of providing:
  - .1 Site 1: 60kW, 75 kVA, 120/208 VAC, 3 phase 60 Hz

**UNLESS** a larger generator set is required to meet the site rating. Generator to be manufactured to CEMA standards.
- .2 Site Rating: The generator set shall have a minimum site rating of:
  - .1 Site: 60 kW

based on project conditions. It is the generator set supplier's responsibility to account for site conditions indicated and provide an adequately sized generator set meeting all requirements indicated in this specification. Should the generator set not meet the minimum site rating during on site commissioning the Owners representative reserves the right to:

  - .2 Request manufacturer to modify generator onsite until the site generator meets or exceeds the site rating.
  - .3 Withhold money from the Contractor at a value deemed acceptable by the Owners representative and allow the under rated generator to remain in operation.
  - .4 Request manufacturer to replace the undersized generator with a suitable generator that will meet the minimum site rating.
- .3 Factory assembled and tested engine generator set, provide report as indicated in Item 1.6 of this specification.
- .4 Provide semi-flexible couplings between generator and engine and protective guards over moving parts.
- .5 Provide properly sized generator main circuit breaker **100%** full load rated and enclosure. Breaker to be sized for unit protection and motor starting capacity. See specification 16433 for related requirements. The generator main breaker can not have a larger rating than the transfer switch and main distribution system it is connected to. Coordinate sizing with the single line diagram in the contract drawing set.
- .6 The generator set and all associated equipment specified is to be mounted on a common steel rail base.
- .7 The generator set and all associated equipment specified is to be mounted on a sub base frame complete with lifting attachments and enclosed in a exterior mounted weather proof sound attenuated enclosure. The enclosure is include the features as noted in item 2.12 of this specification.

## 2.3 ENGINE

- .1 Capacity: 5% per cent overload for one hour and 25 per cent overload for transient or intermittent loads operating on diesel fuel at the listed elevation in 1.9.2.4 and an ambient temperature of 32°C.
- .2 Governor: speed regulation 3 cycles maximum from "No Load" to "Full Load" with two second maximum recovery to steady state.
- .3 Accessories: provide all replaceable type oil filters, dry type air cleaners, automatic choke, lubricating oils and greases, etc. as indicated in Item 1.8 of this specification.

## 2.4 COOLING SYSTEM

- .1 Engine - self contained liquid cooling complete with pusher type fan maintaining safe operating temperature for unit under full load conditions.
- .2 Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the alternator air inlet. Radiator fan shall be suitable for use in a system with 13mm water column restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.
- .3 Immersion coolant heater: located in cooling jacket complete with immersion thermostat for 120V or 208V operation as required. It is the Contractors responsibility to provide proper conduit, wiring and breakers in local electrical panel to power the heater. Heater isolation valves are to be installed so as to replace the heater element without draining the entire cooling system.
- .4 The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

## 2.5 STARTING SYSTEM

- .1 Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
- .2 Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
- .3 Battery: Absorbent Glass Mat (AGM) as per manufacturer voltage and amp hour requirements in order to meet 8 hour run time capacity requirements.

- .4 Battery Cable: Sized as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
- .5 Battery Compartment: Plastic acid proof battery box which includes cover mounted on unit. Include accessories required to support and fasten batteries in place.
- .6 Battery Charger: constant potential type with manual and automatic control mounted on wall adjacent to unit, complete with dc ammeter, volt meter, overload protection, ac input switch, pilot switch for ac "On", equalizing charge and high rate charge. Adjustable rate of charge, "floating" on batteries at all times with full charging period of 24 hours maximum. Suitable for AGM battery. Charger to have charger fault/fail alarm dry contact output relay.

## 2.6 ALTERNATOR

- .1 Alternator to be PMG excitation and appropriately sized for variable frequency drive (VFD) motor loads. Shunt or EBS regulators will not be accepted. Temperature rise to be no greater than:
  - .1 20kW – 200kW Generator = 130 °C
  - .2 201kW – 800kW Generator = 105 °C
  - .3 801kW+, Hospital or prime rated Generator = 80°C

## 2.7 FUEL SYSTEM – NATURAL GAS

- .1 Provide a complete natural gas fuel system with all required regulators and fittings to connect to a Natural gas utility supply.
- .2 Bring fuel supply lines and return lines to extreme forward part of base plate with drop ear elbows to be affixed thereto. Connect the other end of each elbow with 1m of flexible neoprene hose.
- .3 All non- metallic fuel hoses shall be of the steel reinforced rubber type with crimped or swaged end fittings.
- .4 Coordinate fuel capacity requirements with supply authority.

## 2.8 EXHAUST SYSTEM

- .1 Muffler and piping: Provide a complete exhaust system including heavy duty commercial type muffler with condensate drain, plug and flanged couplings. Exhaust system to be steel and completely sealed with corrugated stainless steel expansion joints of suitable length to absorb both vertical and horizontal expansion.

Muffler type: Critical Grade

## 2.9 ALARMS AND INSTRUMENTATION

- .1 Engine Control Panel: Solid state controller mounted in Code gauge metal enclosure on frame of unit complete with oil pressure gauge, water temperature gauge, low oil pressure alarm contacts high water temperature alarm contacts low oil pressure shutdown contacts high water temperature shutdown contacts over speed shutdown contacts cranking limiter relay.
- .2 Generator Control Panel: Totally enclosed ventilated Code gauge metal panel mounted on unit constructed of channel or angle iron frame finished in enamel over corrosion-resistant primer, complete with hinged door incorporating output circuit breaker volt meter and volt meter selector switch ammeter and ammeter selector switch complete with current transformers as required frequency meter, voltage adjustment rheostat running time meter.
- .3 Generator Controller: Incorporate large size 320x240 pixel LED-backlit Liquid Cristal Display. Controller to be capable of displaying scrolling alarms, engine and alternator performance characteristics and alarm history. Complete with generator Stop/Start/Auto/Manual/Reset selection, cranking limiter, trouble horn, and double pole, double throw silencing switch. HMI to include LED indicating lamps: running, remote start, not in auto, shutdown, warning, auto, manual and stop. HMI to be mounted on generator control panel to provide clear and easy access for operating. HMI to be mounted no higher than 1800mm above finished floor to centre of display.
  - .1 Current Transformers: Where Generator Controller utilizes Current Transformers (CT) for measuring alternator current, CT ratio shall not to exceed generator overcurrent device rating.
- .4 Engine Alarm Panel: Alarm panel to be mounted on generator control panel, mounted to provide clear and easy access for operating. Alarm panel to be mounted no higher than 1800mm above finished floor to centre of panel. Alarm panel to be complete with illuminated annunciators with engraved nameplates reading:
  - .1 Low oil pressure alarm.
  - .2 High water temperature alarm.
  - .3 Low oil pressure shutdown.
  - .4 High water temperature shutdown.
  - .5 Over speed shutdown.
  - .6 Over cranking shutdown.
  - .7 Low Fuel alarm
  - .8 Fuel cell leak alarm
  - .9 Low coolant temp alarm
  - .10 Low coolant level shutdown
  - .11 Not in Auto

## 2.10 REMOTE MONITORING

- .1 Remote Monitoring: In addition to contacts for remote start and damper control, the generator control system shall provide the following 120VAC rated, form C dry contact output relays as to indicate the following generator alarms:
  - .1 Natural Gas Generator
    - .1 Generator Running
    - .2 Generator Failed
  - .2 Battery Charger
    - .1 Charger fail

## 2.11 WIRING AND CONNECTIONS

- .1 Provide all conduit, wiring and connections required and recommended by unit supplier.
- .2 Install all control and alarm wiring in RPVC conduit unless otherwise noted in the drawings.
- .3 Connect mid-point of generator to bonding conductor. Bond generator frame to ground by a separate #1/0 copper bonding conductor. Do not make connection between mid-point and generator frame at generator.
- .4 Provide female Cam-Loks and wiring to load bank breaker suitable for connecting a portable load bank. Cam-Lok connectors and wiring to be located within generator enclosure and sized for load bank testing of generator to 110% capacity. Mount Cam-Lok connectors on bottom or side of load bank breaker enclosure or dedicated enclosure adjacent to load bank breaker. Ensure connectors are mounted not more than 1200 above grade and minimum 500m of space is provide to enure easy connection of load bank cables. Provide door-in-door or similar access door to allow load bank cables to leave generator enclosure while main doors are closed.

## 2.12 OUTDOOR GENERATOR-SET ENCLOSURE

- .1 Description Weather and Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.
- .2 Hinged Doors: Lockable. For each door provide either integral lock or padlocking provision and high security padlock. All locks to be keyed alike. Provide 6 keys. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
- .3 Exhaust System: Muffler Location: Self contained within enclosure.
- .4 Hardware: All hardware and hinges shall be stainless steel.

- .5 Wind Rating: Wind rating shall be 195 kph.
- .6 Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
- .7 A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
- .8 Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.
- .9 Louvers: For generator sets greater than 200kW provide adjustable intake and exhaust louvers with thermostatically controlled electric damper motors.
- .10 Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the drawings.
- .11 Service: The enclosure shall allow unobstructed access to perform general maintenance for fluid changes, filter replacements, and monthly inspections as per manufacturers recommendations. Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- .12 Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 70 dBA measured at any location 7 m from the engine generator in a free field environment.
- .13 Site Provisions: Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.
- .14 Block Heater: Outdoor generators and enclosures shall be provided with block heaters and other heaters to suit exterior ambient conditions.
- .15 Rodent Proof: All penetrations and openings along bottom of enclosure to be sealed with filler plugs.
- .16 Enclosure to come complete with D.C. task lighting on each side of the generator enclosure.
- .17 Provide a gravity intake and exhaust louver to minimize air flow through the enclosure when generator set is not operating. Louvers shall include provisions to prevent accumulation of ice or snow that might prevent operation.

**3. EXECUTION**

**3.1 COORDINATION WITH OTHER SECTIONS OF WORK**

- .1 Coordinate to ensure proper execution of work covering ventilation, field supply and products-of-combustion exhaust, to form an efficient and well coordinated layout.

**3.2 INSTALLATION OF GENERATOR SET**

- .1 Provide terminal box for generator and exciter leads.
- .2 Install unit complete and make operational, coordinate with supplier for installation of loose shipped components. Contractor to intall all loose shipped components.
- .3 Coordinate installation of all in-slab conduits with manufacturer drawings prior to pouring concrete.

**3.3 INSTALLATION OF EXHAUST SYSTEM – EXTERIOR ENCLOSURE**

- .1 Open frame generator mounted indoors:
  - .1 The exhaust system shall be installed according to the engine manufactures recommendations and applicable codes and standards. Exhaust system to be supplied and installed by division 16.
  - .2 Coordinate size and installation of exhaust piping with sound attenuated enclosure.
  - .3 Provide 12 mm copper drain line with ball valve from **bottom** of muffler to drain cock for periodic draining of muffler.
  - .4 Provide flexible connection from manifold to muffler. Coordinate size and installation with division 15 and generator set supplier. Connection to be installed in a straight vertical mannon, bends and/or offsets in the flex connection are unacceptable and will be required to be corrected prior to commissioning.
- .2 Generator mounted in an exterior enclosure:
  - .1 To be installed as per manufacturer’s recommendations at the factory.

**3.4 INSTALLATION OF VENTILATION EQUIPMENT**

- .1 Generator mounted in an exterior enclosure:
  - .1 To be installed as per manufacturer’s recommendations at the factory.

### 3.5 OPERATION OF STARTING SYSTEM

- .1 Stop/start sequence: in automatic position, auxiliary contacts in transfer switch initiates starting cycle of unit. The control system provided shall include a cranking system, which shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between periods. After which if engine fails to start, trouble circuit contacts close illuminating appropriate trouble annunciator window and locking out starting cycle until manually reset. On starting of engine, starting circuits automatically reset. On resumption of normal power after time delay in transfer switch, load to retransfer to normal supply and following rundown period engine shall shutdown and return to starting condition.

### 3.6 CONTROL PANEL TROUBLE INDICATION

- .1 Incorporate contacts so that when shutdown occurs from one set of shutdown contacts, subsequent operation of all shutdown contacts are locked off from operating annunciators.
- .2 Operation of silencing switch shall silence trouble alarm but pilot light shall remain illuminated.
- .3 On return to normal and resetting off annunciators, trouble horn shall sound again until switch is returned to normal position.

### 3.7 STANDBY POWER GENERATION SYSTEM TESTING

- .1 Prior to energizing power generation units on site:
  - .1 Ensure generating system is disconnected from normal power supply.
  - .2 Ensure all auxiliary support devices are operational, including ventilation and exhaust systems.
  - .3 Ensure that engine has proper lubricant levels, coolant levels and fuel supply.
  - .4 Ensure all testing on emergency distribution equipment and transfer switch as specified has been completed.
- .2 Site Testing:
  - .1 Perform torsional analysis test of engine and generator compatibility.
  - .2 Perform a four hour load test using a portable test bank. Perform test for four hours with load applied in 20% steps every 30 minutes until full load is applied and one hour at 110% full load. Record following at 5 minute intervals for the first 30 minutes and 30 minute intervals for the remainder of the test. All recordings to be done with computer or digital chart recorder, handheld meter and handwriting on paper are not acceptable:
    - .1 Kilowatts
    - .2 Amperes
    - .3 Voltage
    - .4 Frequency



- .5 Oil Pressure
- .6 Coolant Temperature
- .3 Test response of governor (droop or isochronous) applying 20% load and 100% load in one step. Use a Computer or storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test. Record readings at minimum 0.01 second intervals for a duration of 15 seconds.
- .4 Test voltage regulator and compare for conformance to manufacturer's product data.
- .5 Record noise level measurements in dBA at various locations around unit and area surrounding exhaust port.
- .6 Submit certified tests results for approval by owner representative.
- .7 Conduct Site Testing in conjunction with manufacturer and in presence of the owner representative.
- .8 Test maximum power up to 110% of rated generator set. This does not mean oversize the generator, the intent is to measure and record absolute maximum output before the generator shuts off.
- .9 Simulate power failure including operation of:
  - .1 Transfer switch.
  - .2 Automatic starting cycle.
  - .3 Automatic shutdown and return to normal.
  - .4 Loss of single phase by utility and return to normal
- .10 Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable.
- .11 Test building load and automatic transfer switch settings, coordinate testing with section 16237 Automatic Transfer.
- .12 Contractor is responsible for filling the diesel tank prior to testing. After Site testing has been completed to the satisfaction of the owners representative the Contractor is responsible to refill the diesel fuel tank with "winter diesel" to the full level.
- .13 Generator Manufacturer to provide test results to Contractor and Owner's representative within 10 business days of completion of test. Result to be submitted as an electronic document. Excel (.xls or .xlsx) and Portable Document Format (.pdf) are acceptable. Owners representative reserves the right to withhold up to \$2,500 if the test results are not received.

**END OF SECTION**

**1. GENERAL**

**1.1 SYSTEM**

- .1 Provide complete factory assembled power transfer equipment with electronic microprocessor-based controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of the normal source and one phase of the emergency source, positive mechanical and electrical interlocking, and mechanically held contacts for both.
- .2 The transfer system shall consist of a delayed neutral transition transfer switch. All control modules shall be the product of the same manufacturer.
- .3 The transfer switch shall transfer the load in delayed transition (break-before-make) mode. Transfer is accomplished with a user-defined interruption period in both directions adjustable from 1 second to 5 minutes in at least 15 second increments. Unit is to be designed for fully automatic operation upon power failure.

**1.2 ACCEPTABLE MANUFACTURERS**

- .1 The automatic transfer switch shall be provided by Onan, ASCO, EATON or GE.

**2. PRODUCTS**

**2.1 COMPONENTS**

- .1 Automatic transfer switch: 200Amp, 3 pole, fully automatic electrically operated, mechanically held, for all load classes with normal and emergency supply of 120/208 3 phase, 4 wire, complete with auxiliary engine starting contacts, full phase relay protection to operate on normal power voltage drop to 70 per cent on any phase. Detects when all three phases are present, have the correct sequence and detects if voltage or phase angle asymmetry is below set value. Transfer switch to be a contactor based switch not a breaker style type.
- .2 The electrical operator shall be a solenoid mechanism, momentarily energized. The transfer switch unit shall include both electrical and mechanical interlocks to prevent both sets of main contacts from being closed at the same time. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- .3 Provide time delay relays, adjustable from 10 seconds to 5 minutes to delay transfer from normal to standby until standby power source has obtained 90 per cent of rated voltage.
- .4 Provide time delay relays, adjustable from 1 to 5 minutes, to delay transfer from standby to normal source.
- .5 Provide time delay relays, adjustable from 0 seconds to 5 minutes , to adjust time in neutral "off" position.

- .6 Provide time delay relays, adjustable from 0seconds to 5 mintures , to delay engine start contact.
- .7 Provide time delay relays, adjustable from 10 seconds to 30 minutes for engine cool down.
- .8 Fault level to match level of specified equipment fed from transfer switch.
- .9 In cover of transfer switch provide red pilot light indicating emergency position of transfer switch complete with test switch to simulate a power failure.
- .10 Provide two sets of normally open contacts, one on normal supply and the other on standby supply.
- .11 Provide a set of normally open contacts for transfer switch controller alarm contacts.
- .12 Provide time delay relays adjustable for 0-2 minutes, to delay transfer from load to neutral to load.
- .13 Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all three phases and frequency. System status screens shall display a clear description of the active operating sequence and switch position.
- .14 Inspections of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- .15 The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side, single phase failures on a Grounded Wye – Grounded Wye transformer which regenerates voltage when unloaded. The algorithm shall also inhibit retransfer to the normal (utility) source upon detection of a single phasing condition until a dedicated timer expires, the alternate source fails, or the normal source fails completely and is restored during this time delay period. The time delays associated with this feature shall be adjustable by the user through the controller keypad and LCD.
- .16 A 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port.
- .17 All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port. The time delay value displayed on the LCD or remote device shall be the remaining time until the next event occurs.

**3. EXECUTION**

**3.1 OPERATION**

- .1 Automatic start-up upon normal power failure.
- .2 Transfer when standby unit reaches 90% of rated voltage.
- .3 Retransfer to neutral position then to normal supply after time delays, when normal power is resumed.
- .4 Engine rundown period at "No "Load".
- .5 Engine shutdown.
- .6 Operating sequence automatically reset.
- .7 Connect emergency circuit to emergency contacts in transfer switch for connection to damper controls associated with cooling system.

**3.2 COMMISSIONING**

- .1 To be performed in conjunction with section 16971.
- .2 Provide and pay for the manufacturer representative to commission the transfer switch.
- .3 Notify the Owner 1 week prior to the day in which the transfer switch is to be commissioned.
- .4 Set and adjust all Transfer Switch parameters as per the Owners requirements.
- .5 Commission the transfer switch in the presence of the Owner or Owners representative via a live load test as follows:
  - .1 Turn off the main breaker to the transfer switch.
  - .2 Verify the power transfer from normal to emergency power.
  - .3 Turn on the main breaker to the transfer switch.
  - .4 Verify the power transfer from emergency to normal power.
  - .5 Coordinate Utility to turn off a single phase at a time for the primary of the transformer. Ensure all building loads are turned off or disconnected.
  - .6 Verify "Ghost" phasing does not occur in the disconnected phase by verifying that the transfer switch does not transfer back to utility (normal power) when not under load.
- .6 Record all data and parameter settings on a type written sheet and provide copies to be inserted into the Operation and Maintenance Manuals.

**END OF SECTION**

**1. GENERAL**

**1.1 PRODUCT DATA**

- .1 All performance and test data to meet with the Owners Representative approval, CEMA and IEEE Standards.

**2. PRODUCTS**

- .1 Panel Transformers: 3 phase, 60 Hz, delta 480V-120/208, KVA as indicated on drawings, grounded star, air cooled type, natural circulation in ventilated metal case to CSA and CEMA standards, Class B insulation with temperature rise not exceeding 80°C for rise above 40°C.
- .2 Provide four 2.5 per cent full capacity taps, two above and two below normal voltage.

**2.1 MOUNTING**

- .1 Transformers:
  - .1 Panel Transformers: - Provide mounting brackets for transformers, refer to drawings for details.

**3. EXECUTION**

**3.1 NAMETAGS**

- .1 Provide name tags indicating full electrical data, connection diagrams, etc.

**END OF SECTION**

**1. GENERAL**

**1.1 SOURCE OF SUPPLY**

- .1 All disconnects shall be by a single manufacturer.

**1.2 COORDINATION**

- .1 Coordinate installation of disconnects for equipment specified in other Divisions with installation of such equipment.

**2. PRODUCTS**

**2.1 UNFUSED DISCONNECTS**

- .1 Unfused Disconnects: to CAN/CSA-C22.2 No. 4 - M89 and as follows:
  - .1 Poles, Voltage, Amperage, kW Rating and Enclosure: as indicated on drawings or schedules; if not indicated, select disconnect to suit application.
  - .2 Type: general duty.
  - .3 Operation: lever handle, capable of being locked in "On" or "Off" position.

**2.2 FUSED DISCONNECTS**

- .1 Fused Disconnects: to CSA C22.2 No. 39-M1987 and as follows:
  - .1 Same as unfused disconnects except complete with fuse holders.
  - .2 Fuse holders shall be compatible with fuses as specified in Section 16443.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Disconnects shall be located by all motors and mechanical units as required by the Canadian Electrical Code.
- .2 Coordinate installation of disconnects for equipment specified in other Divisions and installed by this Division.

**END OF SECTION**

**1. GENERAL**

**1.1 REFERENCE STANDARDS**

- .1 Provide motor protection switches of the CEMA size listed. Maximum rating of units not using CEMA rating to be equivalent to CEMA size indicated.

**2. PRODUCTS**

**2.1 SINGLE PHASE MOTOR STARTERS**

- .1 For motors 1/4 h.p and above, quick-make, quick-break with 120VAC operating coil, motor rated contacts sized for the H.P. rating of the motor controlled.

**2.2 THREE PHASE MOTOR PROTECTION SWITCHES**

- .1 Across-the-line magnetic motor protection switches with three overload relays, complete with 120 V operating coil, 480V/120 V control transformer of sufficient VA to handle the starter coil, controls, and integral pilot light.

**2.3 COMBINATION STARTERS**

- .1 Molded case air circuit breaker style complete with rotary type switch with operating handle and lock-off facility. Opening starter enclosure restricted by the use of a defeater screw, unless switch is in the "Off" position.
- .2 Each combination magnetic motor protection switch installed in unit motor control centre to house the following facilities:
  - 1. Moulded case automatic air circuit breaker.
  - 2. Contactor with three overload relays.
  - 3. 120 V holding coil.
  - 4. Pilot light in cover (resistor, transformer, or neon type).
  - 5. Reset button, HOA switch in cover, field convertible to Off/Auto or Start/Stop push button as indicated.
  - 6. Two sets of normally open auxiliary contacts in addition to the standard auxiliary holding contacts supplied with each contactor. One set of auxiliary contacts convertible to normally closed.
  - 7. Control transformer primary and secondary fusing - primary fusing to be HRC type.

8. Control transformer 208V/120 V of sufficient VA to operating coil and associated controls.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 In finished area, provide flush mounted motor protection switches complete with stainless steel cover plates.
- .2 Select overload device trip setting for combination starters to suit the motors. Select heaters to suit full load current of motors.

**END OF SECTION**



**1. GENERAL**

**1.1 RELATED SECTIONS**

- |    |                                  |                 |
|----|----------------------------------|-----------------|
| .1 | Cast-In-Place Concrete:          | Division 03300. |
| .2 | Basic Electrical Requirements:   | Division 16005. |
| .3 | Electrical Identification:       | Division 16075. |
| .4 | Electrical Starting and Testing: | Division 16971. |
| .5 | Overcurrent Protective Devices:  | Division 16443. |

**1.2 SOURCE OF SUPPLY**

- .1 All distribution panelboards shall be by a single manufacturer.

**1.3 PRODUCT DATA**

- .1 Comply with requirements of Division 16005.
- .2 Provide manufacturer's product data for all systems and components.
- .3 Provide data on manufacturer's recommended environmental conditions for equipment affected by temperature.

**1.4 COORDINATION**

- .1 Coordinate size and location of concrete housekeeping bases with work specified in Section 03300.

**2. PRODUCTS**

**2.1 DISTRIBUTION PANELBOARDS**

- .1 Distribution panelboards to CSA C22.2 No.29-M1989 and as follows:
- .1 Bus characteristics:
    - .1 Construction: rectangular section tin plated joints.
    - .2 Bracing: 18,000 Amperes symmetrical.
    - .3 Neutral: full capacity, solid neutral design.
    - .4 Ground bus: copper.
  - .2 Enclosure:
    - .1 Prefinished painted sheet steel.
    - .2 Uniform height, depth and width.

- .3 Drip cover.
- .3 Trim:
  - .1 Hinged door on door construction hinged cover doors, 2 keys per unit.
- .4 Overcurrent Protective Devices: bolt-in breakers as specified in Division 16443.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install panelboards securely, plumb and square to adjoining surfaces.
- .2 Install panelboards flush or surface as indicated.
- .3 Mount panelboards at not less than 1800 mm to top of trim.
- .4 Connect loads to feeder breakers as specified in distribution panelboard schedules.
- .5 Breaker sizes as specified in distribution panelboard schedules.

**END OF SECTION**

**1. GENERAL**

**1.1 PRODUCT DATA**

- .1 Comply with requirements of Section 16005.
- .2 Provide manufacturer's product data for all devices.
- .3 Provide following information:
  - .1 Time current characteristic curves on full size (280 mm x 432 mm) log-log time/current graph paper.
  - .2 Fault interrupting capability of each device in symmetrical amperes at applied voltage.
  - .3 Time current curves for all circuit breaker overload, overcurrent and ground current tripping devices.
  - .4 Relay current transformer ratios, accuracy class and current sensor tap ranges.
  - .5 Motor control overcurrent protective device characteristics and curves.
  - .6 Current limiting let-through information for HRC fuses in graph form.
  - .7 Minimum melting and maximum clearing time/current curves for HRC fuses.

**1.2 SOURCE OF SUPPLY**

- .1 Supply all overcurrent protective devices in each of the following categories by a single manufacturer:
  - .1 Moulded case circuit breakers.
  - .2 Fuses.

**2. PRODUCTS**

**2.1 MOULDED CASE CIRCUIT BREAKERS - GENERAL**

- .1 Moulded Case Circuit Breakers: to CAN/CSA-C22.2 No. 5.1-M91.

## 2.2 BRANCH MOULDED CASE CIRCUIT BREAKERS

- .1 Trip Type: thermal/magnetic.
- .2 Voltage: as indicated in schedules.
- .3 Poles: as indicated in schedules.
- .4 Interrupting Capacity: 10,000 symmetrical.
- .5 Mounting: bolt-in any position.
- .6 Normal operation: in 40°C ambient.
- .7 Features:
  - .1 Thermal and instantaneous magnetic trip.
  - .2 Trip free, toggle type operation.
  - .3 Quick-make, quick-break action.
  - .4 Positive handle trip indication.
  - .5 Trip rating visible with panel trim installed.

## 2.3 FEEDER MOULDED CASE CIRCUIT BREAKERS

- .1 Trip Type: thermal/magnetic.
- .2 Voltage: as indicated in schedules.
- .3 Poles: as indicated in schedules.
- .4 Interrupting Capacity: 42,000.
- .5 Mounting: bolt-in any position.
- .6 Normal operation: in 40°C ambient.
- .7 Features:
  - .1 Thermal and instantaneous magnetic trip.
  - .2 Trip free, toggle type operation.
  - .3 Quick-make, quick-break action.
  - .4 Positive handle trip indication.
  - .5 Trip rating visible with panel trim installed.

## 2.4 FUSES

- .1 Plug and Cartridge Standard (STD) Fuses: to CSA-C22.2 No. 59.1-M1987 and as follows:
  - .1 Standard fuse interrupting ratings: 10 kA symmetrical.
  - .2 HRC fuses: to CAN/CSA-C22.2 No. 106-M92 and as follows:
    - .1 HRC fuse interrupting ratings: 200 kA symmetrical.
    - .2 HRC fuse types:
      - .1 HRCI-J non-time delay.
      - .2 HRCI-J time delay.
      - .3 HRCI-R non-time delay.
      - .4 HRCI-R time delay.

- .5 HRCII-C (motor protection only).
- .6 HRC-L non-time delay.
- .7 HRC-L time delay.
  
- .3 Voltage: as indicated in schedules.
- .4 Ampacity: as indicated in schedules.
- .5 Fuse Types: as indicated on drawings.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install overcurrent protective devices as indicated, in accordance with manufacturer's written instructions.
- .2 Fasten overcurrent protective devices without causing mechanical stresses, twisting or misalignment of equipment in final position.
- .3 Set field-adjustable trip settings as indicated subsequent to installation.
- .4 Overcurrent protective device sizes and identification as specified in respective equipment schedules.

**3.2 TESTING AND ADJUSTING**

- .1 Comply with requirements of Section 16971.

**END OF SECTION**

**1. GENERAL**

**1.1 SHOP DRAWINGS**

- .1 Provide shop drawings for luminaires. Include all pertinent physical characteristics. Manufacturer's standard catalogue literature, clearly marked, may be used where applicable. Provide photometric data for each fixture and lamp combination.

**2. PRODUCTS**

**2.1 LUMINAIRES**

- .1 As indicated in Luminaire Schedule in drawings.

**2.2 LAMPS**

- .1 Provide all luminaires complete with lamps or tubes.
- .2 Fluorescent Lamps: F32/T8, F54/T548 program start, 48 inch nominal length, cool white, 2800 initial lumens, Lamp to be 4100K.

**2.3 BALLASTS**

- .1 Fluorescent Ballasts: to Canadian Ballast Manufacturers (CBM) standards, two lamp, high power factor, rapid start, energy saving, best available sound rating.
- .2 H.I.D. Ballasts: high power factor, constant wattage, autotransformer type with minimum 1.6 current crest factor.
- .3 LED drivers to be easily replaceable in the field without the need to remove entire light fixture.

**2.4 LIGHTING CONTROLS**

- .1 Controls: Provide switches, photoelectric controls, timers and relays for lighting circuits and luminaires as indicated on drawings.

**2.5 APPROVED ALTERNATES**

- .1 Contract lighting design is based on the light figures and controls specified in the drawings, specifications, and luminaire schedule. Alternate make and models of light fixtures and lighting control equipment will be considered during shop drawing submissions (not during Tender) providing the Contractor:
  - .1 provides photometric reports showing light levels comparing fixtures specified and proposed alternates.
  - .2 provides product specification sheet clearly indicating comparable features to the specified equipment.
  - .3 Provide a statement of compliance with supporting calculations for proof of NECB prescriptive path compliance.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Provide adequate supports for luminaires. Use chain or rods for suspended luminaires. Do not support luminaires over 5 kg in weight from outlet boxes.
- .2 Coordinate luminaire installation with architectural details, reflected ceiling plans and mechanical equipment. Install accurately in line and level, to present a neat appearance and avoid conflicts.
- .3 Do the following prior to Interim Acceptance of the Work:
  - .1 Clean all luminaires to remove construction dust and debris.
  - .2 Re-lamp with new lamps, all luminaires which have been used for more than two months as temporary lighting during construction.

**END OF SECTION**

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**1. GENERAL**

**1.1 RELATED SECTIONS**

- |    |                                 |                |
|----|---------------------------------|----------------|
| .1 | Basic Electrical Requirements:  | Section 16005. |
| .2 | Voice and Data Cabling Testing: | Section 16712. |
| .3 | Wire and Cable                  | Section 16121. |

**1.2 ABBREVIATIONS**

- |    |          |   |
|----|----------|---|
| .1 | ETL      | Electronic Testing Laboratories         |
| .2 | IDC      | Insulation Displacement Connectors      |
| .3 | UTP      | Unshielded Twisted Pair                 |
| .4 | NEXT     | Near End Crosstalk                      |
| .5 | ELFEXT   | Equal Level Far End Crosstalk           |
| .6 | PSNEXT   | Power Sum Near End Crosstalk            |
| .7 | PSELFEXT | Power Sum Equal Level Far End Crosstalk |

**1.3 INSTALLER QUALIFICATIONS**

- .1 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project.

**1.4 SCOPE**

- .1 System to be complete with all data and voice outlets, patch panels, patch cords, wire and cable required to from a complete system.
- .2 Install cable in raceway in exposed locations or where concealed in inaccessible walls and ceilings. Elsewhere cable may be installed without raceway.

**1.5 STANDARDS**

- .1 Comply with the following standards:
- |    |                                 |
|----|---------------------------------|
| .1 | TIA/EIA 568-B1, B2 and B3       |
| .2 | TIA/EIA TSB-67, 72 and 75       |
| .3 | ANSI/TIA/EIA 568a-1, 2, 3, 4, 5 |
| .4 | TIA/EIA/IS 729                  |
| .5 | BICSI                           |

**2. PRODUCTS**

**2.1 HORIZONTAL CABLING TO WORKSTATION**

- .1 UTP: to CAN/CSA T529-M95 and TIA/EIA 568 - B1, B2, B3, Category 6.



## **2.2 COMMUNICATIONS OUTLET ASSEMBLIES**

- .1 Communications Outlet - Boxes:
  - .1 1 gang recessed box, 63 mm minimum depth with 19 mm deep two device adapter ring, 1.6 mm 16 AWG thickness.
- .2 Communications Outlet - Housings:
  - .1 Formed Outlet Plate.
    - .1 Maximum dimensions: 150 mm x 150 mm x 38 mm deep.
    - .2 Rear and side entry of cable. Strain relief provisions for side entry of cable.
    - .3 Flat plate: minimum thickness 3.9 mm.
  - .2 Accepts minimum of two snap-in or slide-in outlet inserts.
  - .3 Mounts to standard one or two device opening or mounting ring.
  - .4 Constructed of high-impact fire-retardant thermoplastic.
- .3 Communication Outlet - Jacks:
  - .1 Copper-Based Inserts: to TIA/EIA 568-B1, B2, B3, Category 6 standards, worst pair:
    - .1 Termination via fixed or removable IDC, AT&T 110, Krone LSA-Plus, or NT BIX IDC's with hinged or separate stuffer cap.
    - .2 If removable IDC type is used, they must meet the following physical specifications:
      - .1 Connection of removable IDC's via 8-position edge connectors plated with minimum 40 microns of nickel. Capable of minimum 250 insertion and withdrawal cycles.
      - .2 Connection of removable IDC's via 8-pin header connector. Maximum 8.9 N engagement force and minimum 2.25 N disengagement force. Pins minimum 1.4 mm square.
  - .2 Modular Outlet - UTP:
    - .1 8-position unkeyed jack for voice and data compatible with 4-pair 100 ohm unshielded twisted pair.
    - .2 Capable of minimum of 200 insertion and withdrawal cycles.
    - .3 Copper-based contacts with 50 to 100 microns of nickel overlay uniformly coated with minimum 50 microns of gold overlay.

- .4 Minimum contact force 1.1 N per contact. Minimum plug retention force 76 N.
- .5 Conductors separated and aligned internally by comb structure.
- .6 Electrical Specification:
  - .1 Contacts:
    - .1 Dielectric strength: 1000 V rms @ 60 Hz.
    - .2 Insulation resistance: 10 megohms, minimum.
    - .3 Contact resistance: 0.02 ohms, maximum.
    - .4 Current rating: 1.5 amps, maximum.
  - .2 Insulation Displacement Connectors:
    - .1 Voltage Rating: 250 VAC.
    - .2 Current Rating: 5 amps.
    - .3 Resistance: 0.02 ohms maximum.
    - .4 Dielectric Withstanding: 2000 VAC for 60 sec.
    - .5 Insulation Resistance: 500 megohms minimum.
- .7 Rated for data transmission up to 100 MHz.
- .8 Wire configuration to T568A pair assignment

### **2.3 PATCH CABLES**

- .1 UTP Type:
  - .1 Patch Cables to match installed cable's transmission and electrical specifications.
  - .2 Fire Rating: plenum rated overall jacket, CSA FT-4 compliant.
  - .3 Modular Connectors:
    - .1 Matching types and minimum specifications as for outlet components.
    - .2 Long body type.
    - .3 Suitable for solid or stranded conductor and wire gauge used.
    - .4 Tool-stuffed or plier-stuffed with IDC contacts and plier-latched cap.
    - .5 Factory manufactured
  - .4 Quantity: Provide one 1 m and one 3 m UTP patch cord for each new cable outlet.

### **2.4 IDENTIFICATION MATERIALS**

- .1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
  - .1 Size 1: 12 mm high with 5 mm high letters.
- .2 Wire Identification Materials: Use one of the following:
  - .1 Machine-printed heat shrink sleeves.

.3 Device Identification Materials: Machine-printed black lettering on clear adhesive tape, sizes as follows:

.1 Size 1: 12 mm high with 5 mm high letters.

### **3. EXECUTION**

#### **3.1 INSTALLATION**

.1 Cable Installation:

.1 Generally install FT4 rated data cable and voice cable using raceway except where noted otherwise on drawings or as follows.

.2 Install data and voice cable in conduit where:

.1 concealed in inaccessible walls or ceilings

.2 exposed to mechanical damage

.3 cable runs require fire rating (for example in riser shafts)

.3 Support cable runs independently of ceiling suspension system.

.4 Swab raceway system before installing wiring.

.5 Do not exceed manufacturer's maximum pulling force.

.6 Maintain not less than minimum bending radius for fiber and copper conductors.

.7 Install cable along or at right angles to building lines unless impractical to do so. Verify specific cases of deviation in advance.

.8 Maintain open copper-conductor cable at maximum practical distance from fluorescent ballasts and other EMF - or discharge-generating equipment.

.9 Ensure that cable is not flattened, squeezed, or crimped at any point along entire run. No splices or intermediate terminations in cable runs except by special permission in advance, with documentation detailing locations and nature of splices.

.10 Install cables in PVC raceway in telecom room and fan individual cables to applicable patch panels in neat, logical fashion.

.11 Tie wrap cables neatly into logical bundles.

.12 Minimum 3 m of slack cable per run.

- .2 Connectors:
  - .1 Use tooling specific to connector types in use.
  - .2 Use connectors suitable for nature of conductor in cable, eg. stranded vs solid copper.
  - .3 Ensure that connectors' strain relief provisions are used. Strip jackets only amount required.
  - .4 Maintain pair twists within 13 mm of termination.
  - .5 UTP Connection Configuration in accordance with EIA/TIA 568A-1991 or CAN/CSA-T529-M95.

Pair	Colour	RJ-45 Pins
1	Blue	4
	White/Blue	5
2	White/Orange	3
	Orange	6
3	White/Green	1
	Green	2
4	White/Brown	7
	Brown	8

- .3 Outlets, Boxes and Fittings:
  - .1 Ensure in advance that outlet box/data outlet installation methods yield vertically-mounted data outlets.
  - .2 Install all outlets flush with finished surfaces unless indicated otherwise on the drawings.
- .4 Cabinets, Enclosures, Racks, Backboards:
  - .1 Install at locations and heights indicated on drawings.
  - .2 Use green insulated 6 AWG ground conductors for grounding racks. Use grounding bushing, solderless lug, clamp, or cup washer and screw.
  - .3 Protect ground conductors from mechanical injury.
  - .4 Install ground conductors such that neither ground conductors nor data cables interfere with one another in regards to future servicing of patch panel rear connections.

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- .5 Patch Panels
  - .1 Mount patch panels in order shown on drawings.
  - .2 Ground as required by system.
  - .3 Attach horizontal wiring in an ordered fashion according to the numbers as indicated on the drawings.
  - .4 Mount panels to racks with as many screws as there are mounting holes or slots in panels.
  - .5 Provide and install necessary strain reliefs and cable support brackets, plus trays for cable loop behind panel and install cables utilizing such devices.

**3.4 COMMUNICATIONS CABLE AND EQUIPMENT LABELING**

- .1 Label communication outlets, panels and ports with size 1 Device Identification Materials.
- .2 Label each of cables with other end's address using Wire Identification Materials.
- .3 Label outlets with labels vertically aligned in each row.
- .4 Position panel labels in the same position on each panel.
- .5 Use the following naming convention as indicated on the drawings when labeling communications cabling components.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 Data and Voice Cabling: Section 16711.

**2. PRODUCTS**

Not Used

**3. EXECUTION**

**3.1 TESTING**

- .1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to Owner. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
- .2 Copper Media:
  - .1 Test for the following:
    - .1 Continuity.
    - .2 Pair placement and polarity.
    - .3 DC resistance.
    - .4 Characteristics at Highest contemplated frequency for data and voice cables:
      - .1 Attenuation.
      - .2 Mutual Capacitance.
      - .3 NEXT, PS NEXT, ELFEXT and PS ELFEXT
    - .5 Run length.
  - .2 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:
    - .1 Resistance and capacitance readings more than 10% above or below predicted values.
    - .2 NEXT, PS NEXT, ELFEXT or PS ELFEXT values 3dB higher than predicted values.
    - .3 Attenuation values 2dB higher than predicted values.
  - .3 Reconnect or re-install and retest as necessary to correct excessive variations.

**3.2 REPORT**

- .1 Record results in tabular form.
- .2 Segregate horizontal runs, inter-room runs, and risers by category or run and by type of cable.
- .3 Present horizontals' results in ascending order, following grid numbering.
- .4 Report Submission:
  - .1 Submit three reports printed on 215 mm x 280 mm white paper. Leave copies unbound for insertion into O&M manuals.
  - .2 Submit report prepared in electronic form using Microsoft Excel or Lotus 1-2-3 on a CD.

**END OF SECTION**

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**1. GENERAL**

.1 Not Applicable.

**2. PRODUCTS**

.1 Not Applicable.

**3. EXECUTION**

**3.1 INSTALLATION**

.1 Contractor is responsible for all installation and connection charges.

.2 Telephone line shall be minimum 6 pair cable.

.3 For underground service entrance refer to drawings.

.4 Supply and connect telephone lines from telephone board to modems.

.5 Contractor is responsible for leased line installation and connection requirements on site.

.6 Contractor is responsible for telephone line installation and connection requirements.

**END OF SECTION**



**1. GENERAL**

**1.1 SYSTEM DESCRIPTION**

- .1 This section includes the supply and installation and connection of all conduit, wire, outlet boxes, components, etc. required for a complete video surveillance system consisting of: video cameras, network video recorder and a poe switch. The system is to continuously record video from all cameras.

**1.2 SOURCE OF SUPPLY**

- .1 Basis of design products noted in section 2 can be procured from:

Pinnacle Security  
Kris Osberg  
104C 920 2A Ave North  
Lethbridge AB, T1H 0E3  
403-320-9500  
[kosberg@pinnaclesecurity.ca](mailto:kosberg@pinnaclesecurity.ca)

- .2 Alternates suppliers will be accepted

**1.3 ALTERNATE PRODUCTS**

- .1 Alternate products will be acceptable providing the submitted equipment meets or exceeds the specified equipment.
- .2 Alternates will not be reviewed until shop drawing phase of the project.

**1.4 SHOP DRAWINGS**

- .1 Submit product data sheets with selected equipment part numbers clearly indicated.
- .2 See specification 16005 for additional requirements.

**2. PRODUCTS**

**2.1 VIDEO CAMERA**

- .1 Manufacturer: Eye Sonic or approved equivalent
- .2 Model: ES-3283-SZ Fixed Mini Dome Camera
- .3 Model: ES-5483-SZ Bullet Camera
- .4 Features:
  - .1 Megapixels: 4, 2688 x 1520
  - .2 Resolution: 1080P Full HD

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- .3 Video Streams: dual
- .4 Lens: Motorized 2.88mm – 12mm
- .5 Noise reduction
- .6 POE (802.3af)
- .7 IR Range: 30m
- .8 Protection rating: IP66
- .9 Audio and Alarm input/ouput
- .10 Storage: Micro Sd slot upto 128
- .11 Protocols: TCP/IP, HTTP, DHCP, DNS, RTP, RTSP, PPPoE, SMTP, NTP, SNMP, HTTPS, FTP, 802.1x, Qos
- .12 Connection port: RJ 45 10/100M Ethernet
- .13 Operating Temperature Range: -30° to 60°C

- .5 Location: As shown on drawings.

## 2.2 CARD READERS

- .1 Manufacturer: Kantech or approved equivalent
- .2 Model: ioProx P225KPXSF
- .3 Model: ioProx P225XSF
- .4 Features:
  - .1 Fixed-English LCD displays system status
  - .2 Soft-touch rubber continuous backlit keys
  - .3 Piezoelectric sounder with audible beeps to indicate system status and entry/exit delay
  - .4 System functions clearly labeled on telephone style keypad
- .5 Location:
  - .1 Emergency Service North Entrance: ioProx P225KPXSF
  - .2 Emergency Service South Entrance: ioProx P225KPXSF
  - .3 Vestibule Entrance: ioProx P225KPXSF
  - .4 Lobby Entrance: ioProx P225XSF
  - .5 Corridor 103 Entrance: ioProx P225XSF
  - .6 Bay Entrance: ioProx P225XSF
  - .7 Open Gym: ioProx P225XSF

## 2.3 NETWORK VIDEO RECORDER

- .1 Manufacturer: Eye Sonic or approved equivalent
- .2 Model: ES-7608-P8K

.3 Features:

- .1 Fully integrated, stand-alone video recording management solution in a compact design.
- .2 Four-channel digital recorder using H.264 compression technology.
- .3 View, record, control cameras, handle alarms and check device status through a web browser interface.
- .4 Real-time digital recording and playback at 720p resolution on all channels simultaneously.
- .5 Multiple control options via USB mouse, front panel and remote control.
- .6 Remote configuration and management of devices on surveillance system.
- .7 10/100 Base-T Ethernet port for local or wide area network connection.
- .8 The Video Recorder shall contain alarm handling functions and telemetry control. The alarm functions shall include Motion detection in user-definable areas on any camera input.
- .9 The Video Recorder shall provide a built-in web application for live viewing, playback and configuration over a network. This application shall allow four users to control the video recorder simultaneously.
- .10 Power Input: 120vac
- .11 POE: 4 independent RJ45 100Mbps Ethernet connectors
- .12 Alarm Inputs: 4 Inputs configurable NO/NC, max input voltage 15 VDC
- .13 Storage: 1 SATA 2TB hard drive.
- .14 Video recorder to be 19" rack mountable.

.4 Accessories:

- .1 Rack mount hardware
  - .1 Provide mounting hardware to install recorder in 19" data rack
- .2 USB optical mouse
  - .1 USB connectivity 1.1 or 2.0
  - .2 Type A male 4 pin USB connector
  - .3 Optical movement detection.
  - .4 Two (2) button with scroll wheel.

**2.4 VIDEO MONITOR**

- .1 Accessories
  - .1 Video cables: HDMI, DVI, VGA
  - .2 Wall mount rack: Fixed

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Contractor to provide and install 1 conduit run for each camera including Cat6 wiring for the POE cameras

- .2 Leave sufficient slack in cables and identify at both ends. No splices of conductors will be acceptable
- .3 Contractor to provide and install one octagonal junction box recessed in the block wall for each camera's mounting.
- .4 Verify final mounting locations of cameras with Owners Representative prior to rough in.
- .5 Complete Video Surveillance System equipment to be installed and verified by a professional security installation company located within 2 hour driving distance of the project location.
- .6 Identify NVR with lamacoid nameplate stating "Video Surveillance System".

### **3.2 PROGRAMMING**

- .1 The cameras are to be used to monitor the sludge capacity in the container in the load out building.
- .2 System integrator is responsible for programming the motion detection and blanking regions for the camera in the NVR configuration software so that an alarm message can be sent to the operators when an approximate level of sludge in the container has been reached.
- .3 The Owner reserves the right to withhold \$1000 should the documentation not be submitted.

### **3.3 TESTING AND COMMISSIONING**

- .1 Prior to final acceptance of the system, contractor to fully test the system. Tests shall include:
  - .1 Verify motion detection for each camera.
  - .2 Recording and playback of captured video.
  - .3 Camera heaters are operational (where applicable).
  - .4 Alarm callouts and email messages
- .2 Tests shall be conducted after system is connected to the NVR to ensure that remote signals are properly received.
- .3 Tests shall be carried out in the presence of the Owner.
- .4 Refer to specification 01810 for additional commissioning requirements.
- .5 Upon completion of system testing described above, the system installer shall conduct a training program for designated maintenance and operating personnel. Operating personnel shall be trained to accomplish and understand all aspects of system operation. Maintenance personnel shall be trained to perform maintenance of the system. Training period schedule to be set by the Owner. Training periods shall be of duration required to serve all personnel and shall be carried out after the system is totally completed.

**3.4            MANUALS**

- .1        Provide three (3) full operating and maintenance manuals for the system. Each manual to contain descriptive literature on each system component, full system wiring diagrams, operation and maintenance procedures, parts list, etc.

**END OF SECTION**

**1. GENERAL**

**1.1 SYSTEM DESCRIPTION**

- .1 This section includes the supply and installation and connection of all conduit, wire, outlet boxes, components, etc. required for a door access control panel. of a security control panel and door contacts.
- .2 The security control panel shall provide door monitoring, control and alarm functionality. The door access control panel shall also be connected to the Local area network and be configured for alarm notifications.

**2. PRODUCTS**

**2.1 DOOR ACCESS CONTROL PANEL**

- .1 Electrical
  - .1 Aux power 120V:24VAC class 2 transformer
  - .2 12AH 12VDC battery backup
  - .3 Door strike power: 12VDC
  - .4 External Lock Power: 12-24VDC
- .2 System to be capable of monitoring and controlling 4 doors. System to be self contained and operate in standalone mode.
- .3 Communication: Ethernet 10/100Base-T via RJ45 connector
- .4 Accessories:
  - .1 Cabinet: Large oversized cabinet for upto 6 expansion modules, c/w lock and keys.
  - .2 Additional accessories as required to provide a complete system.
- .5 Installation Location: Install panel recessed into new wall, provide and install custom finish trim around panel exterior.

**2.2 ELECTRIC STRIKES**

- .1 Electric strikes to be coordinated to fit in door frames of controlled doors and the door latch type being provided, coordinate with specification 08111 Hollow Metal Frames.
- .2 Features:
  - .1 Operating Voltage: 12VDC
  - .2 Holding Force: Minimum 634kg (1400lbs)
  - .3 Fail mode: Fail secure (energize to open)
  - .4 Fire Rated: 2 hour minimum

**2.3 DOOR CONTACTS**

- .1 Door contacts to be mounted on each hinged door that is being controlled. All double doors to receive two contacts (one per side)
- .2 Coordinate to fit in door frames of controlled doors, coordinate with specification 08111 Hollow Metal Frames.
- .3 Specified Equipment (Man doors):
  - .1 Make: GE or equal
  - .2 Model: 1076W or equal
  - .3 Features:
    - .1 Type: Magnetic reed contact switch.
    - .2 Mounting: Recessed in door and frame
    - .3 Features: 25mm diameter with “lock-in” mounting caps, standard gap 32mm, zip cord lead, rare earth magnet.
- .4 Operation: Normally closed Contact opens on opening of door.

**2.4 CABLE**

- .1 Electric Strike: 2 - #20 awg belden
- .2 Door switch: 2 - #20 awg belden

**2.5 KEYPADS**

- .1 Applicable Equipment: KP 9811,
- .2 Specified Equipment: No substitutions permitted.
  - .1 Manufacturer: Honeywell
  - .2 Model: 6148
  - .3 Fixed-English LCD displays system status
  - .4 Soft-touch rubber continuous backlit keys
  - .5 Piezoelectric sounder with audible beeps to indicate system status and entry/exit delay
  - .6 System functions clearly labeled on telephone style keypad
- .3 Location:
  - .1 Vestibule Entrance : Exterior mounted at Vestibule 101 entrance.
  - .2 Bay Entrance: Exterior mounted at Southwest Bay entrance.
  - .3 Bay Entrance: Exterior mounted at Northwest Bay entrance.

**3. EXECUTION**

**3.1 INSTALLATION**

- .1 Install cables from each of the devices (i.e. door contacts and overhead door contacts) Leave sufficient slack in cables and identify at both ends. Install cable concealed in walls and ceiling spaces. Install all cabling in conduit.
- .2 Install panel in Plant 2 main corridor recessed in wall server room. Identify with lamacoid nameplate to read "Door Access control panel".
- .3 Install door contacts where identified. Install as per manufacturers instructions. Locate door contact toward, and as close as possible to latch side of door. Connect one pair of control wires to switch contact.
- .4 Test operation of door contact. Contact must change state prior to latch passing the door frame.

**3.2 SYSTEM OPERATION**

- .1 The door access controller is to monitor and control all new secured doors indicated in the project drawings. Each door is to include at minimum:
  - .1 Door contact (ie door position switch)
  - .2 Electronic strike
- .2 Each individual door is to be programmed with time and date schedule based on Owner supplied times.

**3.3 PROGRAMMING AND COMMISSIONING**

- .1 Contractor is responsible for retaining the services of a qualified technician for controller setup and programming.
- .2 Contractor is to document and record all parameter settings used for the programming of the panel and include them in a typewritten report on the Operations and Maintenance Manual. This documentation is to be submitted to the Owners representative for approval prior to integration into the manual.
- .3 The Owner reserves the right to with hold \$1000 should the documentation not be submitted.

**3.4 TESTING AND COMMISSIONING**

- .1 Prior to final acceptance of the system, contractor to fully test the system. Tests shall include:
  - .1 Verify each device and functionality
  - .2 Verify system operation



- .2 Tests shall be carried out in the presence of the Owner Representative.
- .3 Refer to specification 01810 for additional commissioning requirements.
- .4 Upon completion of system testing described above, the system installer shall conduct a training program for designated maintenance and operating personnel. Operating personnel shall be trained to accomplish and understand all aspects of system operation. Maintenance personnel shall be trained to perform maintenance of the system. Training period schedule to be set by the Owner. Training periods shall be of duration required to serve all personnel and shall be carried out after the system is totally completed.

**3.5           MANUALS**

- .1 Provide three (3) full operating and maintenance manuals for the system. Each manual to contain descriptive literature on each system component, full system wiring diagrams, operation and maintenance procedures, parts list, etc.

**END OF SECTION**

**1 GENERAL****1.1 RELATED SECTIONS**

.1	Basic Electrical Requirements:	Section 16005.
.2	Electrical Operation and Maintenance Data:	Section 16021.
.3	Spare Parts and Maintenance Materials:	Section 01795.
.4	Wire and Cable:	Section 16141.
.5	Electrical Identification:	Section 16075.
.6	Electrical Starting and Testing - General Requirements:	Section 16971.
.7	Electrical Equipment and Systems Demonstration and Instruction:	Section 16972.

**1.2 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS**

.1	Install and connect following components supplied under other Sections:	
.1	Roof top units:	Section 15.
.2	Air Handling Units:	Section 15.
.3	Exhaust fans:	Section 15.

**1.3 CONNECTION OF WORK SUPPLIED AND INSTALLED UNDER OTHER SECTIONS**

.1	Connect via relays or otherwise, the following auxiliary equipment supplied and installed under other Sections:	
.1	Door hardware:	Division 08
.2	Supply and exhaust fan control:	Division 15

**1.4 PRODUCT OPTIONS AND SUBSTITUTIONS**

.1	Refer to Division 01 for requirements pertaining to product options and substitutions.	
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**1.5 REFERENCED DOCUMENTS**

.1	CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems
.2	CAN/ULC-S526-M87, Visual Signal Appliances for Fire Alarm Systems
.3	CAN/ULC-S528-M91, Manual Pull Stations for Fire Alarm Systems
.4	CAN/ULC-S529-M87, Smoke Detectors for Fire Alarm Systems
.5	CAN/ULC-S530-M91, Heat Actuated Fire Detectors for Fire Alarm Systems
.6	CAN/ULC-S533-M87, Egress Door Securing and Releasing Devices
.7	CAN/ULC-S537-97, Verification of Fire Alarm Systems
.8	ULC-S525-99, Audible Signal Devices for Fire Alarm Systems
.9	ULC-S527-99, Control Units for Fire Alarm Systems
.10	ULC-S561-03 Installation and Services for Fire Signal Receiving Centres and Systems

**1.6 DESCRIPTION OF SYSTEM**

- .1 Single stage, hard wired, supervised, annunciated, fire alarm system consisting of the following major components:
  - .1 Control panel with integral annunciator
  - .2 Remote annunciator panels
  - .3 Manual fire alarm stations
  - .4 Thermal detectors
  - .5 Products-of-combustion detectors
  - .6 Duct detectors
  - .7 End-of-line resistors
  - .8 Audible and visual signal appliances
  - .9 Isolation Modules
  - .10 Addressable input modules
  - .11 Annunciator Panel
  - .12 Addressable control relays

**1.7 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- .1 Comply with requirements of Section 26 00 10.
- .2 Provide complete riser diagram and detail drawings indicating:
  - .1 All alarm devices
  - .2 Control panel
  - .3 Annunciator panels
  - .4 Component layout
  - .5 Identification schedule
  - .6 Zone wiring designations
  - .7 Panel interconnect wiring
  - .8 Detailed wiring connections and wire designations
- .3 Provide factory data sheets for the following:
  - .1 Annunciator panels indicating: materials, finishes, layouts, and proposed labeling.
  - .2 System devices indicating: typical wiring connection, installation instructions, control settings, and component limitations.
- .4 If requested by Owner, submit samples of following components:
  - .1 Products-of-combustion detector
  - .2 Thermal detector
  - .3 Manual alarm station
  - .4 Graphic annunciator panel
  - .5 Special cables
  - .6 Audible and visual signaling devices

**1.8 OPERATION AND MAINTENANCE DATA**

- .1 Comply with requirements of Section 16021.

## 1.9 SUPPLIER QUALIFICATIONS

- .1 System supplier, that is, manufacturer or manufacturer's authorized agent, shall have an office in Alberta established for a minimum of one-year, with full in-house technical service and maintenance capabilities. Suppliers utilizing third party or subcontracted maintenance services are not acceptable.

## 1.10 SOURCE OF SUPPLY

- .1 Complete fire alarm system shall be supplied by a single manufacturer. New system is to be capable of interconnecting with existing Edwards quick start panel during construction. Manufacturer and Contractor will be responsible for all temporary programming changes to maintain operation of both existing and new fire alarm control panels.

## 1.11 COORDINATION

- .1 Coordinate with the above noted work as required to provide a complete, integrated, and functional system.

## 1.12 SPARE PARTS AND MAINTENANCE MATERIALS

- .1 Comply with requirements of Section 16021.

## 2 PRODUCTS

### 2.1 PRODUCT MANUFACTURERS

- .1 Acceptable fire alarm system manufacturers:
  - .1 Chubb Edwards
  - .2 Vigilant Fire and Life Safety
  - .3 Simplex Grinnell / JCI Controls
  - .4 Approved alternate

### 2.2 CONTROL PANEL

- .1 Control Panel: to CAN/ULC-S527, sheet steel construction, surface-mounted, hinged doors, integral battery compartment, and integral annunciator panel.
- .2 Features:
  - .1 Supervisory Control Wiring: Class A.
  - .2 Number of supervised initiating signal circuits: 2.
  - .3 Number of supervised annunciating alarm circuits: 10.
  - .4 Lamp test button.
  - .5 Trouble buzzer and "acknowledge" switch.
  - .6 Standby power supervision pilot light.
  - .7 All signal circuit modules shall accommodate products of combustion detectors.
  - .8 Auxiliary contacts for monitoring company tie-in, one set normally open, one set normally closed.

- .9 Alarm circuits zoned as indicated on drawings.
- .10 Separate alarm and trouble light for each signal zone.
- .11 Silence switch for each alert and alarm signal.
- .12 Central station disconnect switch.
- .13 Auxiliary relays for:
  - .1 Magnetic door holders
  - .2 Mechanical equipment controls
- .14 Bypass switches for:
  - .1 Fan shutdown
  - .2 Damper closing
- .3 Operation of System Supervision:
  - .1 Fault on system or power failure condition shall cause:
    - .1 Trouble signal to operate.
    - .2 Trouble lamp to illuminate.
    - .3 Silence switch to de-activate trouble signal only.
  - .2 Trouble signal to reset automatically on system restoration.

### **2.3 REMOTE ANNUNCIATOR PANELS, GENERALLY**

- .1 Construction: Sheet steel, painted, flush mounted.
- .2 Features:
  - .1 Window layout on hinged sub plate.
  - .2 LED lamps in barriered compartments.
  - .3 Framed painted steel glass door, lockable, totally concealed hinges and fasteners.
  - .4 Lamp test button with local remote transformer.
  - .5 Common system trouble indication with lamp, buzzer and acknowledge button.
  - .6 Number of zone windows 16.
  - .7 Lettering to suit.

### **2.4 PASSIVE GRAPHIC DISPLAYS PANELS**

- .1 Provide a passive color cad graphic, including building outline, corridors, stairwells, units, legend, Fire Alarm Zones, and all Fire Alarm Devices. Allow for a minimum of 10 colors. Graphic shall measure a minimum of 279mm x 431mm including all plans as indicated on the drawings and mounted behind a Plexiglas cover with brushed aluminum trim.
- .2 CAD drawings of basic floor plan will be provided to the Contractor upon request.
- .3 Provide sample graphic to Owner's Representative for approval prior to installation.
- .4 Graphic to include "YOU ARE HERE" arrow for each location graphic is installed
- .5 Graphic to include legend stating: Zone Color and Zone Name.

## 2.5 MANUAL FIRE ALARM STATIONS

- .1 Manual Fire Alarm Stations: to CAN/ULC-S528 and as follows.
  - .1 Type: Single Stage.
  - .2 Contacts: Addressable.
  - .3 Construction: metal.
  - .4 Mounting: flush.
  - .5 Features: glass rod.
  - .6 Operation:
    - .1 First stage: manual lever.

## 2.6 THERMAL DETECTORS

- .1 Thermal Detectors: to CAN/ULC-S530 and as follows.
  - .1 Construction: metal
  - .2 Mounting: semi flush, trim ring.
  - .3 Contacts: rated at 3 A from 6 to 125 V AC, 1 A from 6 to 28 V DC.
  - .4 Auxiliary contracts for remote annunciation.
  - .5 Screw terminals: designed to accept No. 14 AWG conductors, separate terminal for each conductor.
  - .6 Operation:
    - .1 Resettable, blinking LED shall indicate when alarmed.
    - .2 Fixed Temperature Type: non reset shall operate at 57°C.
    - .3 Fixed Temperature and Rate of Rise Type:
      - Rate of rise element: reset type.
      - Fixed temperature element: 57°C non reset type.
      - Rate of rise: 8°C per minute.
- .2 Explosion proof Type Thermal Detectors: as specified above except as follows:
  - .1 Approved by authority having jurisdiction for use in Class I Group D and Class II Groups E, F, and G applications.
  - .2 Detector Base: Cast metal junction box with two tapped standard conduit outlets and mounting lugs, cast metal guard, surface mounted.
  - .3 Fixed Temperature and Rate of Rise Type:
    - .1 Rate of rise element: reset type.
    - .2 Fixed temperature element: [57°C] [88°C] non reset type.
    - .3 Rate of rise: 8°C per minute.

## 2.7 IONIZATION PRODUCTS-OF-COMBUSTION DETECTORS

- .1 Ionization Products-of-Combustion Detectors: to CAN/ULC-S529 and as follows.
  - .1 Features:
    - .1 Dual chamber
    - .2 Twistlock plug-in base
    - .3 Overall tapered geometry
    - .4 Chamber accessible without special tools

- .5 Chamber easy to clean
  - .6 Chamber port smoke entry 360°
  - .7 Chamber with anti-static protection
  - .8 Alarm indicator: local LED
  - .9 Voltage: 24VDC
  - .10 Auxiliary contacts, SPDT rated at:
    - 2 A at 24 V DC
    - 5 A at 120 V AC
- .2 Operation:
- .1 Sensitivity field adjustable.
  - .2 Detection independent of requirement for presence of heat or smoke.
  - .3 Unaffected by changes in temperature, humidity and pressure within following ranges:
    - .1 Temperature: 0°C to 38°C
    - .2 Air velocity: 0 to 1.52 m/s
    - .3 Humidity: 0 to 90%.

## 2.8 IONIZATION PRODUCTS-OF-COMBUSTION DUCT DETECTORS

- .1 Ionization Products-of-Combustion Duct Detectors: same as products-of-combustion detector specified in 2.7, except as follows.
- .1 Duct Detector Housing:
    - .1 Cast metal construction
    - .2 Surface mounting on duct
    - .3 Rigid sampling tube support
    - .4 Screw-on hinged access cover
  - .2 Sampling Tubes:
    - .1 12 mm metal tubing.
    - .2 Perforation number and size shall suit air velocity.
    - .3 Tube length shall suit duct size.

## 2.9 PHOTO-ELECTRIC PRODUCTS-OF-COMBUSTION DETECTORS

- .1 Photo-Electric Products-of-Combustion Detectors: to CAN/ULC S529 and as follows.
- .1 Features:
    - .1 Twistlock plug-in base
    - .2 2-wire operation
    - .3 Supervisory lamp
    - .4 Alarm lamp
    - .5 Test button
    - .6 Provision for remote alarm

- .2 Operation:
  - .1 Detect smoke obscuration of light by [1.5] [ ]% within device chamber.
  - .2 Temperature Range: 0°C to 35°C.
  - .3 Voltage: 10 - 24 V DC.
  - .4 Supervisory current: 100 microamperes.
  - .5 Alarm current: 65 milliamperes.

## 2.10 SIGNAL APPLIANCES

- .1 Audible signal appliances: to ULC-S525 and as follows.
  - .1 Voltage: 24V DC.
  - .2 Mounting: flush, surface, wall and ceiling mount as required.
  - .3 Horns: steel alloy; sound pressure levels of 95 dB at 3 m. Temporal pattern.
  - .4 Chimes: metal tuned resonating chamber, single stroke plunger; sound pressure level of 69 dB at 3 m.
- .2 Visual signal appliances: to CAN/ULC-S526 and as follows.
  - .1 Voltage: 24V DC.
  - .2 Mounting: flush, surface, wall and ceiling mount as required.
  - .3 Construction:
    - .1 High intensity zircon flasher.
    - .2 Pyramid shaped.
    - .3 Red lexan lens with white "fire" lettering.
  - .4 Operation: 1 stroke flashes per second.
  - .5 Intensity: Selectable 15, 30, 75, 110cd output
- .3 Combination audible and visual signal appliances: to ULC-S525, CAN/ULC-S526 and as follows.
  - .1 Voltage: 24V DC
  - .2 Mounting: flush, surface, wall and ceiling mount as required
  - .3 Audible component:
    - .1 Horns: steel alloy; sound pressure levels of 95 dB at 3 m
- .4 Visual component:
  - .1 High intensity xenon strobe
  - .2 Housing cover, red with white "fire" lettering
  - .3 Lens shape: to provide 180° minimum visibility
  - .4 Operation: 1 stroke flashes per second
  - .5 Intensity: Selectable 15, 30, 75, 110cd output

## 2.11 MAGNETIC DOOR HOLDERS

- .1 Magnetic Door Holders: to CAN/ULC-S533, 120 VAC flush mounted, cast construction, flexible door armature.



## 2.12 END-OF-LINE RESISTOR ASSEMBLY

- .1 End-of-line Resistor Assembly: single gang steel plate, terminal strip on back, resistor, red enamel finish and lamicoïd nametag on front identifying zone.

## 2.13 SYSTEM POWER SUPPLY

- .1 Power Supply: to ULC-S527 and as follows.
  - .1 Rectifier and Battery Charger:
    - .1 Designed to automatically maintain battery bank fully charged.
    - .2 Sized to recharge batteries in 12 hours minimum.
    - .3 Designed to operate system when batteries are disconnected.
    - .4 Temperature compensated.
    - .5 Provide battery connection supervision.
  - .2 Battery Bank: lead acid type.
  - .3 Capacity: designed to operate system under supervisory load condition for 24 hours and then have sufficient power to operate system alarm devices for 30 minutes, without recharging.
  - .4 Mounting: integral with control panel.

## 2.14 WIRE AND CABLE

- .1 Remote Control and Signal Cable: as specified in Section 26 05 13.

## 2.15 RELAY MODULE

- .1 Addressable relay module complete with form "C" dry relay contact rated 0.3 amps at 120V AC. Module to include a green polling LED and a red alarm LED.

## 2.16 ISOLATION MODULE

- .1 Addressable line isolation module. Module is to isolate short circuits within floor areas exceeding 2,000 square meters and between floors, so that a fault within one floor area shall not affect another floor area. At least one isolator module shall be provided for each protected zone of the building. Module is to include green polling and red alarm LED's.

## 2.17 INPUT MODULE

- .1 Addressable input module complete with supervised Class "B" input circuit(s) to monitor non addressable contact devices. Module is to include green polling and red alarm LED's.

### 2.18 FIRE ALARM PANEL CIRCUIT BREAKER

- .1 Provide and install conduit, wiring and breaker to connect the following equipment.
  - .1 Main Fire Alarm Panel: 15amp single pole breaker with red lock kit in closest electrical panel.
  - .2 Annunciator Panel: 15amp single pole breaker in closest electrical panel.

### 2.19 FIRE ALARM PANEL DUAL LINE DIALER

- .1 Provide and install ULC listed Dual line Dialer for central station tie in.
  - .1 Dual line dialer to include the following dial out functions:
    - .1 GSM.
    - .2 Telephone.

## 3. EXECUTION

### 3.1 INSTALLATION

- .1 Install system in accordance with: CAN/ULC-S524-06 & latest edition of the CEC.
- .2 Mount end-of-line resistors where indicated in accordance with Rule 32-008 of the Canadian Electrical Code.
- .3 External AC Power Supply:
  - .1 Provide 120 VAC
  - .2 Provide separate breaker(s) clearly marked "Fire Alarm System".
    - .1 Provide locking device on breaker(s).
    - .2 Breakers to be "Red" in color.
  - .3 Provide power supply disconnect breaker location in control panel.
  - .4 Provide 120VAC power to door holders from closest un-switched circuit.
  - .5 Provide high current relays where the load exceeds the rating of the addressable relays.
- .4 Central Station Tie-In:
  - .1 Provide 19 mm conduit and 1-CAT6 Cable to security panel for central station tie-in.
- .5 Wiring:
  - .1 All wiring shall be in accordance with Local, Provincial, and National Codes, and as recommended by the manufacturer.

- .2 Number and size of conductors as recommended by system manufacturer, but not less than 16 AWG for Indicating Device Circuits, and 12 AWG for Indicating Appliance Circuits.
  - .3 Use all new wiring for system, and install all wiring in approved raceways.
  - .4 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
  - .5 All field wiring shall be completed supervised.
  - .6 Terminal strips may only be used on approval by owner's representative.
  - .7 Make conductor terminations in panel on terminal strips with separate terminal for each conductor.
  - .8 Neatly install wiring clamped with nylon cable straps or laced with jute cord.
  - .9 Number-identify all strips as indicated on shop drawings.
  - .10 Attach wiring diagram to inside of panel door.
  - .11 Termination of cabling to be set up in such a manner that the sections of the system may be isolated or sorted out for servicing a trouble or fault.
- .6 Connect the following fire alarm system components as indicated on drawings:
- .1 Manual fire alarm stations
  - .2 Thermal detectors
  - .3 Ionization products-of-combustion detectors
  - .4 Duct detectors
  - .5 Audible signal appliances
  - .6 Visual signal appliances
  - .7 Isolation Modules
  - .8 Input modules
  - .9 Addressable relay's
  - .10 Fire Alarm Control Panel
  - .11 Audible/Visual Booster panels
- .7 Modifications:
- Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site including:
- .1 Additional and detection devices
  - .2 Circuits
  - .3 Zones and changes to system operation
  - .4 Custom label changes for devices or zones
  - .5 Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made
  - .6 All programming to be completed prior to final verification
  - .7 Division 26 to confirm all device addresses with User prior to initial programming

- .8 Conduit:
  - .1 Use conduit that is in accordance with the Canadian Electrical Code, as well as Local and Provincial requirements.
  - .2 Conduit fill shall not exceed 40% of interior cross-sectional area where three or more cables are contained within a single conduit.
  - .3 Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit junction box or raceway containing these conductors.
  - .4 All circuits shall be provided with transient suppression devices, and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
  - .5 Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
- .9 From the fire alarm control panel, make connection to all motor control centres and related equipment as required for fan systems control. Provide one set of individual relay contacts per fan unit in separate fan control relay box.
- .10 Provide addressable monitor module at each sprinkler flow valve and tie in flow switch to provide activation of zone at fire alarm under flow condition. Confirm locations on site and allow sufficient wire and cable to make required connections.

### 3.2 PROGRAMMING

- .1 System shall be fully programmable in the field with the need for special tools and shall not require field replacement of electronic integrated circuits. Systems that require factory burning of e-proms will not be accepted.
- .2 All programming to be performed via the control panel keypad or a laptop computer.
- .3 All field programming to be stored in a non-volatile memory.
- .4 System programming shall have 4 levels of password protection.
- .5 Any system output, control module or riser module may be programmed to activate on any single input or any combination of inputs.
- .6 Final system programming shall be performed during the construction period.
- .7 System shall be fully programmed and operational prior to the commencement of the verification inspection.
- .8 Provide 19mm conduit from main fire alarm control panel to main telephone board or cabinet.
- .9 Provide 4 #18 AWG wires for monitoring of the alarm and trouble contacts of the fire alarm panel by others.
- .10 Owner to arrange for monitoring of the fire alarm system by a ULC listed central monitoring agency.
- .11 All device descriptors are to include the zone they are physically located in, refer to drawings for zoning.

**3.3 TESTING AND VERIFICATION**

- .1 Comply with testing and performance verification requirements of Section 26 08 10.
- .2 Verify completed system in accordance with requirements of CAN/ULC-S537-96.

**3.4 DEMONSTRATION AND INSTRUCTION**

- .1 Comply with requirements of Section 26 08 40.

**END OF SECTION**

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**1. GENERAL**

- .1 Coordinate all startup and testing with specification 01810 Startup and Commissioning.

**2. PRODUCTS**

- .1 Not applicable.

**3. EXECUTION**

**3.1 BASIC ELECTRICAL START-UP AND TESTING**

- .1 Energizing Main Electrical System:
  - .1 Prior to energizing main electrical system:
    - .1 Verify supply authority voltage and phase rotation.
  - .2 Testing of Wiring and Wiring Devices:
    - .1 Test conductors at distribution centres and panelboards for insulation resistance to ground (megger test).
    - .2 Test service grounding conductors for ground resistance.
    - .3 Test all wiring devices for correct operation and circuitry.
  - .3 Ground Resistance Testing:
    - .1 Measure ground resistance of ground grids with earth test megger to verify compliance with CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.
    - .2 Provide recorded data to Owners representative and insert a copy in the Operation and maintenance manual.
  - .4 Starting Motors:
    - .1 Prior to starting motors:
      - .1 Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.
      - .2 Verify rotation.
      - .3 Ensure disconnects are installed.
      - .4 Confirm labeling of motors, disconnects and starters.
      - .5 Confirm operation of connected I/O
      - .6 Confirm protection relay settings and operation

- .5 Power Quality
  - .1 The Contractor is responsible for testing and measuring Power Quality of main service and each VFD during commissioning. Contractor to ensure:
    - .1 Power quality analyzer (Fluke 43B, Fluke 435 or approved equivalent) is used to monitor and trend and export .xls report for :
      - .1 THD,
      - .2 Individual harmonics for Voltage, Current, and Frequency
      - .3 Power factor, KVA, KW, KVAR
      - .4 Inrush current: 1s, 5s, 10s, 50s
    - .2 Provide type written report with exported data from the Power Quality Analyzer. Report to show graphs of data being measured. Indicate loads being powered at each measurement and measured values as noted in above (items 3.1.5.1.1). Complete the following measurements with the harmonic filter(s) off and then again when the filter(s) is on.
      - .1 Baseline no load: shut off as many building loads as possible (no pumps running, lights off etc...).
      - .2 Baseline standard building load: Power equipment that will normally be in operation (ie lighting, control panel, heater etc...).
      - .3 One VFD running: Power standard building load and smallest VFD in normal operation
      - .4 Additional VFD/Starter combinations: Power standard building load with additional motor staging configurations available in the facility. Account for upto to 10 additional measurements

### 3.2 STANDBY POWER GENERATION SYSTEM

- .1 Factory Testing: Refer to section 16228 item 1.5 Factory Testing
- .2 Site Testing: Refer to section 16228 item 3.7 Standby Power Generation System Testing

### 3.3 SMOKE AND HEAT DETECTOR TESTING

- .1 Provide the following equipment:
  - .1 Artificial Smoke
  - .2 Rate of Rise Heat Detector Tester
  - .3 dB Sound Meter
- .2 Do not proceed with the testing unless the following parties are present at all times during the testing procedure:
  - .1 Electrical Contractor
  - .2 Owner's testing representative
- .3 Perform a smoke/heat test to each device in the facility. Ensure that the device properly responds to the test (alarms) through the PLC system.

- .4 Disassemble and reassemble system components as required.
- .5 Disconnect and reconnect wiring as required.
- .6 Perform required field adjustments.
- .7 Repair defective work and replace defective components
- .8 Perform all other work on system required by the testing procedure to ensure a complete working fire detection system.

**END OF SECTION**



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**1. GENERAL**

**1.1 INTENT**

- .1 Provide demonstration and instruction sessions to familiarize Owners operation and maintenance personnel with electrical systems and their operation and maintenance.

**1.2 RELATED REQUIREMENTS**

- .1 Equipment and System Demonstration and Instruction: Division 01.

**1.3 MANUFACTURER'S SITE SERVICES**

- .1 Arrange and pay for appropriately qualified manufacturer's representatives to provide or assist in providing electrical equipment and systems demonstration and instruction seminars for systems specified in this Section.

**1.4 DEMONSTRATION AND INSTRUCTION SEMINARS**

- .1 Present Operator Training Seminar(s) including content specified in Division 01.

**2. PRODUCTS**

Not Used

**3. EXECUTION**

**3.1 SYSTEMS AND EQUIPMENT DEMONSTRATIONS AND INSTRUCTION SEMINARS**

- .1 Provide demonstration and instruction seminars for the following equipment and systems identified. Include in demonstrations and instruction seminars, the information specified for each piece of equipment and system.
- .2 Normal Power Distribution (Below 750 V):
  - .1 Distribution Switchgear:
    - .1 Torquing procedures and values.
    - .2 Circuit breaker or disconnect switch operation.
    - .3 Protective features on breakers.
  - .2 Dry Type Transformers:
    - .1 Tap adjustment procedures.
    - .2 Drying and cleaning requirements.

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- .3 Panelboards:
  - .1 Types and sizes of breakers.
  - .2 Spare capacity.
  - .3 Visual maintenance inspections.
  - .4 Maintenance procedures.
  
- .4 Branch Circuits:
  - .1 Power receptacle system.
  - .2 Miscellaneous wiring devices.
  - .3 Miscellaneous equipment.
  
- .3 Emergency Power Distribution:
  - .1 Emergency Generator Set:
    - .1 Starting of unit in test, manual and automatic.
    - .2 Alarm conditions causing shutdown.
    - .3 Cooling, exhaust and fuel systems.
    - .4 Troubleshooting.
    - .5 Visual inspections.
    - .6 Maintenance procedures.
    - .7 Testing requirements and procedures.
  
  - .2 Transfer Switch:
    - .1 Transfer switch operation - manual and automatic.
    - .2 Bypass switch operation.
    - .3 Time delay relays, voltage sensors - calibration and operation.
    - .4 Safety procedures.
    - .5 Troubleshooting procedures.
    - .6 Visual inspection.
    - .7 Maintenance procedures.
    - .8 Testing requirements and procedures.
  
- .4 Motor Control:
  - .1 Manual Motors Starters:
    - .1 Overload protection.
    - .2 Troubleshooting procedures.
    - .3 Maintenance requirements.

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- .5 Fire Alarm System:
  - .1 Alarm silence.
  - .2 Trouble conditions, alarm and silence.
  - .3 Annunciator and control panel operation.
  - .4 Mechanical systems control.
  - .5 Control panel module replacement.
  - .6 Alarm lamp replacement.
  - .7 Power supply.
  - .8 Troubleshooting procedures.
  - .9 Maintenance requirements and procedures.
  
- .6 Lighting:
  - .1 Interior/Exterior Lighting:
    - .1 Description of each luminaire with respect to lamp and ballast or any other special features:
      - .1 Troubleshooting procedures.
      - .2 Maintenance procedures.
      - .3 Re-lamp schedules.
    - .2 Emergency Lighting Battery Units and Exit Lights:
      - .1 Troubleshooting procedures.
      - .2 Maintenance procedures.
    - .3 Lighting Controls:
      - .1 Line voltage switching.
      - .2 Motion switches.
      - .3 Low voltage switching.
        - .1 Relay replacement.
      - .4 Photo-cell/time clock operation.
      - .5 Troubleshooting procedures.
      - .6 Maintenance procedures

### 3.2 **SITE TOURS**

- .1 Provide a series of walk through Contractor guided tours of facility to allow operators to familiarize themselves with the buildings electrical systems.
- .2 Coordinate timing of tours with the Owner. Allow for tours at approximately the following times.
  - .1 At Interim Acceptance of the Work.

**END OF SECTION**